

Mentoring Strategies To Facilitate the Advancement of Women Faculty

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Mentoring Strategies To Facilitate the Advancement of Women Faculty

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As a rule, only original research papers and original review papers are included in the volumes. Verbatim reproductions of previous published papers are not accepted.

ACS Books Department

Chapter 1

A Brief Synopsis of Volume Highlights

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Compelling evidence exists to support the hypothesis that both formal and informal mentoring practices that provide access to information and resources are effective in promoting career advancement, especially for women. Such associations provide opportunities to improve the status, effectiveness, and visibility of a faculty member via introductions to new colleagues, knowledge of information about the organizational system, and awareness of innovative projects and new challenges. This volume developed from the symposium “Successful Mentoring Strategies to Facilitate the Advancement of Women Faculty” held at the 239th National Meeting of the American Chemical Society in San Francisco in March 2010. The organizers of the symposium, also serving as the editors of this volume, aimed to feature an array of successful mechanisms for enhancing the leadership, visibility, and recognition of academic women scientists using various mentoring strategies. It was our goal to have contributors share creative approaches to address the challenge of broadening the participation and advancement of women in science and engineering at all career stages and from a wide range of institutional types. Inspired by the successful outcomes of our own NSF-ADVANCE project that involved the formation of horizontal peer mentoring alliances, we have assembled this collection of valuable practices and insights to both share how our horizontal mentoring strategy has impacted our professional and personal lives and to learn of other effective mechanisms for advancing women faculty.

Initiatives at the Institutional Level

The first section of the volume features mentoring programs developed for implementation at a particular institution or a group of collaborative institutions. As a set the contributions reflect a range of campuses and describe programs aimed at a wide range of career stages. Many of the initiatives can be adopted for different settings and thus constitute a powerful “toolkit” for institutions looking for effective formal and informal mentoring schemes to target a range of challenges.

In Chapter 2, Dr. Shannon Watt, a postdoctoral chemist at the University of Michigan, argues for the development of programs and practices aimed at enabling female doctoral-level chemists to achieve their full potential and to attain their personal and professional goals. She attributes the scarcity of endeavors focused on encouraging female doctoral-level chemists to continue in the sciences after completing their training as one of the major contributors to the leak in the career pipeline of academic women chemistry faculty. As a recipient of a prestigious National Science Foundation (NSF) Discovery Corps Fellowship, Dr. Watt was required to conduct a high-impact service project that addresses national needs. In this contributed chapter, Dr. Watt describes her establishment of the Chemistry Professional Development Organization (CPDO) at the University of Michigan in 2009 to address the professional development needs of chemistry-affiliated graduate students and postdoctoral associates, particularly women and underrepresented minorities. These needs were identified through a survey of the climate experienced by graduate women across the University of Michigan; the survey administration was conducted in conjunction with an award to the University of Michigan from the NSF-ADVANCE program that aims to increase the participation of women faculty in academic STEM careers. Data from this survey showed that a majority of the graduate students and postdoctoral scientists surveyed—regardless of demographic group—desired access to training and mentoring programs that would enable them to acquire information, build networks, and develop the necessary professional and personal skills to complement their research expertise. Dr. Watt makes the case for a mentoring initiative to augment the traditional, research-centered graduate curriculum to assist in developing additional critical professional skills. Her chapter describes the initiatives of the Chemistry Professional Development Organization and provides several evaluative measures that reflect the success of this mentoring program. Dr. Watt shares her insights and strategies for establishing such a program to suit the needs and budgets of other individuals or institutions in all STEM disciplines. Adoption of such a widespread model is likely to have a significant impact on improving the retention of women in academic careers.

Chapter 3 describes a collaborative effort at two neighboring liberal arts colleges – Union College and Skidmore College – to develop mentoring networks that provide faculty with a variety of mentors who can share their successes and challenges. The chapter describes a range of formal and informal mentoring activities that offer faculty throughout the ranks with many opportunities to build a network of STEM women who can serve a variety of functions such as role

models, mentors, sounding boards, and advocates. This initiative complements the pre-existing individual mentoring programs at each institution and particularly aims to provide effective information and resources about the tenure and promotion process for female assistant and associate professors. One of the merits of the collaboration is that the two institutions bring different experiences and strengths to the project as a consequence of their distinct origins. One campus was originally a women's college that traditionally emphasized the arts and humanities but now has an increased role of the science, technology, engineering, and mathematics (STEM) disciplines in its curriculum, while the other institution was a formerly all-male college that historically has had a strong natural science and engineering orientation. Such different perspectives broaden the utility of the mentoring tools developed for wider audiences.

The collaboration among three campuses of a single institution – Rutgers University – is featured in Chapter 4. To provide the context for the mentoring program showcased in this chapter, the authors first present a clear description of the unique organization of this university and the elements of each campus' chemistry department. A significant array of initiatives are enumerated that aim to drive institutional transformation that will promote the participation and advancement of women in science, engineering, and mathematics on all three campuses of Rutgers University. Of particular focus in the chapter is the RU FAIR (Rutgers University for Faculty Advancement and Institutional Re-imagining) Professorship program which enables individual faculty to take on leadership roles in advancing women's participation in the sciences. One faculty member on each of the three Rutgers' campuses is awarded the RU FAIR professorship and serves as a university leader to foster mentoring, promote diversity, facilitate communication among geographically dispersed faculty, and mediate between faculty and administration. Such leadership can take a variety of forms, including organizing a series of professional development and leadership workshops that include sessions on leadership training, writing, grantsmanship, and faculty-to-faculty coaching (co-mentoring). Additionally, RU FAIR Professors have also encouraged research on the institutional climate for increasing women and minority faculty's participation and advancement in the sciences. While RU FAIR professors are highly visible mentors and advocates for women faculty on their campus, they authors outline some of the challenges of placing such significant responsibility for institutional transformation in a few key individuals.

This section of the volume concludes with a contribution from Auburn University featuring their NSF-funded ADVANCE project aimed at the establishment of a "small wins" approach to influence lasting change in the culture and climate of the STEM disciplines at Auburn. This chapter advocates for incremental changes with widespread and long-term impacts to eventually transform an institution. These small wins are practices implemented at the departmental, center, or college level that result in greater buy-in from all administrative levels and ultimately more substantial institution-wide transformation. Of particular interest in this chapter is a cost-benefit analysis of best practices employed at other ADVANCE-funded institutions. Using ADVANCE program websites and published materials, the most common faculty

development initiatives geared for women were analyzed and categorized. Several general categories were noted: implementation of mentoring practices, creation of family-friendly policies, organization of training programs aimed at raising awareness of gender bias for various campus constituencies, design of department-wide workshops that highlight the scholarship of female faculty and provide guidance on improving departmental climate; creation of departmental policies and resources that aim to improve the recruitment and retention of female faculty; and creation of funding opportunities aimed at recruitment and retention of female faculty. A cost-benefit analysis was conducted using a web-based survey instrument to identify those practices that required the fewest resources and contributed the most to the improvement of the university climate and community. Of the 29 initiatives evaluated, mentoring programs represented over half of the most highly ranked practices employed at other universities. The chapter describes how this information was used to develop and implement effective programmatic changes at Auburn University.

Multi-Institutional and Interinstitutional Initiatives

The second section of the volume describes mentoring activities at various collections of similar institutions. Chapter 6 examines faculty mentoring at two-year institutions, the segment of the higher education system that represents 34% of the nation's post-secondary institutions and serves a substantial portion of the undergraduates in the United States. With over 1200 institutions, two-year colleges exhibit a diversity of sizes, locations, and program offerings to meet the needs of the regions they serve. Given the extensive array of two-year campuses, a variety of faculty mentoring approaches is anticipated. To get a flavor of how wide-ranging such faculty development efforts might be, the author of this chapter asked eight female chemistry faculty members at different two-year colleges to share their perspectives on the status of women faculty on their campuses. While the situation does indeed vary from campus to campus, this collection of women faculty generally report strong satisfaction in their careers, in the faculty development expectations and offerings on their campuses, and in the institutional mentoring programs available for new faculty. The combination of institutional mission, high numbers of female faculty members even at all levels, and the range of internal and external professional development opportunities suggest a supportive climate that enables two-year college female faculty to prosper. The scope of formal and informal mentoring initiatives present at the campus level and in conjunction with professional societies is highlighted.

Chapters 7 through 9 represent contributions from women full professors in chemistry and physics at liberal arts colleges. All of the authors were participants in the NSF-ADVANCE funded project that is described in Chapter 10, and each recognized the importance of adding to the knowledge base of mentoring strategies and career development resources that contribute to the advancement of academic women at liberal arts institutions.

Chapter 7 describes institutional and departmental mechanisms which support women faculty in chemistry at liberal arts colleges at all stages of their career, from

the pretenure years through retirement. As the authors are all senior women in chemistry, they particularly focus on specific recommendations of policies aimed at supporting women at this career stage. One of their major themes is the need for flexibility in granting resources, developing policies, and providing infrastructure for the professional development of women. The authors also suggest a variety of ways that women can and do support one another. Given the employment experience of the authors, they discuss how shared/split academic positions can enable more academic women to enjoy a better work-life balance and offer insights to both advantages and shortcomings of these hiring arrangements.

In Chapter 8, five accomplished senior female physics faculty describe the unique challenges and demands of senior women scientists at liberal arts institutions. They particularly cite the ways in which their horizontal mentoring alliance helped each participant to successfully navigate a variety of professional and personal issues. One of the areas of professional concern for this group of women was maintaining their research vitality over the course of an entire career. Each pondered next steps such as whether to continue to extend current work with the goal of remaining on the cutting edge of the field, change to a new sub-field to explore new areas of interest, or even to shift gears to pursue less traditional research in pedagogical arenas. The chapter highlights the way in which the alliance was instrumental in strengthening each member's professional research by the answering the question of "What next?" in different ways. Through the experiences of the alliance members, this paper makes a strong case for sustaining and propagating similar networks and suggests some initial steps to achieve this continuity without the need for significant external funding.

Indeed, Professor Carol Ann Miderski explores in Chapter 8 one such mechanism for continuing and expanding the practice of horizontal peer mentoring across a number of institutions within a close geographical region. Professor Miderski's home institution is situated in a region with a significant number of small undergraduate-focused campuses with similar low numbers of female faculty in chemistry. To overcome such professional isolation and continue the benefits that she has experienced in her horizontal network, Professor Miderski described her initiation of The Women Chemists Web in 2009 to bring women faculty from regional colleges together to get to know each other and to develop a resource network. She designed the group with the objective of serving as a source of outside perspectives, fresh ideas, and alternative strategies for facing the academic, professional and personal challenges encountered in small college environments. This chapter shares some of the insights gained by exploring the most commonly-cited vexing issues for women faculty and offers some of the mechanisms by which The Women Chemists Web will serve as a resource for participants.

National Initiatives

The third section of the volume showcases two mentoring initiatives administered at the national level for women in academe. In Chapter 10 the editors of this volume describe their project funded by the National Science Foundation

ADVANCE Partnerships for Adaptation, Implementation, and Dissemination (PAID) program to test a horizontal mentoring strategy for senior women faculty in chemistry and physics at liberal arts colleges. The project, Collaborative Research for Horizontal Mentoring Alliances, focuses on the distinctive environments of undergraduate liberal arts institutions and the challenges faced by senior women faculty on these campuses to attain leadership roles and professional recognition. Four five-member alliances of senior women faculty members at different institutions were formed for the purpose of “horizontal mentoring” to enhance the leadership, visibility, and recognition of participating faculty members. The chapter describes the rationale for the horizontal mentoring approach and the key elements of the alliance structure to insure the effectiveness of this form of peer mentoring. The chapter also describes the mechanics of alliance formation, the professional development activities of alliance gatherings, and the professional and personal benefits of participation cited by the twenty women faculty involved in the project. The benefits include the added confidence to seek leadership positions, enhanced visibility and recognition on campus, encouragement to seek and accept external recognition, and support to pursue new directions. The authors of this chapter, as the editors of this book, have found the horizontal mentoring project to be one of the most powerful undertakings of their professional careers.

Chapter 11 highlights the decade-long faculty development efforts of COACH, the Committee on the Advancement of Women Chemists. COACH is an organization that focuses on developing and implementing programs to increase the career success of women chemists in academia.

Included among the many activities sponsored by COACH are workshops that provide negotiation, management, and leadership skills to help women achieve their professional goals as faculty in the chemical sciences. These workshops are a form of group mentoring where a protégé has access to a group of experienced individuals working together to provide career information to the protégé with each mentor contributing her unique talents to the group. The chapter examines women chemists’ mentorship experiences by drawing from information gained from surveys and interviews of individuals who participated in the COACH workshops over the past decade. The authors share their insights on a variety of aspects of mentoring, including the effectiveness of formal mentoring programs, the changing mentor/mentee role over the course of a career, why mentoring often doesn’t happen, and what factors can contribute to having a positive mentoring experience. The particular ways that COACH has promoted mentoring and the outcomes of such efforts are also discussed. The authors conclude their work by indicating the mentoring research that still needs to be completed and sharing lessons for policy and action.

Recommendations for Individuals

In the final section of the volume we address two of the key professional challenges that academic women routinely find vexing – integrating work and a personal life and enhancing one’s professional presence. These topics transcend institutional type and even career stage. In Chapter 12, Drs. Millard and Mills

advocate for the importance of faculty well-being to maintain both professional productivity as well as personal satisfaction and to cope with both time and stress management. The chapter begins with a consideration of the hidden consequences of failing to achieve an acceptable balance of professional and personal commitments and a discussion of the practice of “bias avoidance” that leads to behavior that minimizes or hides the impact of family life on academic commitments. The particular challenges faced by senior women and those in the sciences are further outlined. The bulk of the chapter provides a wealth of useful tips for better integrating one’s personal and professional lives. Many of the suggestions are derived from the personal experiences of the authors and offer successful strategies for simultaneously achieving fulfillment in one’s career as well as contentment in one’s personal life. The very useful exercise of determining one’s “chaos coefficient” is an effective first step toward achieving balance. As the authors note, incorporating personal needs into the equation is essential for attaining the most sustainable lifestyle.

In Chapter 13, Dr. Millard continues to provide insights gained from her professional career as she offers suggestions for enhancing one’s professional impact and acquiring the leadership positions and recognition commensurate with one’s expertise. While women in science fields anticipate being judged on their professional credentials, Dr. Millard reminds us that other unexpected factors may be used in assessing our professional competence. For example, students and colleagues may use our physical appearance, body language and nonverbal cues, and attire to judge our professional capabilities. In today’s electronic world where impressions are made in the absence of face-to-face interactions, Dr. Millard makes a strong case for maintaining a strong virtual presence. The art of effective self-promotion - communicating one’s strengths and accomplishments to others in a sincere way without appearing to be bragging - is also a skill that women faculty should master. While it’s wonderful when others notice another’s achievements, individual faculty are in the best position to share their accomplishments with others. The chapter concludes with some expert advice for those faculty members privileged to be in leadership positions, namely understanding the responsibilities associated with holding prominent roles on campus.

Final Thoughts

We sincerely thank all of the contributors to this volume. This compendium of successful mentoring practices to enhance the leadership, visibility, and recognition of academic women in science and engineering emphasizes the importance of the collective efforts of the academic community to broaden the participation and advancement of women faculty. It is our sincere hope that readers of this volume will find valuable information that assists individual faculty members in their careers and inspires institutions to provide the resources that enable every faculty member to flourish. An investment by an institution in the continuous development of a faculty member’s career will have a broad impact not only on the individual faculty member, but also on his or her colleagues and

students and on the ability of the institution to attract and retain excellent faculty and students.

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Chapter 2

Facilitating the Advancement of the Next Generation of Women Faculty: Female Graduate Students and Postdoctoral Associates

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It is critical to facilitate the advancement of female faculty by developing and promoting successful mentoring strategies at all educational and professional levels. This is especially true during doctoral and postdoctoral study, when potential future faculty members evaluate their career options and academic environments on a daily basis. A recently-established program at the University of Michigan focuses on addressing the identified professional needs of chemistry graduate students and postdoctoral associates, particularly women and underrepresented minorities, in areas not commonly addressed during doctoral and postdoctoral training. This chapter discusses the establishment of the student- and postdoc-led Chemistry Professional Development Organization, which has developed a variety of data-driven programs to equip chemists of all backgrounds—especially those in underrepresented groups—with the tools to reach their personal and professional goals, including pursuit of faculty careers.

Background

Although women currently earn 50% and 36% of bachelor's and doctoral degrees in chemistry (1), they remain underrepresented at almost all levels of academic faculty and administration, as well as in industry and government (2). Table I shows the representation of women among chemistry faculty members based on the highest degree awarded by their institution (2, 3). While women

of all races-ethnicities are underrepresented compared to their proportion of the U.S. population, this is particularly true for women of color: African-American, Hispanic/Latina, and Native American females comprised *less than 1%* (22 of 2787) of tenure-track faculty at the top 100 chemistry departments (by National Science Foundation research expenditures) in 2007 (4).

The dearth of females in science, technology, engineering, and mathematics (STEM) fields, including chemistry, has often been attributed to few women pursuing careers in technical fields or to insufficient ‘lag time’ to allow the employment rates to ‘catch up’ to the educational rates. At least in chemistry, however, these suggestions are not supported by statistics. Women have earned at least 25% of all Ph.D.s in chemistry since the late 1980s—rising above 30% by the late 1990s—yet after three to four tenure cycles comprise only 12% to 18% of full professors at institutions granting at least a baccalaureate degree (1–3). In fact, the increase in representation of women among chemistry doctoral degree holders in recent decades is itself potentially misleading because it is due not only to the higher number of female graduates (723 in 2005 vs. 362 in 1985) but also to the decreasing number of male graduates (1,403 in 2005 vs. 1,474 in 1985) (5).

The underrepresentation of women in the ranks of academic chemistry faculty can be attributed in large part to significant leaks in the career pipeline that represents progression from (pre)undergraduate training through the professional ranks. Leaks occur before, during, and immediately following the Ph.D. as a result of self-selection of qualified individuals out of these careers (6, 7). For example, despite earning 30–32% of chemistry doctorates during the late 1990s (1), women comprised just 22% of chemistry postdocs in 2002 (8) and 18% of applicants for research-intensive chemistry faculty positions from 1999–2003 (9). Reasons for this exodus from academic careers are likely to be as numerous and complex as the women making the decisions. In recent years, a number of studies have sought to describe underlying themes related to the experiences of graduate students (and occasionally postdocs) in all fields (10), in the sciences (11), and in chemistry (8, 12–14). Work undertaken in conjunction with this project also evaluates demographic differences in key experiences, values, and factors that impact the career choices of graduate students and postdocs within a large U.S. chemistry department (15). Ongoing research in this area is critical for developing data-driven programs and policies that increase retention of qualified doctoral-level chemists from all backgrounds.

Why is it necessary to broaden the participation of chemists in underrepresented groups? Research has demonstrated that groups comprised of individuals with a variety of perspectives outperform those comprised of like-minded thinkers in terms of problem-solving and innovation (16, 17). Among other factors, an individual’s gender, race-ethnicity, place of origin, and socioeconomic status contribute to his or her individual approach to problem-solving. Thus, it stands to reason that the chemical enterprise best positions itself for success in innovation and problem-solving when it includes contributions from individuals with diverse experiences and backgrounds.

Successful programs exist to promote and support women in science from preschool through the workplace, but they are rare at the graduate and postdoctoral levels. The scarcity of endeavors focused on encouraging female doctoral-level

Table I. Representation of Women at Various Chemistry Faculty Ranks as a Function of Institution Type (2, 3)

	<i>Assistant Professor</i>	<i>Associate Professor</i>	<i>Full Professor</i>
Bachelor's-granting ^a	37%	36%	18%
Master's-granting ^a	33%	31%	16%
Doctorate-granting ^b	27%	23%	12%

^a Data from 2005. ^b Data from 2009.

chemists, particularly women of color, to continue in the sciences after completing their training is a major contributor to the leak in the aforementioned pipeline to both academic and non-academic careers. These students already have demonstrated an interest in science careers, yet they face imminent decisions about continuing to pursue these paths. Consequently, it is imperative that programs are created to repair this leak, retain chemists who obtain advanced degrees, and establish underrepresented groups in scientific careers. Such endeavors must focus on developing programs and practices that engage, enable, and inspire female and minority doctoral-level chemists to achieve their full potential and to attain their personal and professional goals. In the long term, policies and practices that broaden the participation of women will strengthen the domestic technical workforce and contribute to a level playing field for *all* chemists.

Mentoring plays a key role in career success (8). In an ideal world, all graduate students and postdocs would enjoy ample and uniform access to training and mentoring experiences that help them acquire information, build networks, and develop all of the necessary professional and personal skills to complement their research prowess. However, such aspects of training and mentoring often are not included in the traditional, research-centered curriculum. Recent data show that a majority of the graduate students and postdocs surveyed—regardless of demographic group—desired access to such complementary programs (15). In addition, a significant percentage of these students and postdocs, particularly women, lack mentors (15). Anecdotally, it appears that these trainees may not recognize the need for mentoring or may be unsure how to identify and establish a relationship with appropriate mentors. If, for whatever reason, mentoring is not readily available or accessible, how can students and postdocs fill the gap for themselves?

Complementary Initiatives

Across the United States

A number of initiatives have focused on broadening women's participation at the graduate and/or postdoctoral levels. The Committee on the Advancement of Women Chemists (COACH) has expanded its repertoire of professional skills workshops for female faculty to include sessions specifically designed to help female and underrepresented graduate students and postdocs build their negotiation skills and develop strategies for career success. These

workshops are offered at professional society meetings (including those of the American Chemical Society) and in conjunction with individual organizations or institutions. MentorNet pairs female and underrepresented minority graduate students, postdocs, and early-career faculty at partner institutions with senior mentors in one-on-one ‘e-mentoring’ relationships. A number of campus-based programs—for example, the Stanford Chemistry Women’s Committee on Graduate Life, the Georgia Tech Women in Chemistry Committee, and several Association for Women in Science (AWIS) and Iota Sigma Pi chapters—have also taken steps to improve various aspects of female graduate students’ and/or postdocs’ experiences. Such initiatives include support programs, career-related events, issue-focused discussions, and maternity or parental leave policies or guidelines.

At the University of Michigan

Since its founding in 2001 as part of a larger National Science Foundation effort to increase the participation of women faculty in academic STEM careers, the University of Michigan (UM) ADVANCE program has developed a number of successful department-, university-, and nationally-based initiatives to effect institutional climate change. This work, including a survey of the climate experienced by graduate women across UM, has set the stage for the development of new, complementary endeavors to increase the participation of graduate students and postdocs from underrepresented groups.

The UM chemistry department has also implemented effective programs over the past several years to increase the gender and racial-ethnic diversity of its faculty and to enhance the departmental climate for diverse populations. As a result of a UM ADVANCE-sponsored Departmental Transformation Grant, the faculty hiring process was redesigned to foster diversity; departmental policies were modified to be more democratic and transparent; and mentoring efforts and departmental climate were enhanced to foster the success of junior faculty, especially women. This program resulted in a substantial increase in the representation of women among department faculty, from 2.5 female professors in 2001 to 8 (of 37) in 2009. It also set the stage for the establishment of a similar program focused on graduate students and postdocs.

The University of Michigan Chemistry Professional Development Organization

The project described herein extends the UM ADVANCE and chemistry faculty development initiatives described above to meet the needs of chemistry graduate students and postdocs. The department is home to 76 postdocs, including 21 women, 3 underrepresented minorities, and 47 foreign nationals. Of 193 graduate students enrolled in chemistry, 107 are women, 10 are underrepresented minorities, and 55 are foreign nationals. In addition to those enrolled in the chemistry department, 76 graduate students are enrolled in other UM departments (e.g., Macromolecular Science and Engineering, Applied Physics,

and Biological Chemistry) but have research advisors with primary appointments in chemistry. A number of these ‘chemistry-affiliated’ students choose to take part in project-related activities.

Origin and Establishment

The Chemistry Professional Development Organization (CPDO) at the University of Michigan was founded in 2009 to address the professional development needs of chemistry graduate students and postdoctoral associates, particularly women and underrepresented minorities; these needs were identified through a department-wide assessment and series of listening sessions. The organization is one component of a National Science Foundation Discovery Corps Fellowship project to evaluate and address a number of factors related to the experiences of members of underrepresented groups within the UM chemistry department. The CPDO’s programs and activities are meant to complement more traditional mentoring strategies rather than to replace them entirely. This program is one of several potential tools in a graduate student’s or postdoc’s mentoring toolbox.

