Broader Impacts in the Broadest Sense

Luncheon Keynote at the USUCGER Early Career Development Workshop
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Professor Priscilla P. Nelson
Department of Civil and Environmental Engineering
New Jersey Institute of Technology
Newark, NJ 07102
pnelson@njit.edu
Organization

• Broader Impacts and NSF
• Research Group Culture and Climate
• Interdisciplinary Research
• Diversity and Career Development

I will try to provide
  – Information for grant aspirants and career development
  – Thoughts pertinent to mentoring young faculty
  – A few comments for NSF to take (or leave)
Broader impacts and NSF

• Very little detail of proposed activities is included in NSF abstracts or on the web sites of many grantees
• What is there seems highly conventional

  • teaching cases, case studies
  • virtual plant tours
  • new courses
  • team teaching
  • continuing education tutorial for industry practitioners
  • user-friendly tools and tutorials
  • design methodologies and modules
  • UG and K-12 research involvement
  • service learning projects

  • real-life problems and challenges for the class room
  • hands-on problem exploration and solving
  • research seminar to provide an informal forum for students
  • teachers' (grades 9-12) workshops and summer camps
  • science summer camp for students
  • web site
  • publishing and presenting
Broader impacts and NSF

• Relevance is usually included, esp. with reference to the NAE listing of grand challenges, e.g.
  – Globalization
  – Environment
  – Climate Change
  – Health – demographics and QOL
  – Extreme Events (XE) and damage reduction
  – Code development
  – Safety
  – Reduced costs of CE projects
  – Sustainability
Broader impacts and NSF

- Few NSF Abstracts include reference to international activities (e.g., research collaboration, exchange programs)
- Some have reference but little detail on the following - just that it will be done – but how are these efforts assessed by NSF?
  - Connections with alumni and practitioners, stakeholders (including owners and the public)
  - Connections across Broader Impacts components of proposals
  - Student retention activities
  - Recruitment of students from traditionally underrepresented groups (just that it will be done – how assessed by NSF?)
  - Connections with programs on campus (e.g., minority programs, women engineering programs, EOP, etc.)
  - Building network of relationships between minority and majority institutions
Broader impacts and NSF

• Little reference to several areas
  – Use of social networking and other new technology (although there was one proposal that included making Jumbotron video presentations describing engineering concepts in the language of football to be shown during University of Florida home football games)
  – Development activities to create excellent research groups for graduate students, UGs, K-12, etc.
  – Field research experiences
  – Partnering with a science or children's museum (might actually be institutionalized)
  – Working with non-engineering students on campus
Broader impacts and NSF

Ideas:

• Establish (and maintain) a web portal to provide access to broader impacts products – for grantees and everyone else (and advertize it)
  – K-12 and college teaching resources
  – Practitioner professional development and continuing education

• Centralized reporting to exchange information – what activities worked well and what was more difficult than anticipated, make virtual peer mentoring possible

• Mandated assessment and analysis by NSF of the success of different diversity recruitment and collaboration (on campus and across campuses) strategies
Broader impacts and NSF

Ideas:

• Use grant resources entrepreneurially to leverage partnerships with industry, establishing connections that may become long-term

• Focus and reporting on development of research advising skills and quality of research environment for graduate students and research teams

• Go beyond conventional thinking – developing entrepreneurial opportunities, new ideas – e.g.
  – Engineering Better Readers and students writing kids books based on research experiences
  – Multidisciplinary design studio - organizational framework to bring together students from civil engineering with other disciplines to pursue innovation and invention
Research Group Culture

Culture:

• A set of values and assumptions (sometimes hidden) that underlie the statement: this is how we do things around here.

• Tells people in the group what is truly important and how they are to act.

• People in a group commit their energy only to what they believe in, what captures their enthusiasm and imagination. The culture needs to reflect this.
Research Group Culture

Group Values:

- Internalized attitudes about what is right and wrong, ethical and unethical, moral and immoral.
- Are things individuals hold true and dear, but are rarely talked about.

