

Perspectives on Gender Issues Within the Chemical Sciences

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The Goal

Speaking to the U.S. House of Representatives in October 2007:

“Faculty, university leaders, professional and scientific societies, federal agencies, and the federal government” need to unite to ensure that “all of our nation’s people are welcomed and encouraged to excel in science and engineering in our research universities.”

Dr. Donna E. Shalala
University of Miami, President
Former U.S. Secretary of Health and Human Services

So how are we doing?

Percentage of Chemistry degrees awarded to women:

1981	bachelor	29%
	masters	28%
	Ph.D.	16%
1991	bachelor	40%
	masters	41%
	Ph.D.	25%
2001	bachelor	48%
	masters	40%
	Ph.D.	34%
2006	bachelor	52%
	masters	49%
	Ph.D.	36%

Heylin, M. Chemistry's Pipeline Remains Healthy. *Chem. Eng. News*, August 25, 2003, pp 46–52.

Heylin, M. Chemistry Grads on the Upswing. *Chem. Eng. News*, August 20, 2007, pp 60–63.

Female Chemistry Faculty

At the top 50 Research Universities:*

	2000	2001	2002	2003	2004	2005	2006	2007
Full	6%	7%	7%	8%	8%	9%	10%	11%
Associate	21%	20%	20%	20%	19%	21%	22%	22%
Assistant	18%	20%	21%	21%	20%	21%	21%	22%
All ranks	10%	11%	12%	12%	12%	13%	14%	15%

At the 51st to 100th Research Universities:*

	2007
Full	11%
Associate	18%
Assistant	23%
All ranks	15%

*as determined by the NSF based on total and federally funded research in chemistry

Female Representation in Other Types of Institutions

Primarily Undergraduate Institutions:

New, tenure-track science professors: 1980's : 21% women
1990's : 40% women

Christian Institutions of Higher Education:*

18% women overall (2008)
6 of 15 (40%) had no women chemistry faculty

42 largest publicly traded chemical companies (2006):

12% of people serving on the boards of directors are women
9.2% of executive officers are women

Curry, D. More Women Teach Science in Colleges, Study Finds. *Chron. Higher Ed.*, July 6, 2001, p A9.

Tullo, A. H. Women in Industry: In the Boardroom and Executive Suite, Women's Participation is Still Minuscule. *Chem. Eng. News*, **2007**, 85, 38–39.

* Baylor, Calvin, Wheaton, Messiah, Gordon, Hope, Azusa Pacific, California Baptist, George Fox, Oral Roberts, Grove City, North Park, Anderson, Seattle Pacific, Westmont

Two Major Theories for the “Leaky Pipeline”

Theory A:

Women simply choose to leave chemistry and science for other (less demanding) jobs.

Theory B:

The accumulation of disadvantage forces women out of scientific fields.

Accumulation of Advantage and Disadvantage

“Like interest on capital, advantages accrue, and like interest on debt, disadvantages also accumulate. Very small differences in treatment can, as they pile up, result in large disparities in salary, promotion, and prestige. It is unfair to neglect even minor instances of group based bias, because they add up to major inequalities.”

In other words....

Even if each discrepancy between how men and women are treated is tiny, those differences add up over time to create a markedly different environment for the two populations.

How do we know that disadvantage is accumulating in chemistry?

yield = # of Ph.D.'s awarded \div # of bachelors degrees awarded

parity value = yield of women \div yield of men

		yield	parity value
All Ph.D. granting schools	female	47%	0.77
	male	61%	

Kuck, V. J. *Women in Academe: An Examination of the Education and Hiring of Chemists*. In *Are Women Achieving Equity in Chemistry? Dissolving Disparity and Catalyzing Change*, Marzabadi, C. H.; Kuck, V. J.; Nolan, S. A.; Buckner, J. P., Eds.; ACS Symposium Series 929; American Chemical Society: Washington, D.C., 2006; pp 107–128.

Disadvantages Resulting from Small Numbers of Women

- 1) Lack of role models and female mentors
- 2) Feelings of isolation
 - it is believed that 20% of a group (or faculty) must be women before the ideas of the minority can be comfortably voiced
 - only 22 of the top 100 research universities would meet this criteria
- 3) Stereotyping as to what female chemists are like, what they are capable of, how they will react to different situations, etc. dominate the perception of who female chemists are.
 - affects those mentoring females
 - female scientists expectations of themselves

More Subtle Disadvantages

Some possible examples:

- In a large research group, a post-doctoral researcher is always chosen as the lab manager and just happens to always be male.
- It is easiest for an advisor to put one person in charge of organizing lunches with speakers; that person happens to be male. It is easiest for him to always choose the same people to go to lunch, all of whom happen to be male.
- A PI corrects both a male and a female graduate student simultaneously. She leaves in tears; he blows off the criticism. The graduate advisor tells her to “get a thicker skin; science is hard”.
- Attendance at conferences is a necessary part of career advancement in chemistry, but a young faculty member must either bring her children with her or find (and pay for) childcare.