Before constituting the organization, all graduate students and postdoctoral associates affiliated with the department (both chemistry enrolled/appointed and ‘chemistry-affiliated’) were asked to participate in a confidential, anonymous online assessment. Disaggregated data from this study were used to evaluate the personal and professional needs and goals of the participants and the ability of current standards and practices to enable individuals to reach their goals. The data clearly indicate that women often have significantly different support and professional development needs from their male counterparts, including different levels of expressed interest in co-curricular programs (18). A subsequent series of four listening sessions was held to affirm the assessment findings; refine program goals; promote active engagement by and support from graduate students, postdocs, faculty, staff, and administrators; and recruit members for the organization. Seven founding graduate students and postdocs established the group and named it the Chemistry Professional Development Organization.

Organizational Structure

UM chemistry and ‘chemistry-affiliated’ graduate students and postdocs of all backgrounds are welcome to join the organization. CPDO membership is not required to participate in our activities. We strive to include as many people as possible from diverse backgrounds (i.e., gender, citizenship, race-ethnicity, seniority, sub-disciplines, and departments of enrollment/appointment). Current members include 10 women, 2 underrepresented minorities, and 5 foreign nationals. Twice each year, new members are recruited to serve renewable one year terms. These staggered terms allow for continuity, new member training, knowledge transfer, and development of leaders from within. The addition of a second membership cohort in early 2010 increased the group size from 7 to 13; as of this writing, members of a third cohort are beginning their terms.

The CPDO has chosen to adopt a relatively flat structure, with the only official role being that of the organization's chair; however, the group's setup allows for the installation of co-chairs or more traditional officers as it evolves. Members take turns arranging and chairing the hour-long biweekly organization meetings, which distributes responsibility throughout the group and allows each member to develop his/her leadership skills in a low-pressure setting. Initially, the size and interests of the group led each member to take responsibility for a particular area (seminar series, website, networking events, etc.). Now that the group is larger and more established, this is no longer necessary. Each member commits to organizing at least one event per year, and more senior members mentor newcomers as they begin to plan events with the aid of CPDO-developed guides, checklists, and templates. In addition, members have access to an internal resource website containing a digital archive of all CPDO records (recruiting materials, event details, meeting minutes, etc.). These resources empower new members to take ownership of their event while minimizing the time investment and potential intimidation associated with a new undertaking. A number of the resources developed in conjunction with this project may be made available to leaders of similar programs upon request.

Thematic Initiatives

Based on assessment data and information from listening sessions, we chose to establish three main focus areas: career exploration; professional skill development; and community-, communication-, and resource-building. To date, we have hosted 22 events and led several projects within one or more of these broad areas. Speakers are identified within the department, on campus, in the region, or across the country by word-of-mouth, through web research, or via networking. Speaker travel and event-related expenses (e.g., refreshments) are funded by the Discovery Corps grant. CPDO-sponsored programs are open to all chemistry graduate students and postdocs, regardless of gender or race-ethnicity; in fact, many of our participants are Caucasian men.

Career Exploration

In the course of their training, students and postdocs often witness aspects of their faculty advisors' professional—and sometimes personal—lives. At least among female graduate students, however, recent research suggests the presence of a disconnect between students' perceptions of different careers and the experiences of women in those careers, especially in academia (19). Based on their daily observation of faculty life at a research-intensive university, students may focus more on the challenges of a tenure-track research career (long hours, grant deadlines, increased competition for funding) rather than identifying with potential rewards and benefits (flexible schedules, academic freedom, and supervising students in the lab). In addition, standard curricula often do not afford the opportunity to explore career options outside the research-focused academic tenure stream. As the number of chemistry doctoral degree holders far

outstrips the number of tenure-track positions available (an imbalance that may only increase in the future), it is critical that chemists of all backgrounds be able to make informed career decisions.

To that end, many of our events focus on career exploration. We have organized speakers or panel discussions on careers at teaching-focused academic institutions, in patent law, in federal research labs, in science policy, and in industry. At these sessions, chemical professionals share their career paths; discuss strategies for success and for navigating challenges such as work-life balance; and answer participants' questions. We have also hosted five external visitors (four from academia, one from a federal lab) as part of the CPDO Seminar Series. In addition to meeting with UM faculty members and presenting their research in a department seminar, each speaker spends one to two days meeting with students and postdocs over meals; participates in a networking reception; and gives presentations on topics complementary to his or her research. Examples of such presentations include:

- diversity in science,
- women in academia,
- creating innovative undergraduate courses at a research university,
- developing a career in the U.S. from an international perspective,
- comparisons between academic and industry careers,
- comparisons between government research and science policy careers,
- the role of service in a chemist's career, and
- several (different) perspectives on work-life balance.

All of these sessions allow participants to more fully explore their own places in the chemical enterprise, whether through academia or another career path. The events, which often include individual or small group meetings, also afford participants an opportunity to make connections with potential mentors outside UM.

Professional Skill Development

Chemistry doctoral programs excel at training students and postdocs to become highly skilled and independent researchers. Many trainees also have an opportunity to build skills complementary to their research; for example, they may serve as substitute lecturers, assist their advisors with grant-writing and manuscript review, or mentor junior students in the lab. However, these opportunities tend to be specific to the individuals and situations involved. Therefore, we offer programs that allow all participants to build the so-called "soft skills" (e.g., communication, self-differentiation, effective teamwork, etc.) that are becoming increasingly critical for career success.

A series of events has focused on the academic job search from a variety of perspectives. At one such event, a panel of UM chemistry faculty members—a recently hired junior professor, a search committee chair, and a department chair—discussed the mechanics of applying for tenure-track research faculty positions. A follow-up event featured two postdocs, who simulated the research

proposal portion of a faculty candidate interview by giving mock presentations to an audience that included several professors volunteering as ‘search committee’ members. These faculty members helped the audience to understand a heretofore mysterious process by posing questions commonly asked in such sessions, providing feedback on the proposals and presentations, and sharing strategies from their experiences. Soon-to-depart chemistry postdocs who have successfully obtained a variety of administrative, teaching-focused, and research-focused academic appointments have served on annual panels to discuss the details of their recent job search and share tips for success. Postdocs on the most recent panel also shared their application materials to illustrate appropriate approaches to applying for various kinds of positions.

Two other skill-building events have leveraged innovative programs to teach more generally-applicable skills. In collaboration with several campus entities, we hosted two facilitators who present workshops through the Committee on the Advancement of Women Chemists. These facilitators presented a half-day negotiation skills workshop that allowed participants to explore key elements of negotiation, assess their own conflict resolution styles, develop strategies for approaching negotiations, and practice via case studies. We also collaborated with the UM Center for Research on Learning and Teaching (CRLT) Players, a theater troupe often invited to perform their interactive skits on educational and diversity topics at national conferences and workshops. We worked with the CRLT Players to customize four such skits to illustrate the challenges that chemistry students and postdocs often face in communicating with their research advisors and lab colleagues. Coupled with written conflict resolution materials, these skits served to catalyze a guided discussion about the various dynamics involved in and strategies for successfully resolving such situations.

Community-, Communication-, and Resource-Building

It is critical that all department members enjoy equal access to communities, methods of communication, and avenues for resource dissemination. This is particularly true for postdocs, who almost always enter departments as individuals rather than in a cohort. Consequently, they lack opportunities to build relationships with faculty and colleagues through coursework, curricular requirements, or other student-focused pathways. The CPDO events and programs described above also often include one or more components of our community-, communication-, and resource-building objective. These networking-based efforts complement the department Graduate Student Council’s periodic social events and the annual department-wide research symposium.

As is common in large departments, some individuals may lack opportunities to interact with peers or potential mentors. We have initiated a periodic series of networking events to increase informal interaction among graduate students, postdocs, and faculty. The events have been held at various times of day (breakfast, lunch, mid-afternoon) to facilitate participation by those with constrained schedules. We have also co-sponsored a gathering specifically for postdocs to enhance community within this population.

In addition to programming, the CPDO has collaborated with chemistry administrators to enhance various aspects of the department experience and to facilitate equal access to resources. Recent initiatives have included implementing a preparation process to facilitate the success of those participating in on-campus interviews for industrial positions and establishing online graduate student and postdoc personnel directories to foster communication. CPDO leaders disseminate career-related announcements through our email list. In most cases, podcasts of and documents from our events are posted on an internal website, enabling UM chemistry students and postdocs to utilize these resources on an ongoing basis. We also have established a CPDO website (<http://www.umich.edu/~chempdo>) that includes an ever-expanding list of department, campus, and external resources of relevance to chemistry students and postdocs.

Evaluation and Measures of Success

We evaluate our individual events and our overall strategic plan on an ongoing basis. Following each program, participants are asked to complete an anonymous, online evaluation that combines Likert-scale and open-ended questions about the event's interest, timing, speaker(s), format, suitability to address a previously unmet professional development need, and most and least positive aspects. Attendees are also invited to suggest topics for future events and to leave any other comments. If the commenter chooses to provide an email address, we reply to questions or suggestions by return email.

In addition to gathering formal program data, we also host informal biannual open house sessions; the purpose of these casual, drop-by events is to provide a mechanism for informal feedback, to disseminate information about the CPDO, and to recruit new members. We also debrief each event at a subsequent CPDO meeting, discussing what was successful and what might be improved upon in the future. The CPDO holds one strategic planning meeting each semester to ensure the continued relevance of our focus areas and to lay the groundwork for a cohesive series of upcoming events.

As of June 2010, 207 individual chemistry and 'chemistry-affiliated' graduate students and postdocs have participated in at least one of our 22 events, for a grand total of 703 participant-occurrences. This is only one of several possible measures of success, but it is supported by our post-event evaluation data. In aggregate, over 83% of participants who responded to evaluation surveys agree or strongly agree that an individual event addressed a previously unmet professional development need. This figure rises to 89% for career-exploration or skill-building events, indicating that these events are of particular relevance. Overall, 93% of evaluation respondents agree or strongly agree that they would recommend the events to others. Word of the organization's activities has spread, and a number of trainees from other UM departments have asked to participate in our events.

Post-event evaluations also reveal participant enthusiasm in the form of open-ended comments about the programs attended. The quotes below illustrate examples of participants' responses regarding the effectiveness of various programs.

- Regarding a panel discussion featuring faculty members from teaching-focused institutions: “[T]hey were able to provide insights regarding differences between small and large universities that we...would not have generally known to ask about.”
- Regarding a career exploration event with a program officer from the National Academies: “The speaker [discussed] a job opportunity I had never thought of before. I had no idea jobs like [hers] really existed.”
- Regarding a CPDO Seminar Series speaker from a research-focused university: “[I]t was exciting to hear a faculty member very happy with her position and so open about how she got there.”
- Regarding a speaker on careers in federal research labs: “[She] gave a great overview of job opportunities and working environments in...national labs. I really appreciated her candor in talking about problems women have faced within those labs and ways they dealt with them to advance their careers.”
- Regarding a CPDO Seminar Series speaker from a research-focused university: “[The most positive aspect was] the less formal discussion of cliques/clubs and the background politics of a faculty position.”
- Regarding the panel discussion on the mechanics of applying for tenure-track research faculty positions: “Discussion of nego[t]iating a start-up package was information I’d never heard before.”
- Regarding the mock faculty candidate research proposal presentations and discussion: “[It] demystified the whole idea of the job proposal talk.”
- Regarding the 2010 panel with postdocs departing for academic positions: “It was helpful to realize that where you are targeting your job application to influences the process so much. The variety in the panelists helped greatly to understand the process as a whole. I’m sure...the packet [of panelists’ application materials] will come in helpful too.”
- Regarding the negotiation skills workshop: “[I]t helped me realize how important negotiation is, and showed me ways to be a better/effective negotiator.”
- Regarding the CRLT Players skits and discussion on conflict resolution: “Open discussion about each topic was very effective as everyone can participate and give an input on the matters face[d] everyday.”
- Regarding a networking event where participants were seated according to the color of their food plates: “Matching your food plate color to a particular table...enables meeting with new colleagues rather than choosing a table with your friends.”

Implications for Other Departments

There is an increasing interest in broadening the participation of underrepresented groups in chemistry by recruiting and retaining diverse populations of graduate students and postdocs. This interest was reflected at the Spring 2010 Graduate and Postdoctoral Diversity Programs Summit, which

fostered connections between CPDO leaders and those in similar roles at other institutions, including Stanford, Georgia Tech, the University of California San Diego, and the University of California Santa Barbara. Summit delegates agreed that these department-based programs play a significant role in enhancing women's graduate and postdoctoral experiences, increasing retention of women in chemistry careers, and working to level the playing field for all chemists. Even in economically challenging times, such programs constitute a minute fraction of a research-intensive department's budget. The costs are far outweighed by the benefits in recruitment, retention, and reputation spread by alumni as they move through the professional world.

The following are insights gained by CPDO members during the process of establishing the organization. They may be beneficial for individuals or institutions considering creating such a program, whether in chemistry or in another STEM department.

Funding

CPDO has had the luxury of ample funding as a result of the Discovery Corps grant, and matching funds from campus entities will continue to support the program into the future. These funds allow for the purchase of supplies and refreshments for events and for reimbursing speakers for travel costs. While this no doubt contributes to the organization's success, it is not necessarily a prerequisite for other programs. The availability of refreshments may easily be varied to accommodate a range of budgets: organizations can choose to host potluck or brown bag events, provide coffee and cookies, or serve full, catered meals. Similarly, organizations with limited budgets can tap into the expertise of their own senior graduate students, postdocs, and faculty members; invite speakers from other campus units or local industry; or share costs with their local American Chemical Society section or another nearby science department.

Personnel

CPDO's founding was overseen by a postdoc appointed to spend a significant fraction of her time on the project. This allowed the organization to immediately implement a high level of activity in line with the observed demand. However, similar initiatives (such as those at Stanford and Georgia Tech) have been successfully established in situations with dedicated student or postdoc leaders, strong faculty and/or staff mentoring, and a clear message from administrators regarding the project's value to the department.

CPDO receives staff support in the form of financial management and assistance with arranging travel, processing reimbursements, ordering food for events, and publicizing seminars. Again, this level of support is valuable but not absolutely necessary, especially for organizations with minimal logistical needs. However, we believe that some amount of staff support is critical for an organization run by graduate students and postdocs, who balance this service to their colleagues and department with their own research, teaching, and other duties. As such, they should be afforded sufficient resources to fulfill their

mission without requiring undue sacrifice in terms of their research productivity and outside obligations. Strong communication between the organization, the staff, and the administration is key to determining what support is needed and how it will be implemented.

Communication

Both CPDO members and event participants have competing demands on their time, so communication within the group and with our constituents is key to promoting active engagement and maintaining support. Our recruitment materials and open house sessions discuss the benefits of CPDO membership, including opportunities to develop leadership experience in low-pressure settings; to build one's CV or resume; to establish or expand a professional network; and to bring to fruition events or programs of particular interest to the organizer. Program announcements explicitly describe what participants will gain (e.g., opportunities to network, to learn about a particular career path, or to acquire a new skill) by attending an event. We also ensure that all members of the department are updated regarding our activities by distributing newsletters each semester that summarize our recent events and highlight upcoming programs.

Our communication strategies appear to be effective, as evidenced by sustained high rates of participation and positive feedback. Nevertheless, communicating with a large group of people in a media-saturated society is an ongoing challenge. Based on the resources available to us, we communicate primarily through our department-wide email list and website; we occasionally invest time and resources into posting fliers for key events. We have received feedback that some graduate students, in particular, feel that email is over-utilized by various campus entities; this seems to pose a challenge in terms of connecting with the small number of department members who prefer not to communicate by email. We continue to evaluate the possibility of utilizing complementary forms of social networking, including Facebook and Twitter. Our dissemination strategies are likely to be an ongoing source of discussion, especially as forms of communication continue to evolve.

Establishing a Sustainable Organization

Setting up a new organization is both time- and energy-intensive, especially in terms of making key decisions and establishing relationships and protocols for logistical support. Several of the CPDO's founding postdocs had been involved in student-run organizations as graduate students and had experienced the fluctuations in activity and momentum inherent in any long-term initiative. To the extent possible, we were able to minimize these oscillations by deliberately establishing a simultaneously regimented and flexible organizational structure that is likely to ensure sustainability. Staggering membership terms allows for leadership continuity and transfer of institutional memory. We avoid the need to continuously 'reinvent the wheel' by maintaining templates, 'how to' documents, and a well-organized digital archive for related correspondence as we work out the logistics of programming (e.g., inviting speakers, ordering

food, running meetings). While this documentation process required an up-front investment of time and energy, we've found that it allows for less-intensive upkeep in the long term and reduces the learning curve for those new to leading such programs. We also take advantage of time-saving electronic resources such as www.surveymonkey.com, www.doodle.com, and UM's web-based course and project management utility to conduct event registrations and evaluations, schedule meetings, and archive CPDO-related materials, respectively.

Establishing a data-driven vision focused on three broad areas serves as an overall strategic planning guide yet also allows us to customize programs and initiatives as new data and interests arise. Mechanisms for ongoing feedback—including post-event evaluations, internal event debriefings, and periodic strategic planning meetings—provide opportunities to evaluate events in real time while planning for the future.

Summary

To increase the representation of women in chemistry, particularly in academia, it is critical to examine and address sources of self-selection at all educational and professional levels, including graduate and postdoctoral study. Graduate students and postdocs of all backgrounds should have access to a suite of mentoring options during a time where they continually evaluate the implications of potential career choices. The student- and postdoc- led University of Michigan Chemistry Professional Development Organization complements more traditional training programs and mentoring techniques by providing opportunities to explore career options; build skills complementary to research; and leverage community, communication, and other resources. Data from a department-wide assessment, a series of listening sessions, and ongoing formal and informal evaluations inform the group's activities within these three strategic focus areas. Ample funding, staff support, clear communication, and a sustainable organizational structure allow CPDO to offer relevant and high-quality programming, enjoy robust levels of participation, and earn overwhelmingly positive feedback. Insights and strategies gained from the process of establishing such a program can be readily adapted to suit the needs and budgets of other individuals or institutions in all STEM disciplines. The widespread establishment of such programs is likely to increase the recruitment and retention of female graduate students and postdocs, equip them with the tools to reach their personal and professional goals, and level the playing field for scientists and engineers of *all* backgrounds.

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Chapter 3

Adapting Mentoring Programs to the Liberal Arts College Environment

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Recent work indicates that mentoring of both tenure-track and tenured STEM women faculty is important for their success. Surveys at Union and Skidmore Colleges have shown that faculty rising through the ranks agree that they need more information about the tenure and promotion process and that having a mentoring program is important to them. Because the development of mentoring networks is considered more beneficial than having a single mentor, the overall goal of our project is to provide faculty with a variety of mentors who can share their successes and challenges. At small institutions such as ours, drawing from the population of both colleges for mentors is advantageous. As a complement to the pre-existing mentoring programs on both campuses, we have developed a series of mentoring opportunities mainly for STEM women faculty, including speed mentoring, receptions, discussion tables, peer mentoring, and a mentoring database. STEM women have found the opportunity to exchange information on achievements and challenges, both personal and professional, to be empowering.

In the summer of 2008, Skidmore and Union Colleges received funding from the NSF ADVANCE program to adapt exemplary tools developed through ADVANCE Institutional Transformation programs at large research institutions to the climate and conditions at small liberal arts colleges. Skidmore and Union Colleges are both highly selective private liberal arts colleges of similar size in the Capital District of New York State that differ from one another in significant ways. Skidmore, co-educational since 1971, was originally a women's college that traditionally emphasized the arts and humanities. Over the course of the past decade, it has increased the role of the science, technology, engineering, and mathematics (STEM) disciplines in its curriculum. In contrast, Union is a formerly all-male college, also coeducational since 1970, that historically has had a strong natural science and engineering orientation—approximately 40% of its students major in the lab sciences and engineering. Thus, the two institutions bring different experiences and strengths to the project, and therefore tools developed for this project are expected to have broad applicability to a wide variety of liberal arts institutions. (More information about the SUN NSF-ADVANCE program can be found at <http://sun.skidmore.union.edu/>.) One important goal of our NSF project involves providing resources and support, including mentoring, that will help assistant and associate professors advance in rank.

By virtue of their smaller size, academic departments in liberal arts colleges often have only one faculty member in a particular subfield. Therefore, there is a much lower likelihood of women faculty finding a mentor with similar scholarly interests, let alone one of the same gender, than at a research university. Cross-institutional relationships become critical when there is only one woman in a department who teaches a particular topic or does research in a particular subfield. They are also, as Gibson notes (*I*), a way to “avoid some of the political constraints of being mentored in one's academic department.”

To address the potential lack of a suitable mentor within the department, we have formed the SUN (Skidmore-Union) Women Faculty Network, a cross-institutional network among women faculty in STEM departments at the two colleges. Our goal is two-fold: first to facilitate finding a mentor(s) among the STEM women at the home institution who can provide campus-specific forms of mentoring, especially related to tenure and promotion processes, and second to facilitate finding a mentor(s) among the STEM women at the partner institution who can provide discipline- and preferably sub-discipline-specific forms of mentoring, especially related to teaching and research. This approach has enabled women faculty to go beyond their own departments and institutions to form relationships with others who might provide the pedagogical expertise, similarity of research interests, and/or the psychosocial support they uniquely require. This partnership model of building cross-institutional linkages to enhance mentoring and development opportunities for STEM women faculty may be appropriate for other small liberal arts colleges.

In this paper, we describe the rationale for the mentoring program we are designing. This design is informed both by the mentoring literature and by survey and focus group data from Skidmore and Union faculty. We also provide an overview of the specific components of our mentoring program and our colleagues' responses to them. We begin the paper with information about the mentoring

climate at our institutions, describing mentoring programs already in place at the beginning of the grant period and the survey and focus group information about mentoring that we gathered early in the grant period.

Mentoring at Skidmore and Union: Institutional Programs and Faculty Attitudes

Pre-Existing Mentoring Programs

Both campuses have had various mentoring efforts over the years, but here we will focus only on the efforts that were in place at the two institutions just before the grant was received. At Union College, the Union Coalition for Inclusiveness and Diversity (UCID) has recently established a program for all pre-tenure faculty members, visiting faculty, and recently appointed lecturers. It provides them with the opportunity to have a mentor from outside their own department to complement the mentoring they receive from colleagues within their department. Participation is completely voluntary. Junior faculty are not assigned a particular mentor but, instead, may choose anyone from a diverse pool of available mentors. Junior faculty members may change mentors at will.

Another ongoing program at Union is part of new faculty orientation and consists of three sessions each year. The first, before classes begin in the fall, is an all-day event focusing on teaching resources and policies. The second and third are made up of a dinner, a short talk, and a one-hour panel presentation and discussion. The second focuses on faculty scholarship and a member of the Grants Office gives the short talk. The third focuses on service to the department, college, and profession with a short talk about faculty advising. New department Chairs also receive a half-day orientation.

At Skidmore, the new faculty orientation program, coordinated by the Assistant Dean of Faculty and Director of the First Year Experience, has been reformulated as a new faculty learning community consisting of all first year faculty and several tenured faculty mentors. Interested second-year faculty are also invited to participate. Before the beginning of the semester, there is a day-long orientation program that focuses on practical faculty issues. After the initial meeting, the faculty learning community meets monthly for informal discussions about any issues of interest which may include classroom management, interpretation of student evaluations, and balancing work/life issues. The faculty mentors also take the new faculty out to lunch or host dinners at their homes.

Focus Group and Survey Data Evaluating Pre-Existing Mentoring

During the first year of the project, we conducted focus groups and administered a climate survey to gather data on the current status of women faculty in the STEM disciplines at the two colleges. During the second year of the project, we conducted a mentoring survey. All three sources of data indicated that most faculty believed mentoring is important and provided suggestions of some ways in which mentoring at the colleges might be improved.

Focus Groups

Three focus groups were held at each institution, one for each rank (assistant, associate, and full professor), resulting in a total of 6 groups. A typical group contained 6-8 women representing the full range of STEM disciplines at each college at each rank. The focus groups provided a rich set of baseline data for a variety of purposes, especially the development of the climate survey.

The issue of a formal mentorship program arose in the focus groups with assistant professors. For example, one natural scientist commented:

I would have liked to see more of a concrete mentorship program, because I think that it would have been helpful for me to have someone outside of my department to talk to. And that it would have been helpful for me to have a go to person within the department. I think I would have benefitted from that.

A natural scientist in a different department responded:

I would agree with that. I find that I can go to the senior members of the faculty and ask them questions, but it's just me asking them questions. There's no sort of rapport or give and take in mentorship. And sometimes I feel like I'm just pestering them with questions, but I don't know how else to find out things that I need to know.

Similarly, the women associate professors in the STEM disciplines on both campuses felt disadvantaged by the lack of mentoring around promotion to full. Specifically, they reported not getting sufficient information about when a faculty member is ready to go up for promotion to full professor. For example, when discussing the issue of when to stand for promotion to full professor a woman associate professor in the natural sciences observed that, "There's not very good advice," her social science colleague responded, "I don't get any real mentoring about it. Whereas when I was junior, I got tons of mentoring." A female assistant professor in the social sciences even remarked on this problem when discussing mentoring in her focus group, commenting that, "There seems to be no mentorship at the next levels. I mean, full professor." Thus the focus group data reinforced our plan to target our mentoring activities at associate professors as well as untenured women to help STEM women at both levels progress successfully to the next rank.