- Fairness
- Respect
- Justice
- Progress
- Honesty
- Self-fulfillment
- Cooperation

- Freedom
- Excellence
- Equality
- Pragmatism
- Humanitarianism
- Courtesy
- Loyalty
Research Group Culture

The Importance of Values

• Values can influence preferences and aspirations, perception of situations and problems, and choice of behavior in a particular situation.
  – In many instances, what matters is how people see the world, and everyone sees it a little differently.
• Values and beliefs form the basic organizational character of a group.
• Through shared values and beliefs, members of the faculty develop a sense of direction that guides their students and research
Research Group Climate

- You are in charge of your research group
  - Set the right values and reinforce
  - Support research group models that foster collaboration
  - Connect across sectors with leaders in government, business
  - Promote citizen scholars
  - Incorporate entrepreneurship and risk-taking
  - Connect with other innovative programs
  - Provide exposure to roles beyond the professoriate
Research Group Climate

• Treat research as a learning environment
• Treat your research group as a cohort, do not create the possibility for student isolation
• Treat research groups as a small learning communities
  – Individual responsibility for self-awareness in learning
  – Discuss teaming and commitments
  – Encourage leadership and mentoring
Research Group Climate

• Build your own skills – learn how to be a great research advisor, and ask for feedback from your students on how you are doing
  – Explain expectations for students to be self-managing
• Discuss what a healthy research environment is, bring increased awareness of issues, and promise prompt action.
  – Keep your personal interactions, classroom experiences and lab/graduate research activities free from harassing and discriminatory behaviors.
  – Talk about discrimination and diversity with your students, and indicate your expectations for their behavior. Everyone should be committed to understanding, preventing, responding and reporting harassment and discrimination.
  – Be determined to investigate and address any allegations of misconduct that might occur.
Research Group Climate

• Build a positive multicultural environment – work at having meaningful relationships across cultures; students need to negotiate a multicultural world to be successful in the global economy
  – Be welcoming environment of respect and courtesy for all members of our campus community.
  – Make sure your students know that you want all students develop cross-cultural competencies while learning in a respectful, inclusive climate.
  – Be aware of ethics issues in multicultural research groups and international collaborations – supervisors need to provide students with adequate guidance on issues of research integrity.

• Address the individuals
  – Be personally encouraging - make eye contact with students, smile or nod during a conversation.
  – Find out about different cultural norms - give students and colleagues a chance to tell their cultural stories.
  – Don’t perpetuate stereotypes.
  – Don’t treat different students differently – but figure out how to reward highly successful students and foster those having difficulties.
Faculty advisers play the crucial role

- What constitutes excellent graduate training?
- How well is the Graduate School succeeding at serving its students?
- How do our students experience graduate school?
- What factors help them succeed in their studies and prepare them for careers?
- How might the university improve the climate for its graduate students?
From Texas

% of Engineering students who say the job is “very attractive”

- Research University Professor: 41%
- Teaching University Professor: 29%
- University Researcher: 21%
- Industry Researcher: 63%
- Administration: 18%
- Politician: 8%
From Texas

Strategic qualities of primary advisors per students

- Need to have a positive, productive relationship
- Has a reputation for getting students through the program quickly
- Available when students needed help
- Can write a good letter of recommendation
- Teaches survival skills for the field (build a professional network, secure funding, develop professional presentations)
- Advises about departmental politics
- Advocates for students with others when necessary
- Provides regular and constructive feedback – annual review of progress for each student with useful and honest information
But too often the negative happens

- Many students believe they are exploited as a source of labor for faculty (22% for Engineering at UTAustin, highest among all colleges)
- Department faculty pay a disproportionate amount of attention and resources to a select group of students (33% at UTAustin)
- Unwritten rules exist (reported by one-third of students)
- Students experience an impact from tensions among faculty in their departments (50% of students reporting)
- Compared to men, the experience of women is often different (more acute for PhD students). Women:
  - were less likely than men to be funded, regardless of their fields of study
  - experienced more stress
  - reported less time for themselves
  - experienced enduring climate of disrespect for academic mothers
  - believed they had had more limited career options in relation to those of their partners
From Texas