Combating Disadvantage: Mentoring

- Multiple studies have demonstrated that having a positive mentoring relationship is more important for women than men

In graduate school:

- the chance of a women finishing graduate school rose from 60% to 100% if she had a strong mentor
- mentoring had no effect on the likelihood of a man finishing graduate school (75% vs 74%)

Effect of mentoring on “successful” early employment situations:

- 52% of women with no mentor or a negative mentoring experience
- 100% of women who reported a positive mentoring experience
- for men mentoring had a less significant effect (70% vs. 83%)

Combating Disadvantage: Mentoring

- While women benefit more from mentoring, they receive less overall mentoring than men.
 - undergraduates: 13.5% of women vs. 40.0% of men
 - graduate school: 20.5% of women vs. 65.7% of men
- Lack of women receiving strong mentoring accentuates the importance of mentoring for women relative to men.
- Establishing formal mentoring programs may provide significant benefits to women in the sciences and improve the overall retention rate.
 - an ASA sponsored mentoring program could be of value
- Should be noted:
 - mentoring is an *investment* in another individual
 - simple academic advising does *not* constitute being a mentor

Other Considerations: Balancing Career and Family

- compatibility with the “academic life style”
 - “rat-race”: long hours signal a commitment to the field
 - publication and funding obligations are significant stressors
 - can be stressful on relationships (marriages, parenting, etc.)

Planning Pregnancy

During graduate school:

- paid maternity leave? If so, who should pay for it?
- MIT was the first major university to offer paid maternity leave to graduate students (2004). Since that time only a handful of other schools have followed suit, most notably Stanford and Princeton in 2006.

Pre-tenure:

- how will being pregnant and having a child affect getting tenure?
- other real or perceived penalties?
- will I be taken seriously?
- many stories of women getting pregnant either just after or during their tenure year

Other considerations:

- exposure to chemicals during pregnancy (conducting research, student supervision, teaching obligations, etc.)
- willingness of colleagues to “cover” and be flexible
- waiting till after tenure mean delaying child bearing until the mid-30’s

Other Considerations: Balancing Career and Family

- compatibility with the “academic life style”
 - “rat-race”: long hours signal a commitment to the field
 - publication and funding obligations are significant stressors
 - can be stressful on relationships (marriages, parenting, etc.)
- if and when to have children
- child care responsibilities, including career interruptions
- dual career couples

The “Two-Body” Problem

- married scientists whose spouses hold a doctorate

Female = 62%

Male = 19%

Best Practices

Mentoring:

- Raise awareness as to what mentoring is (i.e. an investment in human capital) and what mentoring is not (i.e. academic advising)
- Recognize that mentoring is not a “one-size fits all” activity
- Initiate formal mentoring programs

Initiating Family Friendly Benefits:

- Paid maternity and parental leave for birth and adoption
- Automatic tenure clock extensions for new parents
- Flexibility in teaching loads and other institutional responsibilities
- On-site or close-by day care options
- Availability of leave or back-up care for sick children
- Helping a “trailing” spouse find a job or hiring the couple together

Untener, J. Giving Birth to a Good Policy. *The Chronicle of Higher Education*, July 18, 2008, p B30.

Preston, A. E. *Leaving Science: Occupational Exit from Scientific Careers*; Russel Sage Foundation: New York, 2004; pp 83–84.

Summary

- Gender equity not gender parity
 - the ideal professorate may not be half women
 - *ALL* women who desire to pursue a such a career should be able to do so without having to overcome accumulated disadvantage.

Questions

- 1) Where are all of the women going?
- 2) Whose “fault” is it?
- 3) What should our realistic goals for faculty composition be?
- 4) What is lost when women do not enter the professoriate?
- 5) Is a job at one of the top 50 research universities the only measure of success?

Other Considerations: The “Academic” Life Style

- Publish or perish
 - hard work from both faculty and students means more publications
 - a strong publication record is required to obtain both funding and tenure
- Frequent submission of grant applications
 - cover the cost of the a research group
 - “pay-back” the institution for start-up monies
 - gaining prestige
- These requirements frequently require and intense dedication to the field
- Long hours signal a commitment to the field (“rat-race equilibrium”)

Combating Disadvantage: Mentoring

- Mentoring is:
 - building human capital investment
 - establishing an interpersonal relationship
 - providing an apprenticeship for professional development
 - facilitating the development of professional networks
 - allowing for identification and individualization (how much like the mentor does the mentee want to be?)

Schlosser, L. Z.; Gelse, C. J. *J. Counsel. Psych.* **2001**, *48*, 157–167.

Preston, A. E. *Leaving Science: Occupational Exit from Scientific Careers*; Russel Sage Foundation: New York, 2004; pp 92–110.

Best Practices: Instituting Family Friendly Policies

- Helping a “trailing” spouse find a job or hiring the couple together
- Paid maternity and parental leave for birth and adoption
- Automatic tenure clock extensions for new parents
- Flexibility in teaching loads and other institutional responsibilities
- On-site or close-by day care options
- Availability of leave or back-up care for sick children
- Making nursing mother’s facilities and baby changing stations available

“It just seems very stupid to me – economically stupid – for a company to train somebody and then force her out. That has to cost the company money. They invest money and everybody invests time. So why just lose that because people want to have children? They make it a very hard issue. If they were a little more flexible, I would be infinitely loyal and I would stay with this company – I think I would work harder, really.”

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Preston, A. E. *Leaving Science: Occupational Exit from Scientific Careers*; Russel Sage Foundation: New York, 2004; pp 83–84.

As Christians, how can we be leaders in creating equity?

- Reducing barriers and eliminating disadvantages that women and other minorities in the sciences face should be an important goal.
 - need to show our commitment to the “least of these”
 - underrepresented populations in science can be thought of in this way
- Christians should be *leading* the efforts for gender equity for both genders.
 - restoration of our fallen world
 - pursuit of justice for all people
 - use of all the human capital that God has given us