Climate Survey

A climate survey was administered to all tenure-track and tenured faculty employed at the two colleges between March 15 and June 16, 2009. Out of the 341 tenured and tenure-track faculty to whom the survey was sent, 237 completed it, yielding a 70% response rate. Table I shows demographic information for the survey respondents. STEM women at both institutions had a 91% response rate leading to their overrepresentation in the sample.

Table I. Demographics of Faculty Respondents

<i>Characteristic</i>	<i>Frequency</i>	<i>Percentage</i>
College of Employment		
Skidmore College	122	52
Union College	115	48
Professorial Rank		
Professor	90	38
Associate Professor	95	40
Assistant Professor	50	21
Lecturer	2	1
Gender		
Female	118	50
Male	119	50
Discipline		
STEM ¹	139	59
Non-STEM ²	98	41

¹ STEM fields include the Social Sciences (Anthropology, Economics, Political Science, Psychology, and Sociology) in addition to the Natural Sciences, Engineering, and Mathematics. ² Non-STEM fields include the arts, humanities, and professional programs (Education, Management and Business, and Social Work).

The survey was designed in the fall of 2008 to measure dimensions of faculty work life by adapting items from existing climate surveys used at the University of Alabama, University of Illinois at Chicago, University of Michigan, University of Texas, Utah State University, Virginia Tech, and University of Wisconsin to a liberal arts college setting. Items that did not pertain to liberal arts colleges, such as teaching graduate-level courses, were deleted, and some items that were particularly pertinent for liberal arts colleges were modified or added. The survey consisted of 53 questions covering the following domains:

- Demographics
- Tenure and Promotion
- Equipment, Supplies, and Resources
- Department Climate
- Balance between Professional and Personal Life
- Overall Satisfaction with Work/Job/Campus
- Work Load
- Health and Well-Being

The discussion here focuses only on four items that were particularly pertinent to mentoring.

Table II. Climate Survey Data (in percentages)

<i>Statement</i>	<i>1- Strongly Disagree</i>	<i>2- Disagree</i>	<i>3- Somewhat Disagree</i>	<i>4- Somewhat Agree</i>	<i>5- Agree</i>	<i>6- Strongly Agree</i>	<i>Total (N)</i>
Colleagues give career advice/ guidance ¹	8.7	9.2	9.2	22.0	26.1	24.8	100.0 (218)
Senior Colleagues Helpful Toward Tenure ²	8.7	8.2	10.5	20.5	23.7	28.3	100.0 (219)
Senior Colleagues Helpful with Promotion to Full Professor ³	19.1	10.8	19.1	19.7	17.8	13.4	100.0 (157)
	<i>1- Very Unimportant</i>	<i>2- Unimportant</i>	<i>3- Somewhat Unimportant</i>	<i>4- Somewhat Important</i>	<i>5- Important</i>	<i>6- Very Important</i>	<i>Total (N)</i>
Faculty Mentoring Program ⁴	9.1	8.2	7.7	24.5	25.0	25.5	100.0 (208)

¹ This question was prefaced by the general statement: "How much do you agree or disagree with the following statements about resources available to you?" and the statement was "I have colleagues or peers who give me career advice and guidance when I need it." ² The question was prefaced by: "Please indicate your level of agreement with the following statements regarding your personal experience going through the tenure process in your department." and the statement was "My senior colleagues are/were very helpful to me in working toward tenure." ³ The question was prefaced by: "Please indicate your level of agreement with the following statements regarding your personal experience with the process of promotion to full professor in your department." and the statement was "My senior colleagues are/were very helpful to me in working toward promotion to full professor." ⁴ The item was prefaced by: "Thinking about what you need to do your job as a faculty member more successfully, especially to help you attain tenure or promotion to full professor if you have not already, please rate the importance of the following programs or policies".

The climate survey included three questions specifically about colleagues' help with the respondent's career: a general one, one specifically about tenure, and another about promotion to full professor (which only associate and full professors were asked). In addition, the climate survey asked faculty to rank the importance of a faculty mentoring program.

According to Table II, while almost three-quarters (73%) at least somewhat agreed that they had colleagues who gave advice and guidance about their careers, over one-quarter (27%) at least somewhat disagreed. These frequencies did not differ by gender, but they did differ by discipline with faculty in STEM fields more likely to have reported having colleagues who provide guidance and advice. Table III presents means by discipline along with the results for an independent samples *t*-test of the difference of means.

Over one-quarter of the faculty (28%) strongly agreed with the statement that senior colleagues were helpful in working toward tenure, while one-quarter (24%) agreed, and slightly less than one-quarter (21%) somewhat agreed (see Table II). Over one-quarter of the faculty (28%), therefore, at least somewhat disagreed that their senior colleagues were helpful in working towards tenure. These frequencies did not vary by rank, tenure status, gender, or discipline.

Table III. Comparisons of Faculty on Two Measures of Mentoring (n=139 STEM and 98 Non-STEM; n=90 Professors and 95 Associate Professors)

<i>Variable</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>p</i>
I have colleagues who give career advice/guidance			-3.21	216	.002
STEM	4.50	1.46			
Non-STEM	3.82	1.63			
I have colleagues who give career advice/guidance			2.56	216	.011
Tenured	4.07	1.56			
Non-tenured	4.71	1.50			
Senior colleagues helpful towards promotion to full			-2.97	155	.003
Associate Professor	3.07	1.58			
Full Professor	3.84	1.68			

Only 13% of the full and associate professors strongly agreed that senior colleagues were helpful in working toward promotion, 18% agreed, and 20% somewhat agreed. While these frequencies did not vary by gender or discipline, they did vary by rank with the associate professors more likely to somewhat disagree while the full professors were more likely to somewhat agree that senior colleagues were helpful in working toward promotion. Table III presents means by discipline along with the results for an independent samples *t*-test of the difference of means.

When the climate survey asked respondents to rate the importance of a faculty mentoring program, one-quarter (26%) rated it as very important, one-quarter (25%) as important, and one-quarter (24%) as somewhat important (see Table II). The remaining quarter (25%) of the faculty felt that a mentoring program was at least somewhat unimportant. Thus, there appears to be consensus that faculty would benefit from a mentoring program.

Mentoring Survey

A short follow-up survey examining issues related specifically to mentoring was administered electronically to all tenured and tenure-track faculty at Skidmore and Union Colleges in the spring of 2010. Faculty were asked questions in the following general categories:

- Where faculty found mentors (in their department, in another department at Skidmore/Union, at a previous institution, at another institution)
- Their degree of satisfaction with their current mentoring
- The barriers to mentoring
- Areas in which the mentor provides guidance: teaching, student interactions, scholarship, support and guidance, work/life balance, institutional politics.

The response rate to the survey was 144 out of 353 (41%). In total, 46% (65) of the respondents were men and 54% (75) women, of whom 22% (31) were tenure-track and 78% (112) were tenured. Finally, 20% (28) were assistant professors, 43% (61) were associate professors, and 37% (53) were full professors.

Over half (56%) of the respondents indicated that they were satisfied with the mentoring they were currently receiving and almost two-thirds (63%) reported that they had found a good mentor in their department at some point in their career. The percentages of faculty who were satisfied did not differ significantly between tenured and tenure-track faculty. About 25% of full professors, however, replied “not applicable” to the question about current mentoring and noted in the comments section that they feel that they no longer need mentoring and instead provide mentoring.

When asked various questions about why they did not have a mentor, there was very little difference between tenured and tenure-track faculty. Only 10% of tenure track and 20% of tenured faculty agreed that they lacked the opportunity to meet mentors, and 16% in both ranks indicated that they lacked the opportunity to

develop mentoring relationships. Interestingly, one-quarter of tenure track (26%) and tenured faculty (27%) indicated that they would prefer to get mentoring in ways other than the traditional one-on-one senior mentor to junior mentor format.

The data we have gathered via the surveys and focus groups described above is being used to inform our approach to mentoring as our programs continue to develop. We learned that we need to continue to improve mentoring of pre-tenure faculty, and that post-tenure faculty also are in need of networking opportunities to improve access to information about being successful in their careers. The next section will list the mentoring/networking strategies we have developed and our plans for modifying them based on our experiences and the information we have gathered from focus groups, surveys, and assessments administered after each mentoring/networking event.

The Skidmore Union Network Mentoring Program

Our Approach

According to de Janasz and Sullivan (2), the traditional model of faculty being “guided throughout their careers by one primary mentor, usually the dissertation advisor” is no longer appropriate. They argue that faculty are better served by developing “multiple mentoring relationships across their academic career.” Kirchmeyer (3) concurs, concluding that it is important to have an “entire constellation of developers performing functions important for protégé advancement,” particularly since she found that working with developers who are outside of the mentee’s institution resulted in more scholarly publications. Cawyer, Simonds, and Davis (4) also recommend fostering “informal mentoring from multiple faculty members.”

In addition to having multiple mentors, other research finds peer mentoring effective. For example, Files et al. (5) found that a facilitated peer mentorship program for female medical faculty led to an increase in publications as well as promotion in rank. As a result of her research, Wasburn (6) recommends a strategic collaboration approach to mentoring that combines peer mentoring with developmental networks by matching two full professors with a peer group of three to five assistant or associate professors. Our approach seeks to foster a “constellation of developers” by providing opportunities for both vertical (across ranks) and horizontal (between individuals of the same rank) mentoring.

Information collected in the focus groups, the SUN climate survey, the mentoring survey, and informal conversations with assistant and associate STEM professors support our implementation of this approach to mentoring. This broader approach to mentoring is based on the principle we articulated in our NSF proposal that career development benefits from multiple sources, from junior colleagues as well as senior colleagues, from faculty in the same department as well as those from other departments, from faculty at the same institution as well as those from other institutions.

In short, as is true for other occupations, good mentoring plays an important role in a faculty member’s career by enhancing his or her professional growth. Mentoring serves an especially critical role in the advancement of women faculty,

perhaps even more so for those in traditionally male-dominated fields such as the STEM disciplines. Yet, women report low levels of mentoring and other forms of developmental relationships (6–8), perhaps because there is a shortage of female mentors, particularly women in the highest ranks. In addition, the reality of higher teaching loads, higher expectations for service, and heavier student advising responsibilities at liberal arts colleges compared to research universities results in less time for faculty mentoring or professional development by faculty of both genders. In response to our workplace climate survey, women faculty at Skidmore and Union Colleges reported significantly greater time pressures ($M=22.03$) than their male colleagues ($M=19.29$), a difference of 2.74 on a scale ranging from 5 to 30 ($t_{(224)}=3.71$, $p<.001$). For multiple reasons, therefore, faculty at liberal arts colleges, particularly women faculty, may not receive mentoring or may only receive it from a smaller number of people. This lack of mentoring is especially unfortunate because it appears to be more important to women faculty. It has a powerful effect on their perceptions of positive relationships with colleagues which in turn is strongly associated with their job satisfaction (7, 9–11). According to Gibson (1), mentoring affirms their self-worth as teachers and scholars, leads them to feel they are not alone, provides a feeling of connection, gives female faculty a sense that someone cares about their success, and situates them in an academic environment that supports their success.

We have sponsored a wide variety of activities in which mentoring is a component. These range from more formal activities such as speed mentoring to less formal interactions such as receptions. Our goal is to provide faculty throughout the ranks with many opportunities to get to know a variety of STEM women at their own campus as well as the other campus so that they feel that they have a network of people who can be role models, mentors, people to bounce ideas off of, or whatever seems desirable. Below we describe each of these types of activities, providing some information about how to set them up as well as representative feedback from participants.

Our Activities

Speed Mentoring

The speed mentoring program was adapted from Georgia Tech's ADVANCE initiative using materials developed by the University of Kentucky (12). In speed mentoring, tenured STEM women faculty (mentors) provide individual guidance to pre-tenure STEM women faculty (protégés) during an hour-long session that is organized like a speed dating event. Individual meetings between mentors and protégés are short, and participants are matched up in advance by the organizers. Our first event, in April 2009, was for STEM women at both institutions and occurred at Skidmore College, where each protégé met for three minutes with five different mentors. At the conclusion of the event, we had a reception to allow for longer conversations. An anonymous survey conducted after the event showed that 84% of women agreed with the statement that "I was able to meet women working at Union and Skidmore College whom I would not have had an opportunity to meet otherwise" and 79% agreed with the statement that "I would attend another speed

mentoring event.” The major component we planned to change was the meeting time (3 minutes), since 74% of the participants thought that it was “too short.”

The second event was at Union College in Fall 2009, and involved sixteen Union STEM women. It was identical to the first event, except that the meeting times were extended to four minutes. Responses were similar to those in our first meeting, but 60% of participants agreed that the meeting times were “just right,” with 30% agreeing they were “too short” and 10% “too long.” It seems, therefore, that 4 minute meetings work better than 3 minute meetings at our institutions. Below, we include some comments from speed mentoring participants:

I thought the event ran very well. It was well organized and the number of mentors present was impressive. In an indirect way, just the number of mentors interested indicated support/interest in the more junior faculty and that they felt this was something important to contribute to. I would hope that as I progress through my career I would be able to help junior faculty establish themselves in ways similar to those that the SUN program aims to achieve. It was a great event and I hope there will be another one.

Thought it was wonderful! I received alot [sic] of useful feedback from both potential mentors and colleagues. I am less anxious about my ‘long-term’ research goals at the moment. I also found being around women was much less intimidating than I even imagined.

It was a nice afternoon - long enough to make some new contacts but not so long as to detract from the workday. I’m very glad I went.

Overall, speed mentoring offers participants a chance to test out various mentoring relationships and/or to get advice from several different colleagues on a particular question. After adjusting the meeting time, participants were satisfied with the format.

Receptions/Meals with Speakers

In contrast to speed mentoring, which is a very formal type of interaction, our receptions are more informal events. Another component of the SUN grant involves inviting prominent women in the STEM disciplines to our campuses to give research talks. The goal of this part of the program is to provide both mentoring and faculty development opportunities. Women scientists from other institutions can share research findings, form contacts, and identify opportunities for research collaboration with women scientists at Skidmore and Union Colleges. Each speaker spends part of a day meeting with interested women from both campuses. In addition, the group events surrounding these lectures, such as meals and receptions, give women at Union and Skidmore a chance to meet with each other as well as with the visiting scientist.

Overall, informal feedback from these events has been very positive. Women scientists enjoy the opportunity to interact with each other on a professional level. In addition, several collaboration opportunities have developed with the speakers and between women at Union and Skidmore as a result of these events.

Discussion Tables

Feedback from the speed mentoring evaluation and informal conversations among women revealed a desire to have more time to talk about important issues and to bounce ideas off of each other. With this goal in mind, we developed topic-based discussion tables. At these events, women were divided into groups, based on interest, focused on either research, teaching, or service issues. After a casual lunch, discussion on a particular question was initiated. In Fall 2009 at Union College and Spring 2010 at Skidmore College, the topics were:

How do I carve time out of a busy schedule to focus on research?

What role should service play in my career?

How do I interpret student comments on my course evaluations?

The participants were divided into groups of 7-8 members. A facilitator who had specific experience in the area and a note taker were recruited prior to the event. The groups were mixed with women from all ranks participating. This event was opened up to women faculty across the entire campus and was not restricted to STEM women.

In an anonymous evaluation administered after the event, 95% of participants agreed that “The topics chosen provided for interesting discussion” and >90% of participants agreed that they would “attend another SUN lunch,” “recommend this kind of event to my peers,” and “encourage Union College to continue sponsoring this event.” Participants commented:

It was very well organized and our time was efficiently used. My team leader was excellent as well in listening to all comments, then grouping into topics and leading the responses.

I liked this format a lot and thought the group size was perfect (not too big and small enough that everyone had a voice).

Suggestions were solicited for future topics for discussion. In addition to the desire of many to discuss one of the other topics in the future, they suggested the following topics: tailoring research for undergraduate students, work/life balance, and managing students in the classroom. Suggested changes were to make sure that we go around the room and introduce ourselves and to have more time so that people could discuss more than one topic. We plan to continue to run these events under the same format, but will make sure we do introductions in the future. To address the desire to have a chance to discuss the other topics, we plan to run two topic-based discussion table events at each institution during each academic year.

Peer Mentoring

The peer mentoring events were designed to be opportunities for STEM women at the same rank to discuss issues they face and to brainstorm strategies for success. Four events were held for tenure-track STEM women at Skidmore and two meetings were organized at Union, one for all tenure-track STEM women and the other for all STEM women at the associate level. At Skidmore the focus of the meetings has been on issues that are of common concern. At each meeting, the topic for the next meeting is selected. For example, one meeting

was a celebration for faculty who had recently been awarded tenure. It provided an occasion for newly tenured STEM women to share their tips for success as well as answer questions from their junior colleagues. The topic for the next meeting will be about making wise service choices. At Union each group has met only once. In both cases there was good discussion and brainstorming of ideas to improve productivity. These events are still in the early stages. We plan to hold the discussions again this academic year before doing an evaluation of the effectiveness of this mentoring strategy.

Networking Database

To facilitate cross-institutional networking, we are in the process of compiling a database of available mentors and their expertise. The database will be available to STEM faculty at Skidmore and Union. The strength of this approach is that it allows faculty to self-initiate their mentoring relationships rather than being paired by a “match-maker”. This approach also allows the mentor and mentee to self-define the extent of their mentoring relationship along a continuum from a single discussion to an on-going dialogue. We are encouraging faculty at all levels to consider being mentors as well as using the database to identify a mentor. The mentoring database will also facilitate the formation of mentoring alliances. This project is still in the early stages, but will be based on the very successful NSF-ADVANCE funded effort discussed by Karukstis, et al. elsewhere in this book. We plan to develop teams of four women. Each team will have two women from Union and two from Skidmore and will be composed of either social scientists or natural scientists, mathematicians, and engineers.

Conclusions

The climate survey indicated that faculty felt that a mentoring program is important and that faculty desired more guidance about the tenure and promotion processes, especially promotion to full professor. The mentoring survey revealed that only half the faculty were satisfied with the mentoring they were receiving, leaving considerable room for improvement. Respondents expressed interest in having more opportunities to meet mentors and to get mentoring in ways other than the traditional one-on-one relationships.

With all the various mentoring events we have held thus far, we have found that the women who attended enjoyed the experience of interacting with other female faculty. They found the opportunity to exchange information on achievements and challenges, both personal and professional, to be empowering. Often, it was difficult to get people to stop talking and bring the event to a close. Frequently people would offer suggestions for topics that could be discussed at the next such event. The challenge, however, has been to get people to attend the events. Setting aside time in an already busy schedule for mentoring could sometimes seem to be a poor use of time, especially for tenure-track faculty. We had women at both the associate and full professor levels at all of the events,

distributed relative to their numbers in those ranks. Frequently, however, tenure track faculty were underrepresented relative to their numbers at our events. This distribution suggests that we have not made the case for mentoring being a beneficial activity to the tenure-track faculty, and that tenured faculty have more interest in mentoring than is often assumed.

We have been successful at establishing a variety of opportunities for women at all levels. While they have been very effective for post-tenure women, they have had more limited success for pre-tenure women. Pre-tenure women seemed to be most interested in events that provide a clearer link to what is necessary to achieve tenure. While many may not consider the new faculty orientation “mentoring”, it does involve providing guidance from other faculty, and probably should be considered mentoring. Many senior faculty were also clearly not convinced that they continue to need mentoring. They were, however, enthusiastic participants in mentoring events, suggesting that tailoring mentoring activities to both groups is an essential feature of a strong mentoring program.

Plans for the Future

Our grant will be active for at least one more year. Currently we are planning to continue with the following next year: discussion tables, speed mentoring, and the informational sessions available for new faculty. In addition, we would like to add mentor/mentee training sessions, continue to develop our database, and use the database to set up alliances related to those discussed elsewhere in this book. We will also be developing plans to institutionalize the best mentoring strategies that we have developed. Please check our website for updates.

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Chapter 5

Mentoring Pathways

A Small Wins Approach to Fostering Faculty Development

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Substantial scholarly work has documented the lack of persistence among females in the academic STEM pipeline. While intervention efforts over the last several decades have increased the number of females earning graduate degrees, far fewer of those remain in higher education throughout their professional careers. In the past, this pattern was attributed to overt discrimination, but today it is more commonly the result of “tiny cuts” within female faculty careers resulting in professional and social isolation. Through an examination of the implementation of Auburn University’s Strategic Diversity Plan and the *ADVANCE Auburn* project, this chapter proposes a “small wins” solution to improving success and retention among female STEM faculty through a multifaceted approach to faculty mentoring.

Recognizing Tiny Cuts That Impede Women in Academic STEM

Over the past several decades, much scholarly effort has been devoted to assessing and addressing the continuing disparities that exist between the recruitment and retention of male and female faculty within higher education. While these disparities have in general decreased within the private professional sector, they remain firmly ingrained within higher education and are particularly pronounced within the STEM (Science, Technology, Engineering, and Mathematics) disciplines (1, 2). Efforts to address the dearth of female faculty members in STEM disciplines have traditionally interpreted the problem in terms of a pipeline from which there were few female scientists and engineers produced as a result of too few entering the disciplines. This perception, in turn, fostered support for intervention programs that would steer more women into the STEM disciplines and ultimately increase the number earning university degrees in those fields (3). Since the implementation of such efforts, the number of women earning Ph.D. degrees in the sciences has risen to half of all degrees awarded, but ultimately only 3 to 15 percent of tenured full professors in these disciplines are women (4, 5). Clearly, the academic pipeline is leaking and only a few of those women who enter it remain there throughout their professional careers (3, 6).

In contrast to the instances of overt bias and discrimination that were all too commonly faced by female STEM faculty in the past, Etzkowitz, Kemelgor and Uzzi attribute the loss of women within the academic STEM disciplines today primarily to “tiny cuts” inflicted upon their careers (6). For men, initial small advantages typically accumulate incrementally and can lead to significant influence and power with time. In contrast, the cumulative effects of small impediments may result in seemingly insurmountable barriers to professional academic success for women. Furthermore, the most influential and pervasive tiny cuts are those that interfere with the development of guiding professional networks that are an important source of socialization and mentoring.

The National Science Foundation (NSF) has recognized the difficulties in attracting and retaining women within academic STEM disciplines. As a result, NSF announced the establishment of a new funding program entitled ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers. The goal of ADVANCE is to accomplish institutional change by “transform[ing] academic environments in ways that enhance the participation and advancement of women in science and engineering.” Since 2001, NSF has awarded over \$135,000,000 to support ADVANCE projects at more than one hundred different institutions through two different types of grants (7). Grants for Institutional Transformation (IT) are awarded to institutions of higher education that undertake comprehensive projects aimed at transforming institutional policies or climate, with a subsection of IT-Catalyst grants directed at institutional self-assessment to uncover the need for transformation. Grants focused on Partnerships for Adaptation, Implementation and Dissemination (PAID) are designed to share information regarding gender issues as well as the results of institutional transformation projects, and are awarded to a broader range of institutions. ADVANCE-IT institutions consistently identify mentoring as a

critical factor in the advancement and retention of women faculty in the STEM disciplines, and mentoring is a key element of the “small wins” approach that is the central driving force of the ADVANCE-PAID grant awarded to Auburn University in 2006.

A Small Wins Approach at Auburn University

The foundation for the transformation efforts at Auburn University was the Strategic Diversity Plan (SDP) of Auburn University (8). *ADVANCE Auburn* embraces the SDP as a guiding set of principles and members of the grant team have worked closely with the newly appointed Associate Provost of Diversity and Multicultural Affairs, who also serves as a co-principal investigator on the grant, to implement its goals and visions. The grant was initially written during a period of growing momentum in the STEM colleges, reflected in the hiring of seven women faculty in 2005, a record number in the College of Sciences and Mathematics and in the College of Engineering. Prior to the award of the grant, women accounted for only 12% of the faculty within the College of Sciences and Mathematics and 7% in the College of Engineering. As of Spring 2010, the percentage had increased to 17% in the College of Sciences and Mathematics and nearly 9% in the College of Engineering. These percentages of women faculty, however, are far less than the percentage of women faculty overall at Auburn University, which currently stands at 34%. In addition, these percentages are significantly lower than the relative representation of female students at the University in STEM disciplines (55.2% of undergraduates and 38.2% of graduate students in the College of Sciences and Mathematics and 15.8% of undergraduates and 21.5% of graduate students in the College of Engineering are female). Obviously, there is a need to increase the number of women faculty in these underrepresented areas; but equally important are focused efforts to retain and promote these women faculty, with mentoring being a key factor in faculty development.

To further explore the needs of these new faculty and others like them, STEM networking sessions were held for women faculty in 2006-2007 where issues disproportionately affecting women faculty and their families, as well as means to deal with them, were discussed. Mentoring of junior STEM faculty and junior women faculty was intensified university-wide with an emphasis on providing the support and guidance needed for success, retention, and advancement.