• About 30% of students reported at least one type of experience of discrimination.
  – 6% for age
  – 21% for gender (including unwanted sexual attention)
  – 19% for race
  – 17% for nationality
  – 16% for language
  – And 43% of GLBT students reported discrimination for sexual orientation
From Texas

Students wished for

– University-wide graduate school orientation – 66%
– Graduate student center – 87%
– Internship placement assistance – 87%
– Career placement assistance – 96%
– Health support - One-third of students had sought counseling since enrolling in graduate school.
Interdisciplinary Research

Long-term collaborations often lead to new conceptualizations of what the source fields are and change the way problems are defined and addressed.
Interdisciplinary Research

- Interdisciplinary Research requires
  - A priori investment in building intellectual community; demonstrate that you are a team
    - Preliminary data
    - History of joint activities, publications
    - Joint appointments, team teaching
  - Researchers to learn each other’s discipline, vocabulary, methodology, techniques
    - This needs time and effort, trust and mutual respect
    - Each department must value interdisciplinary contributions

- Use interdisciplinary opportunities to develop new ways of addressing and solving problems, new discoveries and advances in technology. Do not just paste together individual efforts – that is not interdisciplinary.

- But – is interdisciplinary work valued at your university?
Barriers that Confront Young Faculty Involved in Interdisciplinary Research

• Is there a deep-seated cultural assumption that research is better when faculty work alone, specialize and dig deeper and narrower to understand phenomena
• Tenure committees are too often narrowly defined, reflecting the subfields of a disciplinary department not the scope of the candidate’s work
• Lack of clear mechanisms to assess interdisciplinary research performance
• Interdisciplinary team work and publications are often not recognized or discounted in value in tenure decisions
• Departments credit young faculty for awards made in their names only, leaving out projects funded by centers
• Lack of mentoring and incentives for young faculty who want to pursue cross-disciplinary research
Interdisciplinary Research

• Encourage your university to foster interdisciplinary research
  – Build management structures that encourage interdisciplinary and cross-program collaborations
  – Create budget processes that foster innovative links between interdisciplinary research programs and graduate curricula
  – Create reward systems that value interdisciplinary efforts

• Too often we focus on the wrong end of the problem
  – It may well be that it is the senior faculty who need the mentoring to understand how to value and reward cross-disciplinary research
Interdisciplinary Research

• Young Faculty in interdisciplinary groups need to be mentored
  – Assign senior faculty experienced in interdisciplinary research to mentor young faculty
  – Give young faculty leadership roles at the project level in a center so they lead, mentor students, and publish, with senior faculty in supporting roles
  – Be sure young faculty have multiple sources of support
  – Be sure they publish in journals respected by their home departments as well as those in the other fields they are working in
Interdisciplinary Research

- Establish a culture that values interdisciplinary research (Deans and Department Chairs)
  - Reward risk taking and work at the interface of disciplines
  - Promote an interdisciplinary research culture and give credit for team contributions
  - Require interdisciplinary input in tenure and promotion decisions and train senior faculty on how to assess cross-disciplinary input
  - Create prestigious, competitive internal small “seed” grants for young faculty to initiate interdisciplinary research projects
  - Give equal weight to interdisciplinary and single discipline activities in tenure guidelines
  - Require a section on “Interdisciplinary Activities” on all annual faculty evaluation forms
  - Require that interdisciplinary publications include a brief statement of the contributions of each listed author
A closing comment on Interdisciplinary Research

“One can only carry a collaboration as far as a cup of coffee. In the age of the internet it is as easy to collaborate with someone anywhere in the world as it is with someone at a distance at your own institution.”