As a land-grant institution, Auburn University is characterized by faculty who are deeply dedicated to educating students, conducting research, and serving the needs of the people of Alabama through extensive outreach. Such attitudes and achievements are attested to by Auburn being consistently ranked among the top 100 public universities (9). Auburn is a research institution, steeped in tradition, with strong alumni support. It was founded in 1856, was named a land-grant institution in 1872, and became co-educational in 1892. The institution was officially integrated in the 1960's; however, it continues to have difficulties in recruiting a diverse student body and faculty. As explained by Schein (10), the culture at Auburn has become so embedded in the people, processes and relationships that change is resisted even when demanded by

a changing environment, including a changing gender and racial face in the workforce and student body. In 2001, the leadership of Auburn University officially recognized that increasing diversity in its faculty and student body would strengthen scholarship, provide a richer education for its students, make the institution more resilient in the new century, and more effectively serve the people of the state, region and nation. To that end, the University began addressing issues of diversity with renewed vigor through the creation of the Diversity Leadership Council, which developed the Strategic Diversity Plan (8). The basic tenets of the SDP are to foster a respectful and inclusive campus environment and to increase recruitment and retention of a diverse faculty, student body and supporting staff. The plan, accepted by the interim president in March 2005, includes a call for diversity efforts from all faculty, staff and students and charges the senior leaders of the University with the responsibility for guiding and monitoring “meaningful progress” (8).

Two additional signs of the university’s desire to move diversity efforts forward were evidenced in the findings of two undertakings. A focus group of women and men faculty leaders overwhelmingly identified three main existing barriers to an inclusive faculty environment: 1) lack of clear policies to support balancing work and home life; 2) lack of official mentoring or support as women go through the tenure and promotion process; and 3) a campus culture that makes women feel unwelcome (11). Another indicator of collective interest in fundamental change occurred in the spring of 2005 when 100 participants in three follow-up strategic planning sessions convened by members of the Strategic Diversity Committee (12) repeatedly declared a need to attract more women and minority faculty and to improve work-life policies. Given this increased awareness, Auburn was poised for change when the NSF PAID grant was awarded. The grant was awarded the same month that one of the co-principal investigators at that time, and currently the principal investigator, was appointed to the newly created position of Assistant Provost for Women’s Initiatives, a position that emerged as part of the Strategic Diversity Plan. In that role, she oversees faculty advancement initiatives, as well as the newly formed Women’s Resource Center, the WISE (Women In Science and Engineering) Institute, and the *ADVANCE Auburn* Center, which was established as one of the grant objectives.

As an *ADVANCE-PAID* project, the programmatic goal of *ADVANCE Auburn* was the establishment of a “small wins” approach to influence lasting change in the culture and climate of the STEM disciplines at Auburn University. A small wins approach suggests that the overall transformation of an institution or workplace comes through incremental change – essentially, it recognizes that small changes can have widespread and long-term impacts (13). Rather than large-scale edicts from upper administration or radical organizational revolution, small wins practices that are implemented at the departmental, center, or college level result in greater buy-in from all administrative levels and ultimately more substantial institution-wide transformation (14–17).

The small wins approach is appealing because it allows for small or incremental costs (time and/or money) to return a substantial benefit to the institution, namely, an improvement in the climate for all faculty and greater

retention of female faculty in the STEM disciplines. Auburn's grant had five objectives: 1) to establish the *ADVANCE Auburn Center*; 2) to assess the status of STEM women faculty and the climate within the STEM disciplines at Auburn University; 3) to develop a small wins cost/benefit model; 4) to select and implement small wins that have the highest benefit to cost ratio for transforming STEM disciplines and are most applicable to Auburn University; and 5) to disseminate the small wins cost/benefit model and implementation results. Two objective-related efforts have had a significant impact upon faculty mentoring initiatives: the administration of an AU faculty climate survey and a cost-benefit analysis of best practices employed at other *ADVANCE*-funded institutions. The findings from both of these endeavors have been used to develop and implement programmatic changes at Auburn.

Climate Survey Results on Mentoring

The faculty climate survey was designed and administered by the *ADVANCE Auburn Center*, in conjunction with the Office of Diversity and Multicultural Affairs, to help identify climate issues and impediments to the retention of female STEM faculty at Auburn University, as well as effective strategies to combat such barriers. While the resulting quantitative measures of evaluation suggested that mentoring of junior faculty was needed, participant responses to qualitative open-ended questions concerning departmental satisfaction offered additional insight. One female faculty member remarked, "Although my chair has been very helpful, there is no social support within my department, which makes being a new faculty member difficult." Another explained that "[m]ost of my disappointments with AU have to do with communication breakdowns between myself and my chair... the department was woefully unprepared for the influx of new faculty (there were 4 new hires this past year). We've all been pretty much left on our own to figure stuff out..." As these comments suggest, a lack of empathetic colleagues, inadequate coaching during professional transitions, and a lack of appropriate role models can serve to estrange female faculty from the rest of their department. Such subtle exclusion can occur socially and intellectually at both the departmental and college level as the following comment by another female faculty member illustrates:

There is no connectivity between the program I am a part of and the department as a whole. There is little opportunity for intellectual stimulation outside my unit and no opportunities to network with other faculty members or programs within the department which would allow resource sharing, brain-trust capitalization, etc. Virtually no contact is made from the dept. head or dean from [our] college with our program.... We are very isolated and operate as an independent unit.

Ultimately, these combined tiny cuts foster an "emotionally draining" sense of both professional and personal isolation (18). This sense of isolation has negative consequences for both the individual faculty member and the institution as female

STEM faculty leave the university either due to inadequate professional academic success or by their own volition by seeking a job outside of academe.

The comments from the respondents in our climate survey reflect the typical struggles of female faculty to develop professional networks and become integrated within institutions at the departmental level, struggles that have been identified as all too common for women STEM faculty at other ADVANCE institutions. Tiny cuts ranging from a lack of social support and open lines of communication serve to alienate female faculty from their department and institutional colleagues and, in turn, deny them access to shared resources, intellectual communities, and the power structures of the institution. With a proper understanding of the local academic culture and guidance from those who have already succeeded along the professional academic path, however, female faculty can be encouraged, included, and retained. A female climate survey respondent noted the value of such assistance by explaining that “[M]y Department Head is a very organized leader who believes in shared governance, so I always feel I have a voice with him. I went through the Tenure and Promotion process 18 months ago and felt very prepared because of his foresight and guidance.” As the comment suggests, mentoring can help set a new faculty member on the right path and play a key role in the success of female faculty members in departments where they are a minority.

Cost Benefit Analysis of Other ADVANCE Institutions

To complement the findings of the climate survey and further develop a small wins model, *ADVANCE Auburn* sought to understand how other ADVANCE-supported institutions have effectively implemented programs that might represent the small wins approach. A content analysis of ADVANCE program websites and published materials illustrated the primary approaches that have been employed by other universities. The most common initiatives were then grouped into general categories for evaluation: 1) Mentoring; 2) Family-friendly policies; 3) Training programs aimed at raising awareness of gender bias for various campus constituencies (students, faculty, search committees, etc.); 4) Department-wide workshops that highlight the scholarship of female faculty and provide guidance on improving departmental climate; 5) Departmental policies and resources that aim to improve the recruitment and retention of female faculty; and 6) Funding opportunities aimed at recruitment and retention of female faculty. A cost-benefit analysis was conducted to identify those practices that required the fewest resources and contributed the most to the improvement of the university climate and community. The directors of other ADVANCE-funded projects were asked to evaluate both the perceived costs and benefits of those practices that had been implemented at their institutions using a web-based survey instrument. Of the 72 ADVANCE grant principal investigators contacted via e-mail, 49 responded for a 68 percent response rate.

A cost-benefit ratio was calculated for each initiative by dividing the mean score for benefit by the mean score for cost. This ratio provided a measure for identifying programs that were the most impactful with the least cost, and would therefore be considered a small win. These programs have substantially aided in

the career development of women in the STEM disciplines, but it should be noted that these interventions are of value to all untenured faculty. Moreover, the benefits are derived from changes in the organizational culture that have evolved from the motivated efforts of administrators and tenured faculty across the university. Of the 29 initiatives evaluated, mentoring programs represented over half of the most highly ranked practices employed at other universities. While the format of the mentoring program may vary from institution to institution, mentoring for different areas such as understanding the culture of the university or department, balancing work and family life, and providing insight into the promotion and tenure process were highly endorsed in our survey instrument by other ADVANCE grantees as being cost-effective and impactful. Creating programs that incorporate mentoring as a small win will not only aid female faculty development, but also improve the working environment for minority faculty, male faculty, and those from across the disciplinary spectrum alike.

Mentoring as a Pathway to Faculty Development

A recent article by de Janasz and Sullivan notes the limited amount of scholarly research related to mentoring faculty members in academia (19). The authors attribute this dearth to three main causes. The first is that new faculty members are presumed to have been fully prepared by their graduate studies. The implication then is that faculty members are assumed to have been mentored during their graduate studies, and to have maintained contact with that mentor. Neither of these assumptions is unreasonable, as graduate students typically choose or are assigned to a major professor under whom they are expected to master their chosen area of study. When hiring, academic institutions screen candidates carefully to ensure that the applicant has, in fact, mastered the area of study and is competent to teach. However, hiring institutions have no guarantee about the quality or continuation of that mentoring relationship. It may be erroneous to conclude that just because the major professor *can* mentor a graduate student that mentoring did occur, that the mentoring experience was beneficial for a future faculty member, or that the relationship will be maintained in this new environment. Additionally, many institutions expect junior faculty to establish an independent research program in order to demonstrate their capabilities and ability to function independently of their advisor. To this end, junior faculty may feel pressure to cut ties with their graduate advisor. These predicaments illustrate why a former graduate advisor cannot be solely responsible for mentoring new faculty members.

The second reason described by de Janasz and Sullivan for the lack of literature on mentoring in higher education is that the promotional ladder makes it difficult to identify appropriate mentors. Typically, new faculty begin as untenured assistant professors, advance with the award of tenure and promotion to the level of associate professor, and finally earn senior status as full professors. Despite what seems to be a fairly straightforward progression, new faculty do however vary considerably in their preparation and experience in teaching and research, with some arriving straight from graduate school, and others having had

post-doctoral or professional experience. Additionally, each program, department, and academic institution has subtle nuances in environment and culture that impact the success of new faculty members. Tenured faculty colleagues can play a critical role in helping newcomers understand and navigate the unique departmental culture.

The third reason de Janasz and Sullivan give for the deficiency of literature on mentoring in academia is that some faculty, both junior and senior, perceive little need for mentoring (19). Senior scholars may feel that junior faculty members should be able to navigate the system on their own, referred to as the “sink or swim” model. Additionally, moving up the tenure ladder may only alter the duties of the faculty member in subtle ways. Unlike traditional organizations where a promotion often means a change in responsibilities, a promotion in the academic world is primarily a status change. An assistant professor is expected to teach, conduct research, and engage in service activities just as a tenured professor does. The seemingly static nature of expectations in academia may lead some to believe that mentors are not necessary (20). More recent evidence, however, indicates that support from senior faculty, department chairs, program heads, deans and other higher status academic professionals is crucial to the success of new faculty members (21). These findings suggest that mentoring is indeed needed in academia, and that if it were made available, it would be beneficial to those who wish to engage in a mentoring relationship. Furthermore, if mentoring is embedded into the academic culture, and if providing mentoring, guidance, and professional socialization is viewed as part of the responsibility of departments, colleges, and universities, junior faculty members might not fear the negative repercussions that could arise from acknowledging the need for such assistance.

Despite the lack of literature specific to higher education, a great deal of research has examined the impact of mentoring programs in other areas at both the individual employee level and the overall success of the organization. Kram defined mentoring as a developmental relationship between supervisors and subordinates, or among peers (22). However, this definition may not be the most applicable to mentoring in academic settings (19). It may be difficult to identify a single person who can serve as a mentor for all areas of interest, which is why a mentoring network consisting of multiple mentors for different areas is often advocated (19, 22–24), as is peer mentoring (25).

Many times department chairs or heads of a program area are expected to serve in a mentoring capacity; however, these supervisors may not be the most appropriate mentors due to personality conflicts, differing research specialties, or the added responsibilities of their roles that prevent them from committing significant time to a single faculty member. Moreover, the relationship between a mentor and protégé goes beyond that of a supervisor and subordinate. Ragins and Cotton found different mentoring styles for supervisors and non-supervisors: a supervisory mentor was able to provide more career-focused support, but not more social support, than a non-supervisory mentor (26). A mentor who is also a supervisor may have more direct access to career-advancement information that would be useful to the protégé than does a mentor who is not a supervisor. The reduced social support may be due to a hesitancy to engage in behaviors that may be seen as favoritism by other employees. Finally, it may be problematic to have

a mentor who is in a position to formally evaluate the mentee. It is important to remember that a mentor and a supervisor may have very different roles, and that a chair cannot be assumed to serve as a mentor for an entire program or department.

There is a general consensus in the mentoring literature that naturally developing mentoring partnerships last longer and are deemed more successful than institutionalized mentoring partnerships (26). However, a recent study indicates that highly facilitated formalized mentoring programs can result in many positive outcomes, including more positive job attitudes through higher levels of job satisfaction and organizational commitment (27). This finding implies that it may be beneficial for universities and other academic institutions to implement highly structured mentoring programs to provide formal mentoring to junior faculty. A formal mentoring relationship may be abandoned if it is not beneficial, but it at least exposes junior faculty to the notion and importance of mentoring. This insight can encourage junior faculty members to seek their own informal mentoring relationships, which are likely to be longer lasting and more successful.

Mentoring can be very beneficial if the proper effort is put forth by both parties. Mentoring has been related to more clarity in a protégé's understanding of work responsibilities, as well as less conflict between the different areas for which a protégé may be responsible (28). Additionally, mentoring reduces perceptions of work-family conflict (29). Effective mentoring relationships have also been found to positively influence such tangible career outcomes as compensation, promotion, and reduced employee turnover, as well as improve overall job and career satisfaction (30, 31). In short, successful mentoring relationships produce more successful employees. The inference can then be made that successful mentoring relationships will result in more successful faculty, and potentially a better reputation for academic programs, departments, and institutions.

Faculty Mentoring as a Small Win at Auburn University

Given the lack of literature on mentoring specific to higher education, researchers must turn to other sources to gain insight on how mentoring relationships can be used. The need for mentoring as a small win to improve the university climate is evident from the response to Auburn's climate survey indicating professional isolation, as well as feedback from other institutions which suggest that mentoring is a cost-effective strategy for faculty development. There are several ongoing complementary mentoring programs and initiatives at Auburn University that support the goals of the ADVANCE grant, including programs provided by the Women's Initiatives Office, the WISE Institute, the Office of Diversity and Multicultural Affairs, and the Biggio Center for the Enhancement of Teaching & Learning, as well as programs within departments and colleges.

Mentoring programs at Auburn University in the Women's Initiatives Program include monthly informal networking opportunities for new women faculty to meet each other, as well as continuing male and female faculty. The program aims to provide a supportive network, possibilities for building research collaborations, and opportunities to learn from other faculty members about such topics as classroom issues, balancing work and family, and addressing

departmental climate issues. Importantly, each of these events offers opportunities to interact with other faculty and learn about campus resources that can ease the transition into the faculty ranks, and develop both academic and personal social networks.

One very impactful brown bag lunch gathering included in the Women's Initiatives mentoring program offered a panel of three tenured faculty women representing several academic disciplines, who addressed the topic of "Questions I Wish I Had Had the Courage to Ask." The panelists openly shared their experiences during the pre-tenure years and identified topics and concerns that they felt negatively influenced their advancement. Concrete suggestions and practical advice were also provided, such as updating one's vita every 6 months, asking colleagues both within the department or college and within the field to provide feedback on manuscripts, and providing guidance concerning appropriate and effective ways to request assistance and resources from department chairs.

The Women's Initiatives Office has also established collaborations with a number of other campus departments and programs, including co-sponsoring programs that address concerns of women faculty with the Women's Studies Program. Among the most successful examples of this alliance was a brown bag luncheon that addressed the treatment of women faculty in the classroom, including such issues as student disrespect; expectations that women faculty should be more nurturing than their male colleagues; and the impacts of gender on teaching evaluations. The discussion surrounding these issues not only focused on the problems but also included tactics that more experienced women faculty had used to address such issues. Tactics suggested included: having a class discussion on appropriate classroom behavior towards the professor and other students; frowning at a disruptive student and briefly using silence as a reponse before continuing with the lecture or with classroom discussion; using student comments as a springboard for discussing the underlying issue represented in a negative or aggressive student comment; responding immediately to disrespect in the classroom by telling the student that you want to see him/her after class to discuss the behavior; or even using humor by saying "Did you really just say that?" If a faculty member feels that her gender is negatively impacting student evaluations, drawing the department head's attention to this concern is warranted, as is requesting assistance in addressing classroom issues and in increasing awareness within the department about bias in student evaluations.

Other campus organizations, including the WISE Institute, develop programming specifically aimed at the development and retention of female STEM faculty. WISE is governed by a Steering Committee that consists of women faculty and staff representing the Colleges of Agriculture, Sciences and Mathematics, Veterinary Medicine, Engineering, Education, Human Sciences, Architecture, Design & Construction as well as the Schools of Pharmacy, Nursing, and Forestry & Wildlife Sciences. The Steering Committee members serve as liaisons with their respective units and provide feedback as to the effectiveness and relevance of programming.

The Office of Women's Initiatives, the *ADVANCE Auburn* Center, and the WISE Institute co-sponsor a Speakers Series that features well-known women faculty from other universities who visit campus for two days, during which they

present a research seminar, as well as additional talks on issues facing women in under-represented disciplines. These invited speakers also meet informally with graduate students and women faculty to address issues facing the advancement of women faculty members. Typically, there are two speakers each year, in the fall and spring semesters, and efforts are made to ensure that the speakers represent the departments and colleges that comprise the breadth of STEM disciplines. During this past academic year, Auburn co-hosted three speakers with the Colleges of Engineering and Veterinary Medicine. Overall, the assessment feedback from faculty and graduate students who attend these regular WISE events is overwhelmingly favorable and includes positive comments concerning such opportunities to meet other women in STEM and establish social support networks, as well as to learn how to develop professional networks and get involved in professional societies and conferences. Over the past two years, in addition to faculty from the Colleges of Engineering, Sciences and Mathematics, and Veterinary Medicine, the sessions have attracted increased numbers of faculty from other colleges (e.g., Agriculture, Forestry and Wildlife Sciences, Human Sciences, Nursing, and Pharmacy). Also, graduate students and postdocs have become more actively involved in the programs of the WISE Institute.

At times, efforts to develop professional networks have included support from beyond the Auburn campus. With support from the National Science Foundation, the WISE Institute recently collaborated with the *ADVANCE Auburn* Center and the Auburn University Graduate School to sponsor workshops for women faculty, graduate students and postdoctoral fellows in STEM disciplines. Entitled “COACHing Strong Women in Negotiation, Communication and Leadership” the workshops were organized and led by the Committee On the Advancement of women in Chemistry (COACH). Through the use of self-assessment, experiential learning, and role playing, the two workshops offered attendees the opportunity to develop communication skills crucial to women seeking professional academic success. Each of the two workshops focused upon the needs of differing constituencies, with one addressing the needs of faculty and the other for graduate students and post-docs. Having a separate workshop for graduate students and post-docs also highlights the importance of socializing women students and providing them with opportunities for professional development, as well as addressing the types of issues they may face as women in fields where they will be in the minority. In the workshop evaluations, both groups reported feeling empowered, more capable of negotiation, and less isolated. One faculty member planned to use the skills and tactics from the workshop to “apply to the negotiation process in terms of lessening committee work and taking more credit for grants obtained or in the process of writing,” and another planned to “negotiate with my dean for additional resources for my office.” Sessions like these remind females at all levels that they are not alone in the issues that they face, and offer exposure to women who not only serve as role models but offer practical advice and solutions. One faculty member described the workshop as “outstanding, as I really needed guidance in asking for things since I am the only female faculty member in my department.” Finally, a comment from a graduate student captures the importance of the format that provides an opportunity “to have the interactive audience and hear what issues others have.”

While the various speaker visits are typically organized as discrete events aimed at mentoring an audience or workshop group, other campus programs have been developed to foster longer-term faculty networks through mentoring. For example, the Biggio Center for the Enhancement of Teaching & Learning has introduced new Auburn faculty to the university through their New Faculty Scholars program for several years and provides presentations on professional development and group-level mentoring that extends throughout a single academic year.

To ensure that new faculty are also provided opportunities for one-on-one mentoring, including mentoring on grant-writing and publishing, the Early Career Faculty Mentoring Program was initiated in the fall of 2009. Housed in the Office of the Provost, this program conveys a strong message about the commitment of upper university administration to supporting mentoring opportunities that will enhance the success of all new faculty members in their academic careers. The program also supports the Strategic Diversity Plan goal of recruiting and retaining minority and women faculty. In February 2009, the first female Provost was hired at Auburn University, and later that year she convened a committee to plan this mentoring program. Committee members include the Associate Provost, the Director of the Biggio Center for the Enhancement of Teaching & Learning; the Diversity Faculty Mentor in the Office of Diversity and Multicultural Affairs; and the Presidential Fellow whose work in that role focused on identifying and addressing mentoring needs at Auburn University. The Assistant Provost for Women's Initiatives, who is also responsible for the activities of the *ADVANCE Auburn* Center, was asked by the provost to oversee the new mentoring program and to coordinate activities of this program with existing departmental mentoring programs and other faculty development programs on campus. Members of the committee meet regularly to discuss ways to provide support and mentoring for junior faculty.

The key elements of the program included inviting new faculty to participate and identifying mentors; coordinating activities of the new mentoring program with ongoing efforts for faculty development; creating the mentor-mentee pairs; and maintaining contact with the participants over the course of the year. A mentoring website was developed and is available via the webpage of the Office of the Provost. The program is open to new faculty who are in their first three years at Auburn. Currently, 35% of participating mentees are in STEM fields; and roughly half of these STEM mentees are female. Program mentors are Alumni Professors, an honor given to a small number of faculty members each year as an indication of excellence in teaching, research, and service to the university and larger community.

Potential mentors and mentees receive a letter from the provost explaining the purpose of the new formalized mentoring program and inviting them to participate. Interested faculty members complete a checklist of expectations for their role in the mentoring relationship. The checklists used were modified from those developed by Brainard, Harkus and St. George (32), which have been employed in other academic mentoring programs such as those at the University of Missouri and fellow *ADVANCE* recipient New Mexico State University. Participants indicate areas of professional expertise (mentors) or

development needed (mentees) and amount of time they felt they could dedicate to a mentoring relationship, as well as the types of mentoring relationships in which they would be interested in participating: one-on-one mentoring, mentoring circles, peer mentoring, or having multiple mentors. The checklists are used to match mentors and mentees. A mentoring contract worksheet was provided to encourage mentoring pairs to outline the expectations and boundaries of their new relationship in writing. The pairs were asked to return these worksheets (as recommended by New Mexico State University) to the Office of the Provost because formally filing the contracts has been shown to foster accountability within a new mentoring relationship.

The Early Career Faculty Mentoring Program has helped spread awareness of the types of mentoring available to new faculty, not only through formalized mentoring pairs but also through co-sponsoring events such as the “Best Practices in Mentoring” panel with the Office of Women’s Initiatives and the Provost’s Office. This panel featured six tenured faculty who were recommended by their deans as outstanding mentors and are well known for their service to the institution. The main purpose of the presentation was to address mentors’ interest in learning about successful mentoring strategies from their peers. Panelists addressed the need for multiple mentors to aide with different areas of development at different points in time, as well as the need for mentoring at different levels, including program, department, college, university, and career. The panel also discussed the importance of being able to give and receive critical feedback, and the necessity of longitudinal mentoring relationships.

To assess the effectiveness of this new faculty mentoring program, an electronic survey was sent to all participants in the program. Responses from the junior faculty indicated that the most helpful mentoring experiences emphasized: academic activities that will most benefit my future career; writing for publication; developing and funding research; getting resources to support professional development; working with the department chair and with senior faculty in the department; networking; time management; promotion preparation; and contract renewal and tenure strategies. In addition to identifying specific topics that were most helpful, respondents also provided comments and suggestions for changes. A majority of mentors and mentees who responded indicated that the experience was worthwhile, and all responding mentees indicated that they intended to continue and would recommend the program to other faculty. One mentee remarked that “it was helpful not to have to find my own mentor,” while another noted that “the fact that such a program exists made me feel that the university recognizes that it can be overwhelming to be a new faculty and cares to make the first year more pleasant.” Of particular relevance for faculty in STEM is this observation: “As a young scientist, [my mentor] has taught me how to deal with adversarial senior people in the department, and also how to develop graduate students and postdocs, and get those most interested in the lab to commit to the program.” Another mentee noted that the “insight and guidance of senior mentors is extremely valuable.” Mentors too indicated that they had benefitted from their participation and valued opportunities to “provide insight to assist early career faculty,” “interactions with colleagues and administrators,” “the opportunity to meet young faculty,” and to take part in “deliberate discussions about what is

important for career.” Mentors noted that the overall strengths of the program included access to major leaders in the university, professional contacts between junior and senior faculty, purposeful and scheduled mentor-mentee interactions, and demonstrated administrative support for developing young faculty.