Do not take for granted working with your institutional colleagues. It will take immense effort to bring them together, but it is possible and the rewards will be numerous.
Diversity and Career Developments

- Fewer high school senior girls than boys state a desire to major in science or engineering in college.
- More white men that women or URM enroll full-time in undergraduate programs.
- About 50% of the men and women who declare 1st year intent for engineering actually graduate with a degree in engineering.
- Women science and engineering majors are less likely than men to enter graduate school.
- Women who enter graduate school in science and engineering are as likely as men to earn doctorates, but give a poorer rating to faculty-student interactions and publish fewer research papers than men.
  - Many women graduate students report feelings of isolation.
- More women than men seek postdoctoral positions.
- Women are proportionately underrepresented in the applicant pools for tenure-track faculty positions.
- More women than men leave a career in academic science and engineering at nearly every stage of the career trajectory.

*Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering (2007), NAP/COSEPUP*
Diversity and Career Developments

In Engineering

• The workforce is 6% minority and 91% male.
• The % of women students in undergraduate Engineering programs reached a high of about 20% in the late 1990’s. This % is dropping.
• The overall Engineering faculty is more than 92% male.

Find web links for more:
http://www.engineeringk12.org/educators/making_engineers_cool/diversity.htm
# Tenured/Tenure Track Faculty in “Top 50” Departments

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Total</th>
<th>S&amp;E PhDs Awarded in 2002</th>
<th>% of Total</th>
<th>Total in “Top 50” Departments</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Sciences</td>
<td>811</td>
<td>1,332</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>168</td>
<td>20.7</td>
<td>141</td>
<td>10.6</td>
<td></td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>705</td>
<td>820</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>176</td>
<td>25</td>
<td>86</td>
<td>10.5</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>626</td>
<td>1,347</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>120</td>
<td>19.2</td>
<td>132</td>
<td>9.8</td>
<td></td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>1,393</td>
<td>1,929</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>163</td>
<td>11.7</td>
<td>126</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>829</td>
<td>1,421</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>96</td>
<td>11.6</td>
<td>95</td>
<td>6.7</td>
<td></td>
</tr>
</tbody>
</table>

Note: “Top 50” science and engineering departments are based on research expenditures as reported by the National Science Foundation, so the list of departments varies by discipline.

In 1999, the highest percentage of foreign-born doctorate-holders was in civil engineering (51.5 percent).
More women than men are in part time jobs or not working.

FIGURE 4-5 Employment status of those not working full time for combined fields, by sex, and year of survey.

From Scarcity to Visibility, NAP, 2001
Where are we now?

More women and minorities are taking nonacademic positions.

WHY WOMEN DISAPPEAR FROM ACADEME

• Time commitments tend to be inflexible and incompatible with child-rearing .... unless there is a sharing partner.

• Many women never start on the tenure track – they preferentially do not apply for Assistant Professor positions.
  – Many complete postdocs and decide either they are not competitive or they are no longer interested in faculty positions at research universities.

• Success in academic research requires levels of effort that many women (and an increasing number of men) find unreasonable. The problem may be quantity of product, not quality.
The Need for Mentoring

- 33% of exiting women but none of the men interviewed cited lack of mentoring as major factor leading to the exit decision.

- 73% of all the women interviewed described:
  - situations where positive mentors advanced their careers
  - negative or indifferent mentors impeded their careers

Diversity and Career Developments

- Men who move prior to tenure tend to leave academe, while women tend to enter adjunct positions.
- As faculty move up in rank, differences between men and women become apparent in promotions, awards, and salary. Small incremental differences become compounded until obvious lack of equity is observed.
- Efforts to increase the number of women in science and engineering should be focused on both recruiting and retention.

Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering (2007), NAP/COSEPUP
News Flash: There are Still Men’s Clubs in the World

Percentage of Male vs. Female Members Elected to National Academy of Sciences Annually

- % Male
- % Female

MOVING TOWARDS A SOLUTION

• Academe must change the culture of work to accommodate 21st century lifestyles.
• Women and men in academe must approach work-life balance with a realistic strategy.
• We all need to remove inadvertent biases from our recruiting and evaluation systems.
• We all need to believe that achieving a culture inclusive of diversity is mandatory for our nation’s continued success and competitiveness.

But do we really believe?
The Rice Study (2003)

- Admitting and producing graduate students is done not at the administrative level, but at the faculty level.
- Faculty members determine graduate admissions and accept students into their research programs.
- Faculty members support students on their research grants, serve as research advisors, and make decisions about when a student’s research merits the Ph.D.
- University faculties, not university presidents, determine who will be the next generation of scientists.
- Hence the faculty’s deep understanding of, and commitment to, diversity is especially critical to the success or failure of diversity efforts at the graduate level.

Do we value diversity or just say we value it?

If you value something, your should
- Require reporting on it
- Measure it
- Reward success

At Rice, they asked: “Do we...
- do this in graduate study regarding recruitment and retention of graduate students from under-represented groups? No.
- consider this in ranking? No.
- train faculty for success in supervising students from underrepresented groups in a demanding and multicultural environment of graduate study? No.

Although the University stated a diversity priority, in fact, of 15 STEM departments at least 13 had faculty who reported this was never formally discussed or made an operational goal.

MYTH: Academe is a Meritocracy

“Although scientists like to believe that they ‘choose the best’ based on objective criteria, decisions are influenced by factors—including biases about race, sex, geographic location of a university, and age—that have nothing to do with the quality of the person or work being evaluated.”

Fight Schemas: Non-conscious Hypotheses

Expectations or stereotypes associated with members of a group that guide perceptions and behaviors

- Schemas influence the judgments of group members as well as of non-group members.
- Gender and race schemas influence group members’ expectations about how they will be judged.
Numerous studies show that schemas affect evaluation, for example:

- Blind auditions
- Evaluation of CVs
- Evaluation of resumes
- Evaluation of job credentials
- Evaluation of minimum standards vs. ability
- Evaluation of fellowship applications
- Letters of recommendation
Strategies for breaking the cycle

• Increase conscious awareness of bias and how bias can affect evaluation

• Increase critical mass – recruit, retain, train for leadership

• Learn to communicate in gender-neutral and cultural-neutral language

• Either be more explicit regarding evaluation criteria, or intentionally keep ambiguity but treat evaluation with clarity/transparency

• Alter institutional policies and practices
Other Ideas

WEAAP

Women Engineers in Advanced Academic Positions

Effecting Change in Higher Education

Report from a Workshop Convened Under NSF Funding through the National Science Foundation Directorate for Engineering Engineering Education and Centers Division Director of Diversity and Outreach
The WEAAP Workshop

• What are the real career paths of women in engineering? Are alternative career paths and interdisciplinarity considered assets?
• Combat isolation - enhance industry collaboration and professional degrees, opportunity for “co-mentoring” by academe and industry.
• Develop cohorts and networking to improve climate for graduate students– conduct graduate student climate assessments.
• Develop better information, and include sensitivity training, for faculty about becoming better advisors and supervisors.
• Care and learn: conduct exit interviews for each woman who leaves with or without her Engineering degree.

Open Partnership
Harnessing the Power of Cross-Sector Collaboration

The Open Partnership is an activity started at NJIT – to seek ways of connecting in ways that share sources of personal and professional power

- Information
- Knowledge
- Experience
  - Technical
  - Managerial
  - Cultural/global
- Skills
- Connections
- Resources
  - $
  - Space
  - Facilities
  - People
- Personal strength
Open Partnership
Harnessing the Power of Cross-Sector Collaboration

Goals:

• Enhance the roles of women in science and technology research, education and service by creating connections between women in academia and peers in industry and government.

• This must be an Open Partnership because
  – interfaces between academia, government and industry should be permeable to ideas and people;
  – knowledge, experience and opportunity should flow smoothly across sectors; and
  – synergistic cross-sector projects and programs will be especially enriching and exciting.
## Open Partnership

### Harnessing the Power of Cross-Sector Collaboration

Possible Actions for Cross-sector Partnerships

| Board nominations, appointments | Publications |
| Workshops                          | Research proposals, industry-funded or collaborative |
| Courses/degrees                    | Interface organizations (e.g., centers or institutes) |
| Sabbaticals/residencies            | Resource access – equipment/staff sharing |
| Personal networks                  | Library/information/database access |
| Professional networks              | Lectures/seminars (bring in big names) |
| Expert access networks             | Convening |
| Recruitment                        | People exchanges - Professors of practice, faculty in residence, coops and internships |
| Cooperative and internship opportunities | Executive Corps, coaching |
| Consulting/problem solving          | Business development workshops |
| Invitations                        | |
| Awards/rewards/nominations         | |
| Technology Showcases, technology transfer event | |
Thanks!