Interactive Theatre as a Small Wins Approach to Mentoring

ADVANCE Auburn has incorporated the use of theatre techniques as a way to illustrate departmental climate issues and other barriers to the advancement of women faculty, an approach used by a limited number of *ADVANCE* institutions as a means of drawing attention to the issues faced by female faculty. One of our team members, a professor in the Department of Theatre, combined the interactive theatre techniques pioneered by Boal (33) and the gender schema concept of Valian (34) to script two original theatrical pieces. These scripts were designed to educate departmental and university administrators on the unique impediments to success encountered by female faculty, particularly those within the STEM disciplines. Semi-structured interviews with female faculty and administrators across the STEM disciplines at Auburn provided the basis for the scripts. The interactive scripts were then performed at two annual workshops organized by *ADVANCE Auburn*. At the request of the provost, the first script was also presented at the monthly meeting of department heads and chairs. Subsequently, all heads and chairs were invited to attend the second script performance at the next year’s workshop.

While both scripts explored milestones within a female STEM faculty member’s career, each emphasized a different critical stage of her career. The first piece, entitled “The Third Year Review,” depicts a meeting between a male department chair and a pre-tenured female faculty member and their discussion surrounding the results of the faculty member’s third-year review and progress toward tenure and promotion. The exchange between the faculty member and her department chair reveals the challenges faced by both participants with respect to the communication of clear expectations for tenure and promotion and how those ambiguities prevent proper mentoring of the faculty member. In the second script, “Beyond Tenure,” the scenario illustrates an informal interaction between two male and one female senior faculty member immediately following the successful tenure and promotion vote of three junior faculty, two female and one male. The dialogue explores not only the senior faculty opinions concerning the likelihood that each of these newly tenured faculty will ultimately join their ranks as full professors, but also draws attention to gender schemas that are employed by both men and women in evaluating others, and the ways that these schemas contribute to the “tiny cuts” that impede the advancement of women faculty.

The interactive theater pieces draw upon the ideas of Forum Theatre, a theoretical perspective organized around the principles of Theatre of the Oppressed which advocates for dialogue as a teaching and learning tool. The goal of writing and presenting the scenarios was to promote reflection and discussion among the audience and performers thus inspiring possible solutions to the problems faced by the characters, including effective mentoring techniques for administrators and senior colleagues and self-advocacy tools for female faculty.

Upon completion of the scenes, audience members were divided into groups to discuss questions designed to: 1) assess instinctive reactions; 2) generate reflective responses and group discussion; and 3) identify specific challenges and effective solutions within the mentoring process. By being both observers and participants, members of the audience were able to debate a range of “best practices” for mentoring and advocacy that could be implemented within their own administrative units.

The interactive theatre pieces also meet the criteria of a small win in retaining female faculty in STEM disciplines at Auburn University. Both pieces seek to create change at the departmental or college level by achieving an awareness of implicit bias and a buy-in from administrators and tenured faculty in those units. In addition, not only do “The Third Year Review” and “Beyond Tenure” advocate proper mentoring for female faculty, but they also represent another type of mentoring. Just as female faculty need mentoring throughout their careers, so too do administrators. Departmental administrators often move into their positions with little previous education on the mentoring of their faculty members – their own experiences are all they have guide them. Their personal experiences may vary substantially from those faced by faculty today. As the faces of faculty become increasingly diverse, so too will their mentoring needs.

New Mentoring Pathways at Auburn University

In contradiction to traditional intervention approaches to improving female representation in the academic STEM disciplines, simply increasing the number of women in the pipeline to a critical mass alone is not sufficient to ensure that those who come after them will be retained. While research by Kanter (35) suggests that while a strong minority presence of approximately 15 percent tends to improve the overall climate by gaining influence and self-perpetuation; higher percentages tend to result in the bifurcation of the minority group along generational lines (36). Often the most senior female faculty in the sciences achieved their success by following the model established by their male colleagues; however, younger female faculty members seek a path to academic success that allows for a balance between home and work lives. There is a need for a new generation of female STEM faculty who have successfully navigated work-family paths through academe to earn senior status as full professors and administrators. Not only would this help the STEM disciplines reach a critical mass of female faculty, but also provide appropriate mentors for those who follow their path to academic success.

Initiatives to mentor junior faculty represent small wins for Auburn University and other ADVANCE-supported institutions, but the *ADVANCE Auburn* cost-benefit analysis also revealed other important steps that can be taken toward institutional transformation for women in STEM disciplines. The results of the analysis suggest that the single most valuable small win that can influence the overall climate of a university for female faculty is facilitating female faculty participation in key academic committees. Membership in key academic committees, including those such as university-level tenure and

promotion committees, allows female faculty to impact policy and the overall climate of the institution. Just as the number of female faculty must exceed a critical mass to reach beyond mere tokenism across the university and within the STEM disciplines, so too must the presence of females on influential committees reach a critical mass for true change to occur (36). Broad committee participation by female faculty would further contribute to the structural assimilation of women within the university and their ability to affect change. For women to obtain seats on these committees and represent the female perspective; however, they must often attain full professor status. As the “Beyond Tenure” theatrical piece illustrated, the mentoring of faculty, particularly female faculty, needs to continue even beyond the initial award of tenure and promotion to associate professor.

Auburn’s current ADVANCE grant has done much to support existing junior faculty mentoring initiatives but has also recently directed efforts toward the support of women STEM faculty beyond tenure. Recently, *ADVANCE Auburn* hosted a workshop entitled “Post-Tenure Pathways” that emphasized the critical need to address the issues faced by mid-career female faculty in the STEM disciplines. Presentations focused on best practices for advancing women from associate to full professor status. As the work of *ADVANCE Auburn* suggests thus far, mentoring will play a key role in opening these new pathways.

Importantly, this discussion of mentoring efforts implemented at Auburn University reveals that successful mentoring is multifaceted. It must be offered in a wide range of formats and scopes so that one or more will be amenable to both mentors and mentees. Formal mentoring can occur at the departmental level or through university-wide programs, as evidenced in the Biggio Center’s New Faculty Scholars Program and the Early Career Faculty Mentoring Program’s one-on-one pairings. Equally important is informal mentoring by individual senior faculty with a vested interest in the professional success of their increasingly diverse junior colleagues. Informal networking activities for women faculty members provide an important source of social support and can offer opportunities to develop relationships with faculty outside of one’s home department. Such relationships can provide safe opportunities to share experiences and tactics for navigating departmental and college climate concerns. Seminar series featuring noted women from other institutions showcase these scholars as role models for academic women in STEM fields. Additionally, their wealth of experience and advice are critical in identifying effective strategies for addressing challenges that academic women in STEM disciplines face. Successful faculty who have benefitted from effective mentoring can ultimately become strong mentors to others, provided they too have received guidance on how to mentor the next generation of faculty. Mentoring must become institutionalized; it must become the norm, not an anomaly in the academic career path for faculty. Support for mentoring at Auburn University spans across the university and has served to create organizational networks of faculty and administrators at all levels who recognize that the small win represented by mentoring can have significant outcomes.

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Chapter 6

Mentoring Initiatives for Two-Year College Faculty

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In the prologue to her chapter “Women Community College Faculty: On the Margins or in the Mainstream”, author Barbara K. Townsend (Townsend, B.K. *New Directions for Community Colleges* **1995**, 23, 39–46) wrote: “Because women community college faculty are understudied, we do not know how they perceive their position within the institution.” In this chapter, eight female chemistry faculty members at two-year colleges share their perspectives on the status of women faculty on their campuses. The combination of institutional mission, high numbers of female faculty members even at all levels, and the range of internal and external professional development opportunities suggest a supportive climate that enables two-year college female faculty to prosper. The scope of formal and informal mentoring initiatives present at the campus level and in conjunction with professional societies is highlighted.

The Two-Year College Landscape

The two-year college system in the United States has grown to nearly 1200 institutions since the founding of the first such institution in 1901 (2). These institutions represent 34% of the nation’s post-secondary institutions and exhibit a diversity of sizes, locations, and program offerings to meet the needs of the regions they serve. Both full- and part-time students attend two-year colleges with a variety of educational objectives, e.g., to receive postsecondary education preparation for transfer to 4-year institutions, to seek workforce development and skills training, to pursue noncredit programs as diverse as English as a second language or first-aid training, or to attend cultural events such as performances,

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exhibits, films and lecture-demonstrations. To offer such broad curricula at convenient times for the community, two-year college campuses use both full- and part-time faculty members with the needed education, expertise, and workplace experiences. The latest assessment of the number of faculty members at two-year institutions estimates the total at over 381,000 individuals, 28% of the total instructional faculty at degree-granting institutions (3).

Two-year colleges serve a substantial portion of undergraduate students in the United States including those receiving degrees in science and engineering (4). Despite the significant role that these campuses play in higher education, there have been few comprehensive efforts to document the faculty demographics at two-year institutions. Two recent estimates (4, 5) of the numbers of two-year college chemistry faculty members suggest that there are at least 2600 full-time two-year college chemistry educators and comparable numbers of adjunct faculty members. According to the most recent statistics reported by the National Science Foundation (6), 55.2% of the scientists and engineers employed at two-year institutions were female, while the last survey of chemistry faculty (5) reported a significantly lower percentage of female faculty members at 32%. The American Chemical Society guidelines for two-year college programs call for institutions to provide mechanisms for the mentoring of instructional staff and for opportunities and funding for faculty renewal and professional development (7). To capture the status of faculty development and mentoring programs at a diverse set of institutions, eight chemistry faculty members were invited to share their responses to several questions on the career issues faced by women faculty and on the nature of existing mentoring programs on their campuses. These responses are summarized or presented verbatim below and provide an insightful view into the array of professional development situations for two-year college faculty. A brief description of each featured institution (Table 1) and a short biographical sketch of each respondent (Table 2) serve to introduce this chapter.

1. What are the demographics of women science faculty at your institution? Are there significant numbers of tenured or tenure-track women STEM (science, technology, engineering, mathematics) faculty? Are there senior women STEM faculty? Why or why not?

As the data in Table 3 indicate, faculty demographics vary widely among the institutions surveyed. A range of tenure situations also exist, from no tenure system to tenured or tenure-track status associated with all full-time faculty members. Respondents provided several insights into the strong numbers of senior women STEM faculty. For example, at Bucks Community College: "...our union contract governs such promotions." At Montgomery College: "There are as many senior women STEM faculty as there are men. There is nothing within the culture or job requirements that discourages women. The lifestyle at my two-year institution is well-suited for people with family commitments and for women raising small children." At Mt. Hood Community College: "...where I work is very child friendly (as well as pregnancy friendly) these days. Both males and females bring their kids (and babies) to work occasionally." At Georgia Perimeter College: "I attribute these numbers to the fact that our administration is made up

of an equal or greater percentage of women to men, and for many years Georgia Perimeter College had a woman president.”

Table 1. Locations and Enrollment Figures of Institutions Contributing to this Chapter

<p>Bucks County Community College consists of two campuses in Buck County, PA located about 40 miles north and northeast of Philadelphia. With over 160 full- and part-time faculty, the two campuses serve about 11,000 students (10,000 students on the Newtown campus and 1000 students on the Upper Bucks County campus).</p>
<p>College of San Mateo is located at the northern corridor of Silicon Valley (CA) and situated on a 153-acre site in the San Mateo hills overlooking San Francisco Bay. The college has over 150 full-time faculty and nearly 300 part-time faculty serving an undergraduate enrollment of about 11,000 day, evening and weekend students.</p>
<p>Georgia Perimeter College is a multi-campus two-year college located in the suburbs of Atlanta, GA. With more than 25,000 students and over 1000 faculty, GPC is the third-largest institution in the University System of Georgia.</p>
<p>Harper College is a two-year community college located in Palatine, IL, situated approximately 25 miles northwest of downtown Chicago. The campus is spread across 200 acres. The institution’s enrollment consists of nearly 26,000 students served by over 200 full-time and over 600 part-time faculty members predominantly drawn from the surrounding suburban communities.</p>
<p>Montgomery College serves nearly 60,000 students on three campuses located in Montgomery County, MD, just outside Washington, D.C. The faculty size is reported to be over 1500 members.</p>
<p>Mt. Hood Community College is the fourth largest of Oregon’s 17 community colleges with an enrollment of over 31,000 students and more than 500 faculty members. The campus is located in Gresham, Oregon outside of Portland with an extension campus in Portland.</p>
<p>Pasadena City College is located in Pasadena, CA approximately 10 miles northeast of Los Angeles. The institution has the third largest community college enrollment in the United States of over 26,000 students.</p>
<p>San Jacinto College has three campuses in Houston and suburban Pasadena, TX serving over 23,000 students with more than 800 faculty (400 full-time).</p>

Table 2. Two-Year College Chemistry Faculty Contributing to this Chapter

Bucks County Community College - Dr. Michaelleen P. Lee, Professor of Chemistry, Newton Campus
College of San Mateo – Kate Deline, Professor of Chemistry
Georgia Perimeter College- Dr. Candice McCloskey, Associate Professor of Chemistry, Dunwoody Campus, Dunwoody, GA
Harper College – Dr. Yvonne Harris, Dean of Mathematics and Science
Montgomery College - Susan Bontems, Associate Professor of Chemistry, Germantown Campus, Germantown, MD
Mt. Hood Community College – Dr. Elizabeth Cohen, Instructor of Chemistry
Pasadena City College – Dr. Kerin Huber, Professor of Chemistry
San Jacinto College - Dr. Ann Cartwright, Professor and Chair of Chemistry, San Jacinto College, Central Campus, Pasadena, TX

Table 3. Faculty Demographics (provided for 2009-2010)

<i>Institution</i>	<i>Faculty Demographics Provided by Respondents</i>
Bucks County Community College – Newtown, PA	<ul style="list-style-type: none"> • All full time professors at the college are tenure-track. • The college is working towards a 60-40 full to part time ratio as per the union contract. • There are senior women STEM faculty as such promotions are governed by the union contract.
College of San Mateo – San Mateo, CA	<ul style="list-style-type: none"> • Chemistry: Tenured full-time: 2 F, 1 M. Tenure-track full-time: 1 M. Adjuncts: 1 F, 2 M. • Biology: Tenured full-time: 4 F, 1 M. (Several adjuncts) • Math: Tenured full-time: 1 F, 10 M. Tenure-track full-time: 1 F. (Many adjuncts) • Physics: Tenured full-time: 1 F, 2 M. (No adjuncts) • Engineering: Tenured full-time: 1 F. • There are many senior women STEM faculty – e.g., 1 chemist with over 20 years; all biologists with ≥ 20 years, 1 mathematician >30 years, 1 physicist > 20 years, and 1 engineer > 10 yrs.

Continued on next page.

Table 3. (Continued). Faculty Demographics (provided for 2009-2010)

<i>Institution</i>	<i>Faculty Demographics Provided by Respondents</i>
Georgia Perimeter College – Dunwoody, GA	<ul style="list-style-type: none"> • Of the 136 total STEM faculty, 72 (53%) are women. • There are 39 tenured women STEM faculty of which 11 are full professors. • The diverse women faculty also includes 17 tenure-track professors.
Harper College – Palatine, IL	<ul style="list-style-type: none"> • 43 full-time STEM faculty (26 M, 17 F) teaching in 6 departments: Biology, Chemistry, Physical Sciences, Engineering, Mathematics, and Computer Science. • Full-time tenured STEM faculty: 19 M, 15 F. • 12 of the women faculty have been at Harper 10 years or more.
Montgomery College – Germantown, MD	<ul style="list-style-type: none"> • No tenure system exists - six-year contracts are the maximum. • Full-time chemistry faculty include 9 women and 10 men.
Mt. Hood Community College – Gresham, OR	<ul style="list-style-type: none"> • Mathematics is 75 % women (8 out of 10) with at least 2 have been at the institution over 7 years. • All 3 engineers are male. • In life sciences, 5 F, 7 M. • In physical sciences, 5 F, 5 M (Chemistry: 3 F, 2 M) Both physical sciences and life sciences have at least one female faculty member that has been at the campus longer than 10 years.
Pasadena City College – Pasadena, CA	<ul style="list-style-type: none"> • Natural Sciences Division (biology, physics, chemistry, astronomy, and geology): women comprise 66% of the tenured and tenure-track faculty and 33% of the adjunct (part time, hourly) faculty. • Many female senior faculty.
San Jacinto College – Pasadena, TX	<ul style="list-style-type: none"> • No tenure system. • In the Department of Science, 20 full-time faculty (9 F, 11 M). • Campus has recently instituted Distinguished Professor Levels I, II and III with plans currently being developed for Level III. • At Level II: 4 F, 0 M.

2. What kinds of mentoring programs are available to faculty at your institution? Are there any particular programs designed for women faculty? Are the faculty interested in having formal or informal mentors? Does most of the mentoring focus on junior faculty? Are there any faculty development resources directed toward senior faculty, particularly women?

The individual responses to this question show a range of formal and informal mentoring situations at two-year colleges. Their statements are presented in full to provide a complete sense of the mentoring experience from the faculty point of view.

Bucks County Community College

“Our College has a one week ‘boot camp’ for all full-time new faculty. In the STEM area, all current faculty are heavily involved in mentoring any new faculty. Again, no distinction between men and women.”

College of San Mateo

“There are no official mentoring programs that I am aware of. There are no programs designed for women faculty. There are unofficial mentors for the new hires in chemistry since I became part of the hiring committee. The mentoring does focus on the junior faculty. Once the faculty gets tenure they are ‘on their own’ so to speak. There are no faculty development resources directed towards senior faculty.”

Georgia Perimeter College

“The Center for Teaching and Learning offers mentoring as well as opportunities for faculty development. There are monies available for travel to conferences, videos on best practices, and opportunities to give or attend talks at the twice-yearly faculty development days. There are no programs geared especially toward women. The mentoring at Georgia Perimeter College is as formal or informal as one desires. Adjunct faculty in the STEM fields undergo a formal mentoring program and are assigned to a full-time mentor. Junior faculty are assigned to a tenured faculty mentor, and they can look to the department chairs for mentoring as well. My department chair offered much valuable advice and direction when I began teaching here.”

Harper College

“We do have ... an ‘established’ informal relationship between faculty that recognizes the need of new faculty to have someone to guide them in navigating

through various layers of tenure and promotion, as well as, acclimating to the institution at large. Usually, the mentor is a senior faculty member from outside of their department. The mentor is usually well established in their own department and expected to meet with the new faculty member regularly and serve as an informal liaison and/or a resource of information. The mentor is expected to help the faculty member through tenure, promotion, committee obligations, professional development and working through departmental, divisional and collegial relationships.

Do our existing mentoring relationships recognize the need for mentoring programs designed for women faculty ... no, we do not.

Do we as an institution have any faculty development resources directed toward senior faculty, particularly women ... no, we do not.

Although, an aggressive professional development strategy is lacking at our institution there have been several faculty who have informally stepped forward to emerge as leaders and excellent mentors. ... They are most often the senior faculty who have been involved in various initiatives across the college and have managed to befriend colleagues in other divisions and departments and at other institutions.... These faculty find themselves not only mentoring other faculty but administrators as well. I know because I seek them out often.”

Montgomery College

“We mentor all new faculty, not just women. There is no particular program for women that I am aware of. We also do a lot of informal mentoring within chemistry. We share lecture notes, sample problems and exams and many other resources with new faculty to make their transition to teaching easier. The formal mentoring program only focuses on junior faculty. We have many professional development classes available to us through our institution; however, they are not directed particularly toward any group of people.”

Mt. Hood Community College

“There are no mentoring programs specifically designed to mentor female faculty members, and until relatively recently there was no mentoring program for pre-tenured faculty. When I started 9 years ago, there was almost no mentoring in place at all. During the three years that it took for a junior faculty member to earn tenure, mentoring consisted of student evaluations and in class evaluations by fellow faculty members. Now, every junior faculty member has a mentoring committee that is there to answer questions and give advice. The committee also meets with the tenured faculty to discuss each non-tenured faculty member to see if there are any issues with that individual that may not have been brought to light in the various evaluation processes. If there is an area that a faculty member needs to improve, the committee then informs the faculty member and offers advice. Thus, when the faculty member comes up for tenure there are no surprises. This system

has been working well for many years now. There is no mentoring in place for tenured faculty.

Although there is money still available for us to seek out our own faculty development, but there are few scheduled faculty development activities compared to what their use to be. There use to be faculty development workshops almost every week on a wide variety of topics ranging from improving your syllabus to reducing racial stereotyping in the classroom, but these are almost all gone because of budget cuts. Faculty now must find their own professional development activities outside of the college. By contract we must complete 14 hours of professional development activities.”

Pasadena Community College

“We have official, administration-run orientation programs for new faculty for both men and women. Most of the ‘real’ mentoring of new faculty is done on an informal basis within each departmentThere are faculty development resources, but they are equally directed to all tenured faculty. We are a public institution- so faculty development resources, such as funds for conference attendance and release time for special projects, have been cut severely during the last few years of budget struggles.”

San Jacinto College

“We have a full-year of bi-weekly sessions for new faculty provided by the Office for Professional Development. There has been an informal mentoring system in places for several years, but this year it will be formalized and all faculty who wish to attain Distinguished Level III will be assigned two new faculty members to mentor for a year, with training, classroom visits, journaling, etc. Since we instituted an Office for Professional Development a few years ago, we have programs, workshops, etc., almost weekly for all faculty. They are usually scheduled for more than one time, so that everyone can attend, if desired. We have no special programs for women, although a chapter of the AAUW [American Association of University Women] is forming in our college district.”

3. What are the major issues for women STEM faculty at your institution? Are these issues for all faculty or are their particular needs for women faculty that are not well-addressed? What kinds of programs or policies are in place to assist women faculty? What programs or policies would you like to see implemented?

Some of the respondents felt that there were few issues facing women faculty (or even faculty as a whole) at their institution.

Bucks Community College

“No major issues for women at this time. In the past, women came in at lower salaries but this was addressed by the union about 20 years ago and things are on par now.”

Montgomery College

“I feel that all faculty are well-supported at my college. I do not feel that there are any major or minor issues for women STEM faculty at my college. ...the lifestyle of a two-year college professor fits well with the needs of younger women with families.”

Mt. Hood Community College

“I think that the issues have already been addressed over the years. The issues most likely had to do with family, but over the years my college has become increasingly family friendly for both students and faculty.”

Others felt that the issues, while varied, were equally challenging for both male and female faculty.

College of San Mateo

“All of us are being inundated with more and more administrative work which is becoming very draining. Due to the budget cuts and AB 1725 “shared governance” [California Assembly Bill 1725 ensuring faculty, staff, and students the right to participate effectively in district and college governance] we have countless extra hours for non-teaching stuff. It gets harder as the number of full time faculty shrinks and the “busy work” increases.”

Georgia Perimeter College

“The major issues for all STEM faculty include pay, merit raises, workload, the adjunct-to-fulltime ratio, and program assessment. “

Pasadena Community College

“The issues we face cut equally across gender lines. Our main difficulties are a shrinking budget, not enough class sections to handle the student demand, inadequate and obsolete tech support, and aging, poorly maintained buildings.”

San Jacinto College

“The problems are the same for all faculty, men and women. How to engage our students, meet their needs and help them be successful.”

One respondent, Yvonne Harris of Harper College, described several broader issues that she feels should be of concern to women STEM faculty in general.

Harper College

“Moving through the processes of tenure and promotion is not a major issue for women STEM faculty at Harper. This is not a surprise since, except for the President, most of the upper administrators are women. All in all, Harper is a very good place for women faculty to be.”

What programs and policies would I like to see implemented at this institution? I want to see programs and policies that serve to remind women that, despite the appearances of our times, we continue to struggle for equal recognition and support and that these things are absolutely essential to having a successful mentoring program for women STEM faculty. They must serve to educate and bring awareness to our historical struggles. They must serve to enlighten our women students who seek careers in STEM related fields so they not forget who they are. They must serve to bind us together as women; as compatriots who have the understanding that we are part of something larger than ourselves. It is from here that mentoring emerges and where we begin to build the architecture of mentoring women in STEM. It is from having a ‘sense of self’ that having a ‘sense of ourselves’ become manifest in the kind of relationship that helps us guide other women.”

4. How do you think the faculty development situation differs for women faculty at two-year colleges compared to women faculty at other types of institutions?