• And I hope some of the information here actually is new for you, that you were interested, and that you have ideas you will be trying in the future!
  – Broader impacts and NSF
  – Research group culture and climate
  – Interdisciplinary research
  – Diversity and Career development
• I’d welcome hearing from you about the things you are trying – the riskier the better as far as I am concerned!
Information Sources

• National Science Foundation
  – SESTAT Scientists and Engineers Statistical Data System


• American Chemical Society Annual Reports of Earned Degrees www.acs.org/education

• American Institute of Physics Roster of Physics Departments with Enrollment and Degree Data 2007 www.aip.org/statistics/trends/reports/physrost.pdf

• Computing Research Association (CRA) Taulbee Trends: Female Students and Faculty www.cra.org/info/taulbee/women.html


• Making Engineers Cool http://www.engineeringk12.org/educators/making_engineers_cool/diversity.htm
Information Sources

Information Sources

• Report of The University of Texas at Austin Graduate School Climate Study, Fall, 2011 VICTORIA E. RODRÍGUEZ and CHANDRA MULLER
  www.utexas.edu/ogs/about/climatestudy/
  http://www.phd-survey.org/report.htm
• Berkeley:  Marc Goulden, Karie Frash, and Mary Ann Mason. 2009.
• Michigan:
  http://sitemaker.umich.edu/advance/campus-wide_climate_for_graduate_students
• CGS (Council of Graduate Schools)
  http://www.phdcompletion.org/
Organizations
(see links on AWIS for many more*)

- MentorNet (http://www.mentornet.net.)
- Women in Engineering ProActive Network (WEPAN) www.wepan.org
- Women in Engineering Leadership Institute (WELI) http://www.weli.eng.iastate.edu/
- Society of Women Engineers (SWE) www.swe.org
- Association for Women in Science (AWIS) http://www.awis.org/
- Association for Puerto Ricans in Science & Engineering http://www.aspira.org/
- Graduate Women in Science (GWIS) http://www.gwis.org/
- Society of Hispanic in Professional Engineers (SHPE) http://oneshpe.shpe.org/wps/portal/national
- Society of Hispanics in Science and Engineering (SHSE)
- Committee on Women in Science and Engineering (CASEE), National Research Council http://sites.nationalacademies.org/PGA/cwsem/index.htm
  - Women in Science and Engineering: 50 Must-Read Bloggers http://sites.nationalacademies.org/PGA/cwsem/PGA_050396
- National Society of Black Engineers (NSBE) http://www.nsbe.org/
- Assessing Women and Men in Engineering (AWE) http://www.engr.psu.edu/awe/

*http://www.awis.org/displaycommon.cfm?an=1&subarticlecnbr=19
Extra slides for posting and reference
Managing the Obstacles in Academic Science and Engineering

1) Adapt to the culture (“Fix the Woman”)
   – How to be successfully mentored
   – Networking skills
   – How to market achievements
   – How to acquire recognition and prestige
Managing the Obstacles in Academic Science and Engineering

2) Change policy – top-down Family Friendliness

- Family leave, modified service
- Extension of probationary period – not requested but as a right with new children
- Childcare facilities
- Jobs for dual-career couples
Managing the Obstacles in Academic Science and Engineering

3) Work with younger male colleagues and institutional leadership for an environment that:

– Is collaborative and not competitive
– Emphasizes quality of effort, not quantity
– Institutes family-friendly practices
– Supports and rewards mentoring
– And that suppresses macho empire building
Managing the Obstacles in Academic Science and Engineering