A number of the respondents indicated that they had experience teaching at a variety of types of institutions and were able to address this question with first-hand experience. Dr. Candice McCloskey at Georgia Perimeter College remarked that the experience at institutions where faculty members are expected to develop their careers based on their research programs could be a “highly individualized” and “fairly lonely” venture. “At Georgia Perimeter College, however, I am expected to further my development as an educator. And I have found that the conferences that are geared to this tend to promote and foster a feeling of community. The friendly atmosphere at these conferences makes meeting and talking to new colleagues easy, enjoyable and meaningful.”

Dr. Michael Lee at Bucks County Community College felt “that women are much better off at two-year schools probably due to the fact that so many of us are unionized and also that we do not work under a ‘publish or perish’ environment. We do have to do ‘other scholarly’ activities but most of these activities do not absolutely need to be done at the ‘office’.” Professor Susan

Bontems at Montgomery College also remarked on the availability of flexibility to enhance faculty satisfaction: “At my two-year college, women seem to thrive. They have time to be successful at work and happy at home. This comes predominantly from the flexibility of the hours. Grading and preparation can usually be done at home or at a time most convenient to the faculty member. We are not required to be at our desks from nine to five and this makes the work much more productive and fun. I work hard to get my job done and then still have time to enjoy life. It has been an excellent fit for me.”

5. Is there any way that professional societies or funding agencies could help to provide the faculty development resources that women STEM faculty at two-year colleges might need? What mentoring or career development resources or activities does ACS provide through the Two Year College Chemistry Consortium (2YC₃) within the Division of Chemical Education?

Responders praised the usefulness of 2YC₃ conferences for two-year faculty in terms of providing both professional development as educators and opportunities to serve in leadership roles. In fact, several of those surveyed indicated that their own professional development had been enhanced by election to an officer position in the Division of Chemical Education (CHED) or on the CHED's Committee on Chemistry in the Two-Year College which serves as the board of 2YC₃.

Professor Candice McCloskey of Georgia Perimeter College offered some specific recommendations: “ACS and funding agencies can help by funding travel to conferences, by funding testing research for program assessment purposes, and by promoting the societies geared to two-year colleges, such as 2YC₃. ACS, especially DivCHED, should bolster the presence of this relatively unknown part of ACS.” Professor Yvonne Harris of Harper College suggested that the faculty themselves must take the initiative to build professional development resources and that “what ACS and/or 2YC₃ can provide is the ‘spark’ for motivation.” She offered several crucial questions for the two-year community to address:

- “How do we organize and ‘knit’ together women across different STEM disciplines within an institution such that they are working together in an interdisciplinary way to support and mentor each other and women students who are interested in pursuing careers in science, mathematics, advanced technologies and engineering?”
- How do we promote the institutionalization of such an organization such that they are supported by the college's strategic plan?
- How do we empower these women and ensure monetary support?
- How do we build a program with these women across institutions?
- How do we provide and encourage growth and sustainability?
- How do we ‘seed’, expand and weave this type of mentoring for women STEM faculty into other regional and organizations such as ACS [American Chemical Society], AWIS [Association for Women in Science], AAAS [American Association for the Advancement of Science], etc. such that we have a united voice that is heard nationally?”

Indeed, these are significant questions for all types of higher education institutions to address to insure the participation, promotion, leadership, and visibility of all women STEM faculty.

Future Directions

With projections for increasing enrollment at two-year colleges in the future and the associated need for expanding faculties, consideration of two-year college mentoring and faculty development programs is timely. Recognizing that more deliberate efforts might be necessary, some interesting models for mentoring programs exist beyond individual campuses.

For example, the American Association of Physics Teachers (AAPT) conducts a 14-month experience designed specifically for two-year college physics faculty in their first five years of teaching. Known as the “Two-Year College New Faculty Experience” (<http://www.aapt.org/Conferences/newfaculty/tyc.cfm>), the program consists of attendance at two summer AAPT national conferences and online discussion sessions during the intervening fourteen months. The experience is led by experienced two-year college faculty and is designed to equip new faculty members with knowledge of three major active-learning pedagogical initiatives in introductory physics that have improved student comprehension and that have been successfully implemented at two-year colleges across the country. While the activities are clearly geared toward communicating pedagogical innovations, participants are likely to begin to build a support community of both fellow new faculty and experienced mentors. This initiative, while organized around a professional society’s annual conference, is supported by the National Science Foundation and represents the kind of partnership that will facilitate the professional development of cohorts of community college faculty.

Another partnership involving the National Council of Instructional Administrators (NCIA, www.nciaonline.org) and the Council on Undergraduate Research (CUR, www.cur.org) conducts workshops for community college faculty interested in incorporating undergraduate research into the curriculum. This initiative, also supported by the National Science Foundation, aims to provide a workshop curriculum to implement undergraduate research programs tailored to the needs of community colleges and to develop an undergraduate research mentoring network of community college faculty. Once again, while the focus of the workshop is pedagogical, the experience generates mentoring relationships that can continue beyond the workshop offering.

The American Association of Community Colleges (www.aacc.nche.edu) notes that “Community colleges are in the midst of a transition brought about by the numerous retirements of administrators and faculty members.” As such, this is an opportune time to consider new mentoring initiatives and faculty development programs as a whole. Many of the successful career development examples shared here as well as the thoughtful suggestions offered should prove invaluable as institutions both hire new faculty to meet future demands and design the supporting infrastructure that will enable them to thrive.

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Chapter 7

Support from Academe: Identifying Departmental and Institutional Resources, Policies, and Infrastructure to Support Senior Women STEM Faculty

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In this paper we discuss institutional and departmental mechanisms which support women faculty in chemistry at liberal arts colleges at all stages of their career, from the pre-tenure years through retirement. For senior women faculty who will be in their careers for the longest time span, we recommend six policies which include sabbatical leaves, travel support, faculty development efforts, family leave policies (including elder care), medical leave policies, and phased retirement options. Shared/split academic positions are also discussed as a mechanism for the academy to bring more women into academic positions and promote a better work-life balance. Flexible implementation of policies can provide the broadest participation of women in these career advancement mechanisms.

Introduction

The presence and success of women in academe, especially in the sciences where women have been and continue to be under-represented nationally, can be constructed and supported by the academic infrastructure of institutions and departments. In contrast, the absence of women in programs can be directly tied to the absence of effort and/or lack of support for women in particular locales. The National Academies' comprehensive study of women in science and engineering is a treasure trove of information on the problems and a call for change (1). As well, the glacial pace of change in the academy modeled by Marschke et al. will cause gender equity in the future to be just as elusive due to demographic inertia (2). In this paper we will illustrate mechanisms that have led to the success of women in liberal arts chemistry departments.

We will use the typical academic career path of hiring, tenure, and post tenure professional development as our roadmap. As the focus of our NSF-Advance-Paid project is on senior women faculty, we will go into more depth on the post tenure professional development mechanisms. But, we won't ignore how we got to be senior women faculty at our institutions and reflect on hiring and tenure policies briefly. Many of these mechanisms can be generalized to other areas in which women are under-represented in the work force.

Hiring

Senior women faculty at liberal arts colleges began their careers with an initial hire into an academic department, usually at the assistant professor level. Success in hiring women into broadly advertised, open positions can be most successful if the department or institution makes a serious effort to attract female applicants. This paper will not argue the importance of women's representation in departments, leaving that topic to other published work.

The efforts to attract female applicants need to go beyond the legally required equal opportunity language. Institutions that welcome diverse applicants have augmented language that encourages women and minorities to apply. For example, every ad at Rhodes College has the following language at the end of the ad:

Founded in 1848, Rhodes College is a highly selective, private, residential, undergraduate college, located in Memphis, Tennessee. We aspire to graduate students with a lifelong passion for learning, a compassion for others, and the ability to translate academic study and personal concern into effective leadership and action in their communities and the world. We encourage applications from candidates interested in helping us achieve this vision. Memphis has a metropolitan population of over one million and is the nation's 18th largest metropolitan area. The city provides multiple opportunities for research and for cultural and recreational activities. Read more about Memphis at <http://www.rhodes.edu/about/369.asp> We are an equal opportunity employer committed to diversity in the workforce [<http://www.rhodes.edu/collegehandbook/10309.asp>].

The goal of the ad language is to attract a wide variety of qualified applicants that share the Rhodes College mission. They wish to hire people that will embrace different cultural perspectives, contribute to a liberal arts college environment and educate students in a way that fosters respect and intellectual stimulation. The ad language accomplishes this, in part, by using the college handbook link that describes their commitment to diversity which is also tied to their multicultural affairs webpage. An applicant can read about the kinds of diversity supported by the institution (for example, gay-straight alliance, black student association etc) and feel confident that the College supports women and minorities.

Institutions with diversity officers (also affirmative action officers) who participate and impact searches can also increase the opportunities to hire a woman into an open position. Real participation means inclusion in the formulation of the ad, in departmental discussions of search candidates, and a voice in the decision on which candidates to bring for a campus interview. Institutions with marginalized diversity officers are unlikely to improve the number of women on their faculty. For example, the diversity officers at Rhodes College meet with each candidate during their campus visit to articulate the College's commitment to diversifying the faculty. The American Chemical Society's recent inclusion of the Academic Employment Initiative at fall national meetings provides all employers a forum to connect advanced graduate students and post-doctoral students who will be seeking jobs (and are disproportionately from under-represented groups) with institutional representatives who are searching for faculty candidates. Academic institutions need to expend the resources to send a representative to this meeting because it is an excellent venue to recruit diverse faculty to an open position.

Upon hiring, start-up funds, salary, laboratory space, and initial teaching assignments can set the stage for success or failure of a new faculty person. New women faculty typically benefit from a helpful advocate to negotiate the best possible starting position in a department. Valuable assistance can also come from off-campus organizations such as CUR (the Council on Undergraduate Research), and the YCC (the Younger Chemists' Committee of the American Chemical Society) who offer career planning advice to job candidates independent of any particular institution. Lack of support or resources to conduct research or develop courses can undermine any career at its start.

Pre-Tenure Years

During pre-tenure years women frequently need to balance their burgeoning careers with family responsibilities. At the typical age of new faculty, family demands often involve young children. Institutional policies for pregnancy and family leave make this balance more successful. Not surprisingly, more generous policies lead to a higher level of success for women faculty. Resources such as an on-campus day care center provide significant support, allowing faculty with families to be both parents and successful employees. Policies that do not consume additional resources but can support faculty with family responsibilities include:

- a) willingness to allow flexibility in scheduling (such as scheduling courses so as to not conflict with daycare/school start and end times),
- b) informational assistance on local daycare availability,
- c) willingness to schedule meetings at times that don't conflict with family responsibilities, and
- d) tolerance of arrangements that include the occasional presence of children in academic buildings.

Formal mentoring, typically of a vertical nature, can benefit young faculty. The most common form of these arrangements pairs an experienced faculty member with a novice faculty member. The experienced faculty member can advise the novice on decisions regarding teaching, research, service, and the peculiarities of the institution. Such advice can be much more efficient than a trial and error approach to such decisions. Horizontal mentoring of young faculty can also be beneficial. Davidson College has an organized group of young faculty who meet regularly for mutual support and discussion of issues. Grinnell College also has a more socially construed group to serve the same purposes. Tenure brings the necessary (if unfortunate) eviction from this coterie.

All young faculty benefit from a progress review or reviews prior to the tenure decision. This is regularized at several institutions in the form of an interim review after one year of teaching and a complete review after three or four years of teaching. The interim review focuses on teaching while the complete review includes all the components of a tenure review except the external review of scholarship. An important goal of the reviews is to give young faculty feedback on areas which need improvement in order to achieve tenure. This is an investment of internal resources (and senior faculty time) but the tenure success rate is much improved. When the pre-tenure reviews are conducted from the developmental point of view instead of a purely critical point of view, the young faculty member also receives important suggestions for their own career development. For both of these reviews at Grinnell, the candidate receives a carefully constructed written progress evaluation that details specific objectives for improving job performance if necessary.

With many liberal arts colleges including a grants component as part of scholarship, all faculty and especially pre-tenure faculty can benefit from an on-campus grants officer. This person can keep faculty apprised of grant programs for which they might be eligible, assist with grant preparation (such as NSF Fastlane submissions), and keep faculty members on a schedule to meet the grant deadlines. It is important that young faculty see examples of successful proposals from their department or institution and have a resource/mentor on campus who can critique proposals and make suggestions for revisions and resubmissions of proposals.

Pre-tenure sabbatical opportunities greatly assist young faculty in meeting the scholarship demands of tenure. Typically in chemistry departments at liberal arts colleges, faculty work with undergraduate students on research projects. The presentation and publication of the resulting work at the professional level depends solely upon the expertise of the faculty member. A pre-tenure sabbatical can be essential support from the institution so that manuscripts and presentations can

be prepared with some release from regular teaching responsibilities. Grinnell College provides all pre-tenure faculty with a one semester release from teaching in the fourth or fifth year of service and a competitive program to support two or three pre-tenure faculty with full year releases.

Post-Tenure Years: Senior Women Faculty

Our NSF-PAID-Advance project has focused on senior women faculty at liberal arts colleges. Appropriately so, this paper will discuss the institutional and departmental role in promoting the success of women who have achieved tenure at their institutions. In a faculty career of 30 years, almost 70% of a career is spent in this phase, so both individuals and institutions can benefit from enhancing senior faculty success.

Institutional and Departmental Support

Professional development support is important for senior faculty (3). Sabbaticals are essential for continued research productivity and updating of courses to continue to reflect current advances in science. Flexible sabbatical policies which support faculty at their home institution or off-campus, support faculty work on broad ranges of projects (both research or teaching projects), and flexible timing (calendar year or academic year, full year or 1 semester) can offer senior women as many options as possible to continue their professional growth. Replacement of faculty during a sabbatical leave is essential because otherwise, a department or its members are disadvantaged when one of their colleagues takes a sabbatical. If courses will be lost in a department or colleagues will have to take on an overload for the faculty member on leave, the pressures inside a department may result in less frequent sabbatical experiences.

Travel funds also are essential for senior faculty to engage with the other experts in their subdiscipline. Broadly managed programs which support conference attendance (both domestic and international), workshop participation, grant review panels, scientific society service (especially at the national level), and site visits to make specific changes to an on-campus program or facility are all examples of the types of travel support senior women faculty will need over this phase of their career.

Over the twenty or so years as post-tenure faculty, senior faculty will need to update, retool, or shift their research and teaching agendas. Faculty development support from departments and institutions are essential for success in continuing to be a productive scholar (4). Sabbaticals are one form of tangible support. Support for collaborative projects is another measure of career enhancement. Liberal arts chemistry departments have typically placed more value on single investigator projects but as the research topics in chemistry become more interdisciplinary (and complex), collaborative projects are becoming more common. Valuing collaborative outcomes is a significant paradigm shift which will become more important as interdisciplinarity becomes a more integral part of the curriculum at liberal arts colleges.

Tangible institutional and departmental support for new smaller initiatives can come in the form of time or money. Release time from a portion of teaching responsibilities, such as a one lab reduction in course load could support a faculty member to develop a new experimental technique or a course module. Monetary support can fund travel for a site visit or supplies to implement a new idea on the home campus.

Chemistry is an equipment intensive discipline. Updating and maintaining the instrumentation that drives continued success in research requires institutional and departmental commitment. As much of this equipment must be acquired by grant success, support from the institution is essential. Types of support include cost sharing the purchase of equipment, and funding maintenance contracts or training programs for campus users. The institution can support faculty grant success with administrative support such as a grants officer and also promote and reward institution wide proposals to foundations such as the Howard Hughes Medical Institute science education grants.

Senior faculty continue to need support to balance work and life issues. A broad family leave policy which extends to aging parent needs can support faculty who at some point in this phase of their career will face care needs of their elder generation. It is also possible that an illness or injury will require leave time at some point. Medical leave policies which include the hiring of short term replacements are important so that faculty can regain their health and their colleagues are not overburdened by extra responsibilities. A schedule of graduated work responsibilities can aid a faculty member in healing and partial return to their regular duties until the full load can be resumed. Transparent policies on unpaid leaves or fractional appointments can assist faculty in returning to their full duties gradually.

As senior women faculty approach retirement, flexible retirement options such as phased retirement plans can maintain involvement in a department with reduced duties. In departments with very few women, the retirement of even one senior woman can dramatically change the gender balance of the faculty. Grinnell College has a program of phased retirement called senior faculty status (SFS) in which faculty who are 61 years of age can renegotiate their duties with compensation at half of their salary. The range of duties is highly personal with some faculty pursuing only research or teaching while others blend service, research and a small amount of teaching arriving at a half time level of duties to preserve benefits. Departments can typically hire a full time replacement for a faculty member who moves to SFS so that no courses are lost to a department. Since salaries are so different for a new hire and a very senior faculty member, the half a senior faculty salary frequently is comparable to a new hire's salary. At Grinnell, faculty can remain in SFS status for five years and renegotiate the terms of their half duties annually.

Emerita faculty can continue to be professionally active with the support of an on-campus office, computer support, and laboratory space/supplies. These women continue to serve as role models for faculty and students at the institution and regionally or nationally. Well known research scientists such as Larry Dahl (U. Wisconsin-Madison), John Roberts (California Institute of Technology) and I. M. Kolthoff (University of Minnesota) continued their teaching and experimental

work many years beyond their ‘retirement’. At Grinnell College, Ken Christiansen from the biology department has continued his research work with students with an active publication record for twenty-five years beyond the end of his teaching career.

The theme of all of the resources, policies, and infrastructure mechanisms discussed above is **flexibility**. Women’s support needs frequently don’t fit the institutional rubrics which have served men at liberal arts colleges for decades (and were frequently developed by men). Refining of institutional policies to offer more breadth of implementation can expand them to support women. Life and career balance issues for women can mean that the year in which one is eligible for a sabbatical may coincide with family circumstances that would cause a sabbatical away from home to be too disruptive. A sabbatical which could also be held at the home institution is a small example (though a policy shift for some institutions) which would support a faculty member’s scholarly activities and balance a family need. Institutional and departmental agility can benefit women by helping them to work around rigid, out-dated programs that would serve to exclude them from participation. The willingness of administrators to discuss alternate implementation strategies and revise programs can be more broadly supportive of all faculty.

In summary, valuable institutional mechanisms that support senior faculty include:

- 1) sabbatical leaves,
- 2) travel support,
- 3) faculty development efforts, such as:
 - a) workshop participation,
 - b) recognition of collaborative projects,
 - c) partial release time or modest supply funds for small projects, and
 - d) new equipment acquisitions.
- 4) family leave policies which include support for aging family members,
- 5) medical leave policies which include replacement of faculty on leave, and
- 6) phased retirement options.

Women Supporting Women

Women can participate in activities that support each other with no or modest support from their institutions and departments. Over some organizational range (from departments up to entire institutions), there are now a critical mass of women to draw together for mutual support. Regular gatherings such as the Friday afternoon wine and snack group, Beatrice, at Rhodes College can offer regular fellowship and friendship. Davidson College has an email distribution list for women faculty. A local chapter of Iota Sigma Pi can connect women in one institution to others in the area such as the new chapter at Sweet Briar College. Carol Ann Miderski at Catawba College has established a Women’s Resource

Network in North Carolina to draw women within a 100 mile radius to share information and to gather occasionally for networking and support. Grinnell College has an organization called Scholarly Women's Achievement Groups (SWAG) composed of small groups of 3-5 women faculty (both vertical and horizontal groups) that support women faculty in keeping their scholarly goals moving forward. SWAG has received some administrative and food support from the institution but the bulk of the small group meetings require only time from the women who participate. The small groups typically meet 4-6 times over an academic year.

These example activities range in their institutional support levels. Some require no monetary support from the institution (in the case of Beatrice at Rhodes College) to modest support (administration of an email list, institutional recognition of Iota Sigma Pi, administrative support and a small food budget in the case of SWAG at Grinnell College which is supported externally by the Mellon Foundation). These kinds of activities support women faculty with minimal institutional investment.

The Shared/Split Contract

A shared employment contract or a split position can provide a mechanism for career and life balance in any work environment. Typically these employment contracts hire two people (usually a partnered couple) into one faculty position at an institution. Linguistically, liberal arts colleges call these arrangements shared contracts while universities label them split positions. Several liberal arts colleges offer this employment option to faculty including Grinnell College (anthropology, biology, chemistry, mathematics and statistics), Albion College (chemistry), Alma College (chemistry), and Franklin and Marshall College (geosciences), while Calvin College (chemistry), Knox College (physics), and Whitman College (English) had faculty in these positions (5). As early as 1985 a study of twelve couples identified the lifestyle advantages of job sharing (6). The American Chemical Society Division of Chemical Education regularly sponsors a symposium on careers and in 2006 included dual career chemistry couples in both academia and industry (7).

At Grinnell, the terms of employment include sharing the teaching responsibilities of a regular faculty load, benefits for both persons, separate offices, and individual performance evaluations. A nice (and humorous) essay on the shared contract at Grinnell was published in 1999 (8). Historically, shared contract positions date from 1964 at Grinnell and, in part, were driven by diversity efforts in the 1980's and 1990's to hire women faculty. Lyons began her career at Grinnell (as the first woman in a tenure track position in a physical science department) in a shared contract with her spouse (an arrangement that continues today). At universities, job sharing arrangements are more commonly called split positions (9) in which contracts to each individual are tied to one faculty position but the distinctions between split and shared positions are more specific to institutions. Oregon State University marine biologists Jane Lubchenco and

Bruce Menge have described their arrangement in a split position as “the sane track.” (10)

There are advantages for both the individuals and their institutions with shared/split positions. The individuals can live and work in the same place, both have satisfying employment, and both have more time for research, teaching and family/life choices. Institutions gain faculty diversity, stability of their faculty (less attrition, experienced faculty who can cover other leaves, and less reliance on temporary faculty), better spousal employment, and in many cases the added expertise/breadth of two research programs. On a ‘green’ note, the carbon footprint of shared/split positions is lower as there is less commuting and one shared home vs. the long distance, two residence arrangement of so many working couples in the United States.

Disadvantages for the partners include a single salary and the potential for exploitation. While the contract may be for one position with one salary, actual implementation of these arrangements frequently includes negotiation for additional teaching (for commensurate additional pay) and financial support for the individuals via external grant support. Over the twenty-one years Lyons and her spouse have shared a position, their teaching load has ranged between 1.2 and 2.0 FTE with an average of 1.7 FTE the past seven years. The exploitation comes from two sources: the institution and the partners. The institution frequently asks the partners for more service (two people to serve on committees) and the two faculty may spend more total time at their job than one faculty person would. The institution also faces hurdles and challenges in these positions. Revisions of hiring, tenure, and evaluation procedures to establish institutional policies for shared/split positions are significant barriers. Institutions with nepotism policies may also find shared/split positions conflict with that policy. Institutions face increased costs of both individuals in the partnership versus a one person hire. Typically, these include full benefits for both, offices for both, and research support for two research programs if that is a hiring goal.

Women scientists are disproportionately in partnered relationships with other scientists (11) and are a part of the increasing trend of dual career couples in the United States. Partner accommodation policies from 16 institutions are collected by Eric Jensen on his web site (12). The shared/split employment arrangement is one solution to the two-body problem in academia. Shared/split positions are also a mechanism for the academy to bring more women into academic positions and promote better work-life balance.

Conclusions and Concerning Trends

The current economic climate and trends in higher education raise several concerns that may impact women faculty more strongly. Budget shortfalls are now part of the common news cycle (with the protests in March, 2010 receiving the most attention). The erosion of distribution requirements in the sciences at institutions is of general concern for science literacy in America. Frequently it has been women faculty who have taught and developed courses for non-science majors. The loss of these courses in the curriculum will disproportionately impact

women faculty (who will then need to retool to teach other courses or face job loss). Changing enrollments are putting pressures on institutions generally. Class sizes are being pushed up, and private institutions without strong financial aid support for students are facing declining enrollments as their costs go beyond the reach of recession strapped families. Faculty are being asked to do more with less and women faculty see themselves as more vulnerable to the uncertainties of these trends. Changes in the undergraduate chemistry curriculum adopted by the ACS-CPT (American Chemical Society Committee on Professional Training), in the MCAT exam, and medical school requirements will also impact liberal arts chemistry programs.

Gender equity issues in science and at liberal arts colleges will be with the academy for some time. Glaciers in the continental United States will likely melt before gender equity is achieved broadly in the sciences, an example of geological processes outpacing sociological ones. Facing this challenging future, the departmental and institutional mechanisms we discuss here can be a part of improving the future for all faculty at liberal arts colleges with our students receiving the greatest benefits. Mechanisms which are flexible in their implementation support individual faculty to balance their work and life needs while leading the academy into the twenty-first century.

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Chapter 10

Development of a Horizontal Peer Mentoring Network for Senior Women Chemists and Physicists at Liberal Arts Colleges

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Our research project focuses on the distinctive environments of undergraduate liberal arts institutions and the challenges faced by senior women faculty on these campuses to attain leadership roles and professional recognition. The project involves the formation of five-member alliances of senior women faculty members at different institutions for the purpose of “horizontal mentoring.” Three of the alliances are comprised of full professors of chemistry, the fourth involves full professors of physics. We have formed these alliances to test a “horizontal mentoring strategy” that aims to enhance the leadership, visibility, and recognition of participating faculty members. Alliance members participate in discussions, workshops, and activities focused on career and leadership development through periodic gatherings of alliance members at various locations across the country and through electronic communication via online collaboration tools. The alliances are

networked to augment the peer-support structure with a larger cohort of senior women scientists. Outreach activities on home campuses extend the impact of the career development expertise attained by project participants. This NSF-ADVANCE-PAID project is also working to identify and create resources that address career development issues for senior women at liberal arts institutions and disseminate best practices on horizontal mentoring strategies for academic women. We have explored how our institutional structure and culture can profoundly influence the career challenges of academic women and how our mentoring strategy can operate particularly effectively for women from liberal arts colleges.

The Value of Mentoring for Senior Women STEM Faculty Members

The underrepresentation of women in almost all physical science and engineering fields is a well-documented statistic (1). One strategic effort to broaden the participation of women in the technical workforce is to increase the advancement of women faculty in science and engineering fields at academic institutions of higher learning. The presence of senior women faculty in the highest ranks of academic leadership enables female students to self-identify as potential scientists and engineers, thus having a powerful influence on their choice of career. Yet the percentage of women in senior faculty positions in science and engineering is discouragingly low. For example, only 1.5% of those faculty members in universities and four-year colleges holding doctorates in the physical sciences are female full professors with 20 years or more experience beyond their doctorate (2). In contrast, the corresponding figure for male full professors with the same level of experience and doctoral field is 21.8%.

Analysis of the disproportional presence of senior women scientists and engineers at colleges and universities is a complex and multifaceted process. Numerous variables have been examined for their impact on advancement in academia. Compelling evidence exists to support the hypothesis that both formal and informal mentoring practices that provide access to information and resources are effective in promoting career advancement, especially for women (3, 4). Such associations provide opportunities to improve the status, effectiveness, and visibility of a faculty member via introductions to new colleagues, knowledge of information about the organizational system, and awareness of innovative projects and new challenges (5–8). Some of the specific benefits accorded to mentees compared with their colleagues with no mentoring support include enhanced socialization to institutional and professional organizations; greater productivity measured in terms of research, grants, and publications; and increased recognition from colleagues and authorities in the field (9–11). Given these favorable outcomes, higher education institutions, many funded through NSF-ADVANCE Institutional Transformation Awards (12), have established mentoring programs

to improve the campus climate for women faculty and facilitate their retention and promotion.

While mentoring is traditionally viewed as essential early in one's career, the changing responsibilities of faculty members as they advance in the professoriate suggest that mentoring relationships would also facilitate career advancement for senior faculty seeking new challenges and leadership roles and desiring greater professional visibility and recognition. Endowed professorships, department chair positions, membership on tenure and advancement committees, or roles as associate deans or chairs of the faculty are common leadership opportunities for senior faculty. In addition, as a consequence of particular expertise acquired throughout a career, senior faculty might also consider other leadership activities both at their institution and at a national level, including directors of interdisciplinary programs, offices in professional organizations, chairs of national disciplinary and professional conferences, or roles as principal investigators on multi-institutional collaborative grants. All of these career ambitions for senior faculty reflect goals of institutional and national leadership in the profession and are challenging aspirations. The coaching and advice of experienced mentors would be valued resources to assist a faculty member in achieving these goals.

Just as in the case of prospective women scientists, senior women faculty often prefer mentors who are like themselves because they perceive such female role models to have experienced professional and personal difficulties and challenges similar to their own (13–15). Yet, as there are few women faculty in high-ranking positions, cross-gender mentoring is likely to be the only “traditional mentoring” option available for senior women faculty in science and engineering. To remedy the lack of access to experienced female mentors, alternative models of mentoring must be found and research conducted to better understand the benefits of these different forms of mentoring in academe.

Critical Needs for Senior Women Chemistry Faculty at Liberal Arts Institutions

The ambition of senior women chemists at liberal arts institutions to attain the highest leadership positions at their institutions as well as in national professional organizations is a challenging goal. Private, residential liberal arts colleges are typically characterized by strong faculty governance, strong expectations of service, an emphasis on teaching with small classes and low student-faculty ratios, and small departments with few colleagues in one's area of specialization. These settings provide both unique career growth opportunities and challenges for women faculty members. Using local resources to identify female career mentors in the discipline is a limited option. Indeed, the dearth of senior women faculty in chemistry is even more acute at B.S.- and B.A.-granting institutions than at Ph.D.-granting universities. The Women Chemists 2000 publication of the American Chemical Society (16) reported only 932 female full professors of chemistry at baccalaureate institutions compared with 1696 at Ph.D.-granting institutions. With 2.3 times as many baccalaureate institutions than Ph.D.-granting institutions in the United States (647 vs. 283, as reported in the most recent

version of *The Chronicle of Higher Education Almanac* (17)), the scarcity and consequential isolation of senior women chemists at such undergraduate institutions is profound. Alternative modes of mentoring are a necessity if a strong support system is to be established along gender-specific lines to improve the climate for senior women chemists at private liberal arts institutions and to facilitate their advancement to leadership positions.

Formation of Our Inaugural Horizontal Peer Mentoring Alliance

Peer mentoring is one particular form of mentoring that would seem ideally suited to senior women chemists situated at geographically distinct liberal arts institutions. The more egalitarian atmosphere of a peer mentor group with members of similar professional rank is a welcoming venue to share career information and provide support and feedback. Studies have shown that peer mentor groups can be particularly empowering as each member is serving as both a giver and receiver of information (18–21). The varied career experiences and achievements of a cohort of women faculty who have reached the senior ranks at their institutions provide a rich resource to utilize for guidance and recommendations.

In 2004 five senior women chemists (four are authors of this chapter) were successful in receiving funding for an interinstitutional initiative supported by a Mellon Foundation faculty development award to a cohort of eight liberal arts colleges (22). In this project, “Advancing the Careers of Senior Women Chemistry Faculty through a Horizontal Peer Network”, we established a networking peer support group for the purpose of exploring and defining future career aspirations. By meeting together to discuss career goals and establish steps for achieving these aims, the group sought to provide each other with support, advice, ideas, and contacts. We represented the only senior women chemists at our institutions and in the eight-institution cluster (23) and, in some cases, the only female chemists at any rank in our departments. In most instances we were the first women faculty hired in our departments with few, if any, female role models in our institutions as we progressed through tenure and promotion to full professor. Thus peer mentoring involving external mentors was a logical approach for our group of women faculty.

To determine the essential components for a successful horizontal peer mentoring approach, we examined the factors that lead to successful and sustained transformations in organizations. We surmised that face-to-face meetings of our small number of participants from distinct but similar institutions over a sustained period of time were central to the success of our initiative. There is ample evidence that, for organizations to initiate and sustain change, members must have a shared vision, use a systems approach that recognizes the interrelationships among participants, and learn as a team particularly through personal commitments made to each other (24). Furthermore, faculty participation from multiple institutions in discourse and activities focused on faculty development can lead to more creative approaches and certainly mitigates the sense of professional isolation in pursuing new initiatives. The collaborative team model can invoke a stronger

commitment to the goals and a greater appreciation of the dedication of colleagues to the long-range objectives. Research further indicates that successful faculty professional development requires mechanisms that are iterative, systemic, and involve ongoing interactions and interventions (25, 26). The multi-day gatherings for our horizontal mentoring alliance allowed for the personal interactions that are necessary to foster the formation of a support network. With a support network in place and with opportunities to meet regularly, the most lasting career development is likely to occur (27, 28).

Our horizontal peer alliance corresponded electronically for several months prior to our first face-to-face meeting to explore common professional objectives and establish priorities for the first meeting. Electronic communication continued between meetings to continue conversations on issues raised at gatherings, share new information and advice as new professional challenges and achievements occurred, and design the agenda of future gatherings. Prior to the first meeting the group also began the compilation of an annotated bibliography of journal articles and books on career development issues for senior academicians. Reviews of these publications were shared at gatherings and through electronic communications. To facilitate the discussion, members of the group selected several texts to read in common, depending on the particular professional interests of the individuals.

Four meetings of the mentoring group were held from 2004 to 2006 with Mellon funding, with partial gatherings at two professional conferences. At the first meeting, members formulated short-range individual career goals to address over the subsequent months. The group also decided at that meeting to seek the guidance of a career development consultant to enhance their leadership and self-presentation skills. The second meeting was held with an experienced career development and executive coach for women academic physicians and scientists. We addressed a broad range of issues in our coaching sessions including effective communication and relationship-building strategies, self-presentation and self-promotion techniques, and values-based goal-setting. At the third meeting we considered avenues for extending this network to other senior women in chemistry at liberal arts colleges similar to our own institutions and for assisting junior women faculty at our own institutions in their career development. A fourth meeting focused on assessing the impact of this career enhancement project.

Assessment efforts demonstrated this mentoring strategy to be a resounding success. One participant articulated the personal impact of the project on her career as follows: "This grant provided me with the means to meet with and discuss my situation with four other successful and talented women who each had to face their own set of personal hurdles in their career paths. I have been inspired by them and have come to rely on their expertise and decision-making skills to help me in making choices and decisions. ... My confidence and self-esteem have soared." Another expressed the value of the experience for both herself and her institution: "The horizontal mentoring network that we have set up will continue to be of great value to me. I know that if I need advice from someone more removed from my setting I now have four individuals, each with different talents, who I can contact for guidance. Knowing the value of this mentoring has reinforced my willingness to provide guidance for junior colleagues as they progress through their careers.... In addition I now realize that the senior women in science at [my institution] need

to spend more time together. Each of us is fairly isolated in our own department. Having experienced the utility of a mentoring network first hand I now know that we need the equivalent of this to happen on my home campus. ”

An NSF-ADVANCE-PAID Project To Expand the Horizontal Peer Network

Given the success of our initial peer mentoring group, we applied and received funding from the NSF ADVANCE PAID (Partnerships for Adaptation and Implementation) program in 2006 to continue our mentoring approach. Our project established a network of four five-member “horizontal” mentoring alliances of senior women scientists at private liberal arts institutions – three alliances were composed of chemists at the full professor rank and the fourth was composed of physicists at the full professor rank. A significant amount of research occurred to survey the composition of chemistry and physics departments at over 200 liberal arts colleges around the country. The members of the alliances were selected on the basis of their existence as the lone senior female faculty member in their department and often for their presence as the singular female faculty member in their department. Geographical diversity was a key objective in three of the alliances in an effort to bring together women whose institutions might not already be participating in a regional consortium. We did recognize, however, that travel times could hinder meeting during the academic year, so a more regional association of alliance members was sought in one alliance to test the impact of reducing that constraint. No effort was made to match women in similar subdisciplines of chemistry or physics. With one alliance the selection of women who had fairly recently attained full professor status was the aim. We also deliberately chose women from twenty different institutions to maximize the impact of campus outreach efforts.

Each alliance was free to determine their own meeting times and locations. Some alliances chose to meet on each other’s campus to benefit from learning about each institution. Other alliances held gatherings in conjunction with professional society conferences in order to minimize travel. Still others, when time was tight during the academic year, chose hub cities and even airport hotels for convenient air travel and maximum time for interaction. At the first gathering of each alliance, in addition to getting to know one another, each alliance participant shared her individual short- and long-range career goals and the alliance decided on areas of career development to address as a group (e.g., leadership, self-presentation and self-promotion skills, dealing with difficult colleagues, effective communication and relationship-building strategies, etc.). Funds were available for external consultants to provide guidance in these areas and for the purchase of reference books as additional resources. Each alliance chose its own means of electronic communication and/or teleconferencing to stay connected between gatherings and to further promote the sharing of advice, ideas, and contacts. Significant numbers of the members of the chemistry alliances gathered for dinner at national meetings of the American Chemical Society to create an expanded network of colleagues and share news about the activities

of each alliance. Finally, a variety of outreach activities on home campuses extended the impact of the career development expertise attained by project participants. These outreach activities included, for example, book discussion groups on faculty development topics for the women science faculty on a given campus; sponsorship of a consultant visit to conduct a strategic career planning workshop for the women science faculty with individual career planning meetings and sessions on negotiation and brainstorming on critical career issues; and a visit to campus of an external speaker to provide professional development for all science faculty (male and female) in the form of information about significant contemporary interdisciplinary research questions and career paths and internship opportunities for students. As a culminating event of the project, a summit meeting was held in Washington, D.C. for all project participants and more than thirty additional senior chemistry and physics female faculty members at liberal arts colleges to identify and create resources that address career development issues for senior women at liberal arts institutions and disseminate best practices on horizontal mentoring strategies for academic women.

The Efficacy of the Horizontal Peer Mentoring Approach

Our project to establish horizontal peer networks of senior women chemists and physicists at private liberal arts institutions has the following distinguishing features to insure effectiveness:

- an approach focused on senior women chemists or physicists who are employed in the distinctive environment of a private liberal arts campus,
- a structure that enables multi-day gatherings that foster the personal interactions necessary to form a committed cohort of faculty to serve as peer mentors,
- mechanisms for regular follow-up to maintain the support network and mitigate professional isolation, and
- professional development activities tailored to the specific needs of the participants and designed to enable these senior women scientists to serve as effective leaders of institutional change on their own campuses and in their professional associations.

Our project evaluator (and an author of this chapter) conducted an ethnographic study using qualitative research methods, and her results show this form of peer mentoring to be particularly effective. Our summative evaluation is still in progress, but formative evaluation involving interviews with project participants explored early outcomes of participation in the initiative and revealed many benefits of the mentoring approach. Alliance members were asked their views about the efficacy and relevancy of the structural model (i.e., a horizontal mentoring alliance) in practice, their thoughts about barriers and supports to using this model, its sustainability, and where it might be usefully replicable.

Participants overwhelmingly agree that the alliances promote the sharing of ideas, experiences, and expertise. Furthermore, the composition of the alliances

with members from different institutions was valued in that it provided a different perspective from an outsider's point of view and an opportunity to be open and honest without fear of competition or reprisal. Nearly 75% of participants agreed that being part of a horizontal mentoring alliance had given them more confidence to "speak up for myself," ask for what they wanted from their departments, accept due recognition for their professional work and contributions and permission to focus more time and attention on their professional goals. Three-quarters of participants also noted that, aside from strong professional support, they had developed friendships with other alliance members that would last beyond the life of the grant and that a benefit of participating was simply in talking and socializing with other women having similar career paths and interests. The career development focus of alliance meetings, network gatherings, and horizontal mentoring activities also contributed to many major professional developments for the project participants. A key aspect of the initiative is the articulation of short- and long-range career goals by each participant and the formulation of action plans to attain the stated professional goals. An extensive array of enhanced leadership and career opportunities have resulted including endowed professorships, institutional awards for teaching and service, invited lectureships, and offices in professional organizations. Participants also noted a range of additional benefits that included the transfer of gains back to their own institutions in terms of a renewed effort to mentor women and in terms of interactions with deans and other institutional administrators who were actively interested in the horizontal mentoring alliance initiative and were interested in seeking ways to support women science faculty. Coding of the interview data also revealed comments focused on the alliance meetings, the topic of mentoring, geographical issues associated with career development and alliance functioning, professional development issues associated with differences between R1 and liberal arts college settings, replicability and sustainability of the horizontal mentoring alliance, career satisfaction, comments on whom the horizontal mentoring alliance best serves, as well as additional gender, departmental, and institutional issues. These comments helped to structure subsequent alliance gatherings and develop communication among the alliances. Overall, baseline outcomes from the external evaluation demonstrated that the rationales underlying the development of the Horizontal Mentoring Alliance initiative were accurate. In practice, the mentoring model that was implemented was found to be highly effective in addressing issues particular to senior women faculty members in the sciences at liberal arts colleges, and thus, successful in achieving project goals of reducing members' isolation, increasing their access to professional networks and advice, and in promoting their career advancement. It is notable that qualitative findings from participant interviews align with the varied research and discussions in the literature concerning women science faculty and academe. The strong benefits to alliance members, their colleagues and institutions suggest that effective mentoring is needed and beneficial at all levels of one's academic career. As a model, horizontal mentoring might well be adopted by others seeking to effectively promote women science faculty members' advancement in academe.

Conclusion

The formation of these horizontal mentoring alliances has had significant direct impact on the career development of the twenty senior women participants and additionally developed a cohort of leaders of institutional change at the participants' home institutions. Participants cite a range of personal benefits from involvement in this initiative including opportunities to network with senior women science faculty in liberal arts institutions; time to engage in career development discussions aimed at enhancing leadership, visibility, and recognition on campus and in the broader academic community; and occasions to develop mentoring paradigms that can be used with students, junior female faculty colleagues, and other senior female faculty colleagues. This horizontal mentoring strategy has also enabled participants to realize numerous individual gains that have impacted both their professional and personal lives. It is our belief that, for senior women faculty seeking new avenues of career development resources, a horizontal mentoring approach might indeed offer a viable mechanism.

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Chapter 11

Promoting Mentoring among and for Women in Chemistry: The Experiences of COACH

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Mentoring is considered an important factor for why women are underrepresented in academic science and engineering departments. COACH, the Committee on the Advancement of Women Chemists, has been working on programs involving mentoring of women scientists for the past decade. COACH has sponsored numerous career-oriented workshops for academic women chemists and has been instrumental in developing workshops for department heads that all have some component of mentoring built into them. This paper uses data gathered by COACH at COACH workshops that examine women chemists' mentorship experiences. Through a series of comments gathered from these women chemists, insights can be gained on issues such as what mentors have been effective in their lives, what mentors do, the effectiveness of formal mentoring programs, the changing mentor/mentee role over the course of a career, why mentoring often doesn't happen and what factors can contribute to having a positive mentoring experience. The article ends with a discussion of ways that COACH has promoted mentoring and the apparent results of these efforts. It ends with a brief discussion of future research that needs to be done in this area and lessons for policy and action.

A growing body of research documents numerous factors that contribute to women's under-representation in the top tiers of technical and scientific fields. This literature describes the ways in which biases against women, particularly those that are more subtle and implicit, can translate into lower salaries, slower rates of promotion, and less recognition through honors and awards for women relative to their male colleagues (1–3). In 1999 a small group of senior women chemistry faculty from around the United States began meeting to discuss their concerns that women in their field were not experiencing the same career opportunities and advancement patterns as men. With seed funding from the Camille and Henry Dreyfus Foundation, they formed an organization called COACH, the Committee on the Advancement of Women Chemists.

Over the last decade COACH has sponsored numerous career-oriented workshops for academic women chemists and has been instrumental in developing workshops for department heads. One aspect of this work is encouraging mentorship relationships for and by women, an area recognized by the COACH founders as important for career advancement. Mentoring, or, more specifically, the lack thereof, is considered an important factor for why women are underrepresented in academic science and engineering departments (4). A recent review of the literature on mentoring in academic medicine found that having a mentor was associated with greater research productivity and higher likelihood of receipt of federal grants, as well as higher job satisfaction and confidence (5).

This paper uses data gathered by COACH to examine women chemists' mentorship experiences and then discusses ways that COACH has promoted mentoring and the apparent results of these efforts. We end with a brief discussion of future research that needs to be done in this area and lessons for policy and action.

The Mentorship Process

Before attending COACH sponsored workshops, which have been held in conjunction with national professional meetings since 2001, the women participants completed surveys that included questions about their mentorship experiences. In addition, a sub-sample participated in in-depth interviews, lasting up to one hour, regarding their careers. For this paper, we examined data from 255 surveys and 47 interviews. The data were gathered over a span of several years and represent women chemists at various stages of their careers. Thus, they provide information of a broad cross-section of women in the field. The sections below examine who their mentors were and the type of help they received, how mentorship roles sometimes changed over the course of a career, women's experiences with formal mentorship programs, views about why mentoring does not happen more often, and examples of individuals and departments that have had successful mentoring experiences.

Who Mentors?

Slightly more than a third of the women (38%) reported having a mentor during their education and professional training, and somewhat more (44%) reported having a mentor during the first 10 years of their career. As would be expected, mentors almost always held positions that were more senior than the women and had more experience in the field. (Exceptions were those who reported help from a spouse or graduate student and/or post-doctoral colleagues who were just a few years senior.)

A large proportion of the women who had mentors during their training mentioned the influence of their teachers from middle-school teachers who interested them in science to undergraduate instructors, to those with whom they worked in graduate and post-doctoral programs:

“When I was in high school, I think my high school teacher was really, really good...he was an inspiration and that was the most important role that he played.”

“My high school chemistry teacher was very supportive and he really wanted me to get my degree in chemistry. He was very encouraging....I still correspond with him...At [undergraduate school] there was a woman faculty member ... [who] took a liking to me and she was very encouraging...The other faculty ...were [also] incredibly wonderful and mentoring.”

“My undergraduate research advisor was very, very encouraging...My post-doc advisors were good. My PhD advisor and I would talk about all sorts of things, career-related.”

Mentors to women early in their academic careers were often senior colleagues. Several women mentioned their department chairs and, occasionally, division deans as providing support and advice. Senior colleagues mentioned were often chemists, but mentorships also crossed disciplines. In general, respondents indicated that the people who were most likely to provide help were those who were most comfortable in their own careers. As one person put it,

“I have found that people who are very senior and very accomplished, who are basically secure with themselves, help the younger ones. Those people are great.”

Although the women chemists reported having both male and female mentors and we do not have exact counts by gender, the representation of women as mentors appeared to be larger than their representation in the field as a whole. In other words, women reported often looking for other women to serve as a mentor. In addition, women of color sometimes reported choosing mentors that spanned both gender and race/ethnicity. For some, the racial/ethnic similarity was especially important. An Asian-American woman described:

“I think one of the good things about being in both ethnic and gender minorities in this field is that I can draw from both. They have similarities. I find both the Asian and the women’s community are very helpful because they realize the issues facing me.”

Similarly, an African American woman noted,

“I have interacted with the black faculty in the college of [...], all men, and we just connect and click, spiritually and just fundamentally we’re all kind of on the same page....They respect me.”

What Do Mentors Do?

In responses to open-ended questions on the surveys and lengthy descriptions in the personal interviews, the women described how mentors had helped their careers. Most often mentioned was the way in which mentors provided career advice, from assistance in choosing research topics and graduate schools, to feedback on research proposals and writing, to advice on where to apply for jobs and strategies to use in the job search. For example,

“They reviewed papers and proposals, gave me advice for different types of decisions, encouraged me to stick my neck out and take some chances.”

“She helped me through the application process....She gave me tips on interviewing and negotiating.”

“Although he was in a very different field, he [my mentor] would read grants and I would talk to him about how to run my group and how my research was going. My group held joint group meetings with his group regularly and he would serve on my students’ committees.”

“[A senior faculty member and I] taught different sections of the same course and he initially provided the syllabus, set up all the demos, and let me come to his class to observe.”

A number of women also described how, in addition to providing specific advice, their mentors went out of their way to promote their careers. This involved actions as diverse as introductions to prominent researchers in their area, invitations to speak at professional meetings, talking about their work to funders and others who could promote their career, and nominating the women for awards. For example,

“He put forth my name for editing journal articles, grant reviewing, and conference organizing. He encourages me to publish and write grants and connected me to funding opportunities and collaborations.”

“One...knew my NSF program chair personally, and got me to call up my program chair and introduce myself and get some general grant-writing advice that was very useful....My thesis advisor also acted as a mentor after I started my faculty position, by inviting me to speak at a National ACS meeting very early in my career.”

Finally, several of the women mentioned how mentors provided emotional support and encouragement. They helped build their confidence, they provided advice in times of stress and conflict, and they served as “cheerleaders” as career transitions were made. They also made social overtures that promoted feelings of belonging and inclusion. For example,

“He taught me not only the research stuff, but also to value myself as a strong individual with meaningful contributions to make.”

“They often provided assistance with networking and dealing with political situations both within the department and institution.”

“She made sure that I got whatever information I needed, made sure that I joined her group for lunch, [and] did all the right stuff.”

A woman who dealt with issues related to both gender and race-ethnicity reported how her mentor helped her deal with discrimination based on both characteristics:

“He made me become aware of how to deal with people, how to be more vocal, how to talk to people, and so on and so forth, and kind of coached me...I really appreciate him. He really spent time with graduate students, so I’ve been very lucky.”

Changing Mentor/Mentee Roles during a Career

Several women reported changes in the role of the mentor as their careers progressed. Women who were more senior reported seeking out people at their own career stage for advice and counsel, often in other fields. However, several of those at more advanced stages of their careers noted the difficulty of finding someone who felt comfortable working with them at that stage and even that a once productive and rewarding mentor-mentee relationship had soured due to professional conflicts and other issues. For example,

“He changed his mind [about mentoring me] last year and decided that I was intimidating and has stopped mentoring me.”