4) Mentor senior men (?)reverse mentoring) to understand what is a chilly climate, locker-room behavior, sense of isolation. The current academic culture has evolved for men of the past – not for the workforce of the future

– Excessively competitive and entrepreneurial
– Expectation of >12hr workdays & working weekends
– Relying on unsalaried wives at home
Managing the Obstacles in Academic Science and Engineering

5) Enable women in academic careers to get a really fast start (the first year is no time to relax):
   – Maximize publications while in graduate school/post-doc/training
   – Early success in grant writing, starting with fellowships
   – Start a grant track record before applying for faculty positions - both career development awards and research grants
   – Be wise in choice of first position
   – Provide training and skill building in innovation, technology transfer, and entrepreneurism
Managing the Obstacles in Academic Science and Engineering

6) Department Chairs and Deans play a huge role:
   - Provide help with networking and lab start-up
     - Do not shirk from commitments – this is hugely disempowering
     - Follow through with your offer
   - Introduce new faculty directly to colleagues, sources of power and career development
   - Offer information about access to resources – “how can I help?”
   - Reward senior faculty who reach out to new faculty to
     - invite collaborate on proposals
     - Participate in/contribute to curriculum development
   - Really value interdisciplinary contributions (you and your faculty)
   - Always be on the lookout for equitable treatment
   - Encourage inclusion of women and minorities in the academic life and decision-making of the department
Managing the Obstacles in Academic Science and Engineering

7) Train advising faculty to be good managers and career developers for themselves, their peers, and especially to help jump-start their grad students and postdocs for career initiation – this is a skill set and can/must be learned
   – The good academic jobs are filled by applicants with connections
   – The subject of postdoc research may well be less important than the mentored connections
   – Support to make own connections – e.g., professional society meetings, workshop participation, nominations to participation

8) Support development of young faculty self-awareness regarding personal resource and mentoring selection and access – “it takes a village” of mentors for:
   – testing research ideas
   – reviewing first drafts of grants… as well as later drafts
   – instigating lecture invitations
   – nominating
The WEAAP Workshop

Faculty Retention:
• Train and coach Chairs regarding management and mentoring
• Need creativity regarding part-time tenure-track for early, middle and late faculty careers.
• Build virtual networks and cohorts for women on campus, link to women at other campuses and in other sectors. Convene campus events and institutes that can serve as portals for cross-sector interactions and networking.
• Conduct faculty climate assessments, and continuously monitor work equity issues.
• Provide training opportunities for women interested in moving into leadership positions
• Consider how can/should sabbatical programs and residencies in industry be used successfully to also provide mentoring and leadership experience?
• Conduct more longitudinal studies about the career paths taken by women engineering faculty, before and after they received their PhDs.

Open Partnership

Goals for Cross-sector Partnerships

• To facilitate the cross-sector exchange of power to increase collaboration among academia, industry and government.
• To enhance synergies and stimulate new ideas and problem solving across sectors,
  • advance participation of women of all ethnicities in the engineering, science and technology enterprise.
  • promote satisfaction and total career growth.
Open Partnership
Harnessing the Power of Cross-Sector Collaboration

Bases for Cross-sector Partnerships

- Stature
- Personal satisfaction
- Professional growth
- Flexibility
- Power
- Access
- Technical knowledge
- Organizational knowledge
- Student opportunities
- Diversity
- Skills
- Alignment
- Communication
- Resource access
- Broadened perspectives
- International connectivity
Open Partnership
Harnessing the Power of Cross-Sector Collaboration

Problems to be Addressed in Cross-sector Partnerships

- Isolation in position
- Organizational silos
- Disciplinary silos
- Male culture
- Innovation and technology transfer (how to do it, and IP issues)
- Re-entry into profession or sector
- Loss of staff to other sectors
- Academic freedom compromise
- Narrow perspective

- Make wrong beans for sector bean counting
- Recruitment and retention
- Family issues
- Different agendas in different sectors
- Talking sector language
- Need for assessment and metrics
- Reductionist approach to problems
- Satisfaction with product/outcome