“He decided that I was intimidating to the staff and stopped mentoring me and chooses instead to block my advancement and full participation in the department...I believe that they are intimidated because I am a smart, confident, capable woman, and they don’t want to be led by me. The trouble started when I assumed a leadership position that involved staff reporting to me.”

“My chair kind of protected me and respected me, as long as I did stuff for him. Later on, when I wanted to challenge him, he didn’t like it.”

On the other hand, some of the interviewees reported long-lasting relationships that matured and grew, remaining helpful and highly regarded for many years.

“My boss and another colleague in my Department have been excellent mentors. They have been wonderful role models who have created endless valuable professional opportunities for me. They have included me in projects, sent opportunities my way, nominated me for awards, given advice, reviewed my work, given excellent feedback...everything one would expect from a mentor. They have made a significant impact on my career, and as a result of working with them I believe I have been probably 4 times more productive than I would have without their guidance and leadership.”

“I have continued to stay in touch with my PhD advisor and also my other colleagues along the way to talk about the ups and downs of jobs, applications, etc.”

“My former research advisor continues to be a wonderful mentor. While many of the things he did for me in early years are no longer necessary, he still helps with things like award nominations and his words of admiration and approval still make me feel great.”

Formal Mentorship Programs

Some respondents reported that their departments had official or organized mentorship programs. Occasionally the respondents reported that the officially appointed mentor was helpful. For example, one noted that

“[my] assigned mentor from the department...stood up for me during hard times [and] listened...[This was] very important to me because the tenured women and some of the “older male” faculty in my department were not so supportive.”

Several others, however, noted difficulties with the mentor that had been assigned to them and that the people who ended up being most helpful to them were often not those who had been officially designated as mentors. Because the impact of formal mentoring programs was not an explicit focus of the interviews or survey questions, these examples are especially telling.

“I was assigned to work with someone who had no interest and wasn’t willing to take the time to mentor.”

“The mentors assigned to me by my department did not wish to be mentors.”

“[I] enrolled in a mentor program at my university for new faculty, but my assigned mentor had a very busy year and ended up backing out of the program”

“I had one [a mentor] “assigned” by the Dean, but this was useless. I developed an external female mentor in another department...This current mentor helps identify potential awards, answers questions about career planning (which committees to serve on and which not to, etc.) She has also been active in helping to bring the issue of lack of women to the Dean’s attention.”

“A mentor was formally assigned by the department. But I don’t trust him. He has already tried to manipulate me at least twice. Actually the first time that I talked to him after I was hired, he told me that he had argued against hiring me, though I will occasionally ask him for advice.”

“I didn’t find [the formal mentoring committee system] very useful because one of the people that I sort of had a conflict with ... was my main mentor.”

“All that [my formal mentor has] done basically is told me that I need to get external funding, and that that’s what I need to focus on, writing big grants rather than small grants....he’s even being paid to be my mentor, and...I don’t feel like he’s put any time into that....they actually have these formal guidelines...for how it’s supposed to be done, and he didn’t really have any interest because it’s just too time consuming.”

“When I went to ... they teamed us all up with mentors, and we met each other for a few times. My mentor was a very nice man but he just didn’t have time after we had all been assigned. It just didn’t work out...You have to find out who’s interested in what type of research so you can find out whom you can collaborate with quickly.”

Why Does Mentoring Not Happen?

Recall that over half of the women surveyed by COACH did not have mentors during their educational training and early careers. Some of these women reflected upon why they did not have mentors. Some of their responses involved their own actions, such as not knowing how a mentor might help and/or not knowing how to approach others for help. For example,

“I did not know [I] needed one and none were available.”

“I did not understand the system, was unaware of mentoring.”

“No one ever suggested I should have a mentor.”

“I am currently in my fourth year as an assistant professor and I have had no mentors thus far. I was the first female faculty member hired in my department in a new research area. Therefore, I did not have many opportunities to interact with other faculty, unless initiated by me. I often feel awkward asking questions that might make me look “stupid,” and therefore I often feel isolated in my department.”

Others (and occasionally the same respondents) noted that mentorship of young faculty did not seem to be a priority at their institution and/or that more senior faculty members were not interested in pursuing this role. For example,

“It was difficult [after becoming a faculty member] to find a formal mentor who had time or who was genuinely interested in investing in you. I have an official mentor from the university who I would contact when I had questions or needed feedback. I would be the person to initiate this since this person was also the mentor for several other people in the department and he was also a very busy person....The natural

mentor in my field did not seem interested and would often say that they did not have time to meet with me.”

“[There were] no women in senior positions and no men who seemed willing to help.”

“There was no one willing to dedicate the time to mentoring during my early tenure track years.”

“There is no requirement to have a mentor to assist junior faculty in the career development in our college.”

“There was no mechanism for having a mentor [in my department].”

Making Mentoring Happen

Finally, however, the surveys and interviews provided insight into how mentoring can be promoted and developed. In part, this involves individuals seeking out mentoring opportunities. One person described her experiences,

“...Starting in 1984, I've gone to every single ACS meeting. There are a lot of people who do that, but there are also a lot of people who don't do that. I did with the express purpose to really get to know people. And have them get to know me. I presented a lot. I went to theconferences and was generally very impressed how easy it was to get to know people, to talk to them and sort of talk myself up. That was a little difficult....”

Others described how their departmental culture and climate made mentoring an integral part of the organization's day-to-day life and norms of collegiality.

“Even though there was no assigned mentor to me in the department at [...], I think the environment mentored me and everybody else in terms of group development, the whole package.”

“Our department is really good at making sure that there are collaborations. Like the senior faculty would be like I want you to help me with this grant.. And we still do that when someone is new there, we try to get them started [on] something that is collaborative. So, [there are] not true mentors I would say, but when someone is new we try to get them started with collaborating.”

In short, these examples illustrate how some women have promoted their own mentoring activities and how departments can develop cultures and practices that support and mentor all faculty members. The activities of COACH have incorporated these themes, and we now turn to a description of these activities and a discussion of their outcomes.

How COACH Promotes Mentoring

COACH has used two different routes to alter the culture of mentoring in Chemistry. One focuses on women chemists and the other focuses on departmental cultures and leadership.

COACH's professional development workshops for women faculty have been held at national professional meetings and at individual institutions. Workshops have sometimes focused on participants at different points in their careers, such as post-doctoral fellows, assistant professors, or more senior faculty; and on participants with multiple concerns and possibilities of bias, such as women who are racial-ethnic minorities. Since 2001, over 400 women chemistry faculty members have attended these COACH developed workshops at national professional meetings. It is estimated that over one third of the women faculty who hold tenure track positions at the top 100 chemistry departments in the country have undergone COACH training at the national meetings or at their home institutions.

The workshops have two general aims: first, they are designed to help women develop skills to facilitate their career progress. Experts are employed to provide training in areas as varied as communication tactics, negotiation skills, and leadership strategies. Second, they are designed to provide a venue for participants to network with other successful women chemists. By bringing women together from around the country in an atmosphere that is professional, but removed from immediate work obligations and roles, they promote the development of network ties and establishing new relationships. They explicitly seek to broaden women's networks by hosting social events after the workshops.

Evaluations of the workshops, both immediately after the events and up to several years after their occurrence indicate that participants believe that the trainings have contributed significantly to their career progress and their professional well-being. The results also indicate that the workshops motivated the women to help others within their profession. For instance, in response to a survey sent to COACH attendees several years after their first participation, two thirds of the women said that the skills they had learned through COACH had helped them develop supportive networks, either quite a lot (22%) or a fair amount (45%). Only six percent of the women said the skills had not helped them in this area. Almost as many women (60%) said that the skills acquired through COACH had helped them mentor others.

The data also suggest changes over time in the percentage of women reporting that they have received mentoring. Women who have attended COACH workshops in recent years and those who received their PhDs more recently have been significantly more likely than other women to report mentoring both during their education and the early stages of their careers (6).

Changing Department Climates

COACH has also focused on academic leaders within chemistry and, in 2006, helped conduct a workshop entitled "Building Strong Academic Chemistry Departments through Gender Equity." The workshop was sponsored by three

federal agencies that provide the vast majority of research funding to chemists in academic Department heads from the departments that receive the most federal research and development money and/or produce the largest number of PhD students were invited to attend. The workshop was designed to develop awareness of the problem of women's under-representation in academic chemistry, to motivate leaders in the field to work for change, to develop concrete steps to address the inequities, and to obtain commitment from participants to promote changes in their home departments. As with other COACH activities, the efficacy of this workshop was evaluated. Attendees were required to complete a questionnaire that examined their attitudes and perceptions regarding women's representation in chemistry both before attending the workshop and after returning to their home institutions. In the months after the workshop the chairs were also charged with reporting on specific actions they had taken with regard to gender equity on a password protected website open to other department chairs.

Analyses of these data indicated that the heads who attended the workshops became more aware of how the lack of mentoring can impact women's career progress and committed to changing their departments' culture and ways in which it supports young faculty. For instance, before the workshop, half of the attendees believed that few available mentors was either "not an issue" or "not important" in affecting women's career progress. After attending the workshop, however, only a quarter of the participants held these views, a change that was highly statistically significant. The chairs' reports of the action items to which they committed after attending the workshop also indicated a strong focus on mentoring. Of the 45 heads who listed goals and action items on the group's website, over half (26) indicated activities that would assist career development, such as a mentoring program. (See Stockard et al, 2008 (7) for a full report on the workshop.)

Looking to the Future

There are, of course, limitations to the data reported above. For instance, even though the women in our sample represent a relatively large proportion of those in the discipline, we have no way of knowing how representative they are of the total group. In addition, we do not have comparable data on men or on people in other disciplines. Finally, we are not able to provide controls that can help indicate the extent to which the results we found are attributed to the interventions of COACH or to other changes within the discipline or academic enterprises as a whole. Thus, future research in this area is necessary.

That said, we believe that the results summarized here provide important insights that can guide those concerned with promoting successful careers for all scientists and especially those, such as women and members of other under-represented groups, who have historically faced bias and discrimination. First, our results indicate that mentors are important. Most of the respondents believed that their mentors provided important career assistance. Second, only a minority of the women in our sample reported having mentors during their education and professional training or the first ten years of their career. Thus, there may well be an unmet need for mentoring help. Third, the results suggest that mentoring

may have become more common in recent years, perhaps resulting from women seeking out and providing more mentoring support as well as department heads becoming more aware of this need. The evidence associated with the evaluations of COACH sponsored workshops suggest that these efforts may have contributed to these changes. Fourth, official mentoring programs are not always effective and it appears that care must be taken to ensure that mentors and mentees are well matched and that mentors are committed to their roles. Even more important may be developing departmental and discipline-wide cultures that are supportive and mentoring to all young scholars, no matter what their background may be.

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Chapter 13

Enhancing Your Professional Presence

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Leadership roles in science departments have traditionally been occupied by male faculty members, and unwritten measures of performance may limit the professional influence of women not privy to a support network. This paper addresses some of the factors that impact how women are perceived in an academic setting and presents some strategies for enhancing one's professional presence.

Establish Your Professional Presence

Back in high school, I was a state finalist in a public speaking competition. After I finished second by one point, a woman from the audience approached me and identified herself as a speechwriter for our senior senator. She told me that I would have won the competition if I had been wearing a skirt instead of pants. This was my first lesson that you may be judged by more than what you say and how you say it. From that moment on, I paid more attention to my appearance, especially when the stakes were relatively high.

For most women scientists, the term "professional presence" may seem more relevant to those in business than in academia. Indeed, the rules that govern professional appearance appear to differ for women in academia relative to other workplaces, where makeup use is often associated with success (*1*). However, as academic women, we are constantly being judged by our students, colleagues, administrators, and peer reviewers, who often use criteria unrelated to our knowledge or accomplishments. Simply being aware of some of the factors by which we are evaluated can be helpful to make adjustments to enhance our professional presence.

First Impressions Matter

A familiar saying is that you never get a second chance to make a first impression. An important opportunity to make a good impression is the first day of class, when students often make quick judgments about an instructor's competence (2). One study that surveyed college students after the first class found that their initial assessments were based primarily on "communicative competence", including the instructor's overall speaking ability, verbal and nonverbal communication skills, ability to adapt material to the students' knowledge level, level of clarity, organizational skills, and ability to generate interest (3). As professors, we would certainly expect students to value these traits. However, perhaps more surprisingly, another study found that 10-second silent video clips are good predictors of end-of-semester evaluations (4). Teaching evaluations were found to correlate both positively and negatively with many types of nonverbal behavior (Table I). Physical attractiveness was also found to influence student ratings somewhat (4). Other studies have also found that factors not directly related to learning may influence student ratings, including warmth and friendliness, particularly for female faculty (5).

Effective Nonverbal Communication

"Act out being alive, like a play. And after a while, a long while, it will be true."

-John Steinbeck, *East of Eden*

Many of us are largely unaware of the subtle signals communicated by our body language and other nonverbal cues. However, simply acting more optimistic or enthusiastic can influence others to perceive you that way. In a dramatic illustration of the power of nonverbal communication, a psychology professor at Cornell attempted to teach the identical course in the fall and spring semesters, with one exception (6). The second time, he adopted a more "enthusiastic" style, varying his vocal pitch and using more hand gestures. Rather to his surprise, student ratings of his course improved significantly, with higher scores in the spring semester for his level of knowledge, organization, accessibility, fairness, and even the quality of the textbook, which was the same. Students also reported increased learning, although test performances and final grades were virtually identical in both courses.

In addition to being enthusiastic, your nonverbal communication can be enhanced by making good eye contact, having good posture, and displaying energy and confidence (7). A positive, can-do attitude will also reflect positively on you: remember that nobody likes a complainer! Indeed, perceived optimism had the highest correlation with college teacher effectiveness ratings (4).

A professor's classroom attire can also influence student perceptions. Faculty members who dress formally are generally perceived as being more organized, knowledgeable, and competent, whereas those who dress casually are viewed as friendlier, more approachable, and more willing to listen to student opinions (8-10). It would seem strategic for younger female professors to dress "professionally" in order to increase their perceived competence, particularly

in male-dominated fields such as the sciences. On the other hand, older female professors who are found unapproachable might try more casual attire if their competence is no longer in question. Even though academics have a reputation for dressing poorly relative to other professionals (11), it may be worth the effort to spruce up your personal appearance and convey a more professional look (see (12) and (13) for some excellent tips). For example, every professional woman's wardrobe should include a tailored black suit and plain black pumps (13). Again, academics are not generally held to as high standards for good fashion: although the highest-paid female executives frequently wear the highest heels, female academic rarely wear high heels (11), particularly not in a laboratory setting.

A largely neglected arena through which professors make an impression is their office doors. One study focused on the occupational identities displayed through academic door displays, finding relationships between these expressions of self and social status (14). Hallway bulletin boards are also an important venue to influence how an individual, a department, or a program is perceived. Particularly for high-traffic areas, these displays can influence whether a prospective student chooses to attend an institution, selects a major program of study, or elects to work in a particular research laboratory. Look critically at such displays in your hallways to determine if they are consistent with the mission of your laboratory, department, or program. Do they reflect the identity by which you wish others to perceive you?

Self Promotion

As observed by Peggy Klaus (15), "Promoting ourselves is something we are not taught to do. Even today, we still tell children 'Don't talk about yourself, people won't like you.' So ingrained are the myths about self-promotion, so repelled are we by obnoxious braggers, many people simply avoid talking about themselves." Instead, many of us believe that we will receive recognition for the good work that we do. Sometimes this is true, and certainly one of the positive actions we can take for a colleague is to tell the world about her latest accomplishment. However, we can't simply assume that our work will always speak for itself, and sometimes it is necessary to let the chair or the dean know about the acceptance of a major paper, the funding of a grant proposal, or an invitation to speak at a conference. Men are often better than women at self-promotion (15). A former chair of my department told me that he was surprised to learn from my annual report that I had more papers than one of my male contemporaries. My colleague had promoted his own work so effectively that everyone assumed that he had published far more than he actually had.

Part of getting the word out about your accomplishments can be through a network. For example, some of the women on my campus recently initiated a program called *Women in the Spotlight*, a monthly celebration of the accomplishments of women at our institution (16). In addition to raising the public profile of the women on campus, the organizers also hoped to foster dialogue and excitement about women's contributions to intellectual life and community. Venues such as these are an important first step in spreading the word about the work that women faculty are doing.

Table I. Examples of nonverbal behavior that correlate with good teaching evaluations (4)

<i>Behaviors with positive correlation</i>	<i>Behaviors with negative correlation</i>
Projecting optimism	Frowning
Projecting confidence	Fidgeting
Projecting enthusiasm	Sitting

Establishing contacts in the media can also help you to become known in the larger community. Alert them to significant accomplishments that might be of interest to their readers. Since you never know when you will meet someone influential, be prepared with an “elevator speech” that sums up your work in clear and concise language. The general idea behind an “elevator speech” is that you should be able to promote yourself to someone you encounter during an average elevator ride (about a minute in length). You might want to prepare two versions of your speech, one for the layperson and another for someone with prior knowledge of your field.

Also try to develop your network of contacts at professional meetings. Individuals working in similar fields can be excellent reviewers of your work, and if they have a positive image of you from a brief encounter, then so much the better! Although business cards may not be as popular in academia as in other professions, your card contributes to the first impression you make. It should be up-to-date, and you should always have a supply with you.

Maintain a Strong Virtual Presence

In these times of electronic networking, many first impressions are made in the absence of face-to-face interactions. As an example, a female colleague at a liberal arts college received an email from a graduate student requesting that she send him a plasmid created in her laboratory for use in a particular experiment. She responded that she had intended to do a similar experiment herself but would be amenable to collaboration. Shortly thereafter, she received an email from the major professor, who had unintentionally included her in his response to his graduate student. The professor had checked out my colleague’s laboratory webpage and said, “She’s good. Let’s play ball.” The time she had invested in her laboratory webpage paid off.

Web Presence

Make sure that you not only have a webpage, but also that it enhances your professional presence. If someone runs your name through his or her search engine, what pops up? The information on your webpage should be no more than a year old, so make sure that you set aside time each year to update your recent accomplishments. The summer is an excellent time to do this. Additionally, if you have a Facebook page, be prudent about what kind of information you post,

keeping in mind the worldwide presence of such social networking sites. You never know who might take a look at your page.

Telephone Presence

Always keep in mind that your first impression could also be made over the telephone. Evaluate before you answer the phone; if you don't really have time to talk, then let it go to voicemail rather than being short with the person calling. Telephones with caller identification are becoming more common and are useful for screening your calls. (Do you really have the energy to talk to the parent who has already called you several times about her son who is failing your course?) If you have important business to discuss over the telephone, make an appointment so that you won't be rushed. Put a sign on your door saying "important phone call in progress" to avoid being disturbed.

While hiring student workers, a colleague once called the next person on her list, only to reach a voice mail greeting filled with profanity. Instead of offering the student a job, she left a message saying that she had crossed him off the list of possible student workers. Clearly, faculty members will not have such offensive greetings, but we should keep our outgoing messages professional, short, and friendly. If you will be out of the office and not checking messages daily, you should update your greeting to reflect that. However, make sure that you promptly change your greeting when you return, or you will lose credibility.

When you leave voicemail messages for other people, keep them short and to the point. Briefly identify yourself, give your contact information, and state the purpose of your call so that there is incentive to get back to you. Never leave a harsh voice mail message; you may regret it later.

Email presence

Every email that we send makes an impression on the receiver (7). With the rise in the popularity of electronic communication methods such as text messaging and tweeting has arrived the emergence of a new language of abbreviations that may soon hamper our ability to communicate with our students. However, faculty who are up to date with chat abbreviations should avoid using them in professional contexts. Construct your email messages similarly to written notes, using complete sentences, correct spelling, and proper punctuation.

People often write things in an email that they wouldn't normally say face-to-face, a phenomenon known as the "online disinhibition effect" (17). Be careful of any email that you send, always remembering that your message could be forwarded, even to the person you just spent a paragraph complaining about. Never send an email when you are angry, and, like any written document, proofread before sending. Give your email a brief but informative subject heading that will compel the recipient to actually read it.

Be sure that you are actually sending the email to the person that you think you are. Most of us have had at least one embarrassing incident when we sent an email to the wrong person. "Reply all" can be a dangerous tool. Also keep in mind that copying the dean is a power play that suggests a lack of trust and may annoy the

person with whom you are corresponding, unless your email is a positive one (7). Copying the dean can also be a useful move when you feel that you must go over someone's head in order to get the desired outcome. If you are sending a warning or disciplinary email to a student, make sure that you copy the chair, the student's advisor, and yourself so that you have a written record of the correspondence.

Finally, make sure that you check your email regularly and respond in a timely fashion. People who don't respond to emails are often perceived as unprofessional and unreliable. As with your voicemail greeting, if you will be unavailable for more than a few days, set up an autoreply message stating when you expect to be able to respond.

Demonstrate Good Leadership Skills

Once you are tenured, you can expect your service load to increase, even though it has probably already been higher than that of your average male colleague (18). The nature of your service will also change, with increased roles in leadership. Indeed, opportunities for leadership may be more common for women scientists at liberal arts colleges than at research universities. In 2002, women held only 4.6% (26 of 566) of the department chair positions at R1 university math and physical science departments (19). However, at a recent conference of senior women scientists at liberal arts colleges, virtually every woman had served as chair of her department (20). Women tend to be different types of leaders than men, often working towards a consensus rather than using their authority to make unilateral decisions (21). Women also tend to be less confrontational, preferring to respond with written comments and criticisms rather than with face-to-face conflict resolutions. Furthermore, female chairs may be perceived as more approachable by those seeking to secure job benefits for themselves (22). Serving as chair can lead to increased influence in one's institution, particularly for women, who often have less power in academic departments than men (23). Senior women scientists generally have the skills needed for leadership, having survived a highly competitive, male-dominated system (22). However, because of fewer opportunities for networking, they may be less confident in leadership positions.

Manage Effective Meetings

One of the first skills to develop in a leadership position is the ability to run an effective meeting. First of all, consider whether there is actually a need to meet. Just because your department has always had weekly meetings doesn't mean that you actually need to meet that frequently. Perhaps every other week or even once a month is sufficient. Decide on the meeting frequency before the start of each semester so that everyone can put the meetings on their calendar and minimize conflicts. A few days before a meeting, send an email agenda to all participants, giving them an opportunity to add any new business. This email also serves as a reminder about the meeting.

Model conduct that you expect from your colleagues. For example, make sure that you both arrive on time and start on time. Setting clear goals and focusing on achieving them facilitate ending the meeting on time. Circulate necessary materials before the meeting, and make it clear that everyone is expected to review this information before the meeting. Be prepared to ask your colleagues to share responsibility: just because you are chair doesn't mean that you have to do all the work. Keeping a written record of department jobs and who holds them can be useful in identifying those who have lighter loads and could therefore take on new tasks. At the end of meetings, review actions to be taken and the person who will take responsibility for implementation.

Beware of spontaneous hallway meetings, which may be expedient but could lead to disenfranchisement for department members who feel like their voices were not heard. However, speaking informally with key department members about issues ahead of time can be strategic to build consensus on important issues.

Engage in the Workplace

Part of good leadership is being positive about the department and institution you represent. If you show team spirit, then others will want to join the team. When you meet with prospective students and job applicants, be enthusiastic, rather than on dwelling on any negative aspects. On any team, the success of an individual reflects positively on the group, so give credit where credit is due. Post the accomplishments of faculty members and students on the department webpages and/or bulletin boards. This will encourage others to do something worthy enough to be mentioned themselves.

Even though balancing an academic position and a personal life can be challenging (18), you should make an effort to participate in departmental social events when possible, including parties, outings, and retreats. Your presence may be of higher value when students are involved. Participating in college functions such as dinners with the trustees and administration may also raise your institutional profile, and thus increase your influence.

Lead by example, showing your students that you are actively engaged in teaching, scholarship, and service so that they see the value in these activities. Try not to hide your personal responsibilities and life choices; for example, bring family members to work-related social functions. A more family-friendly workplace climate can be created through the actions of those who explicitly acknowledge their own family commitments and/or provide support for the personal lives of their colleagues (24).

Engage in the Community

Take the opportunity to contribute to the community in your own special way by volunteering to give talks in your area of specialty or serve in leadership roles. For example, one of my colleagues serves as a HazMat officer for the local fire department, where his skills as a chemist make him highly valued. Many organizations would be happy to have help from a successful woman scientist with an abundance of valuable skills.

Conclusions

As the number of senior women scientists at liberal arts colleges increases, we can expect more females in leadership positions. Being aware of factors that influence how others perceive us can help maximize our impact, both on our own campuses and in the larger community. Attention to professional development can enhance one's visibility, productivity, and leadership, in turn enhancing job satisfaction (25). Women scientists in leadership roles can also promote practices that result in more female-friendly departments, leading to a more rewarding work environment for all (24, 26).

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