Women in Health Care & Bioscience Leadership State of the Knowledge Report:

Bioscience, Academic Medicine, and Nursing

TECHNICAL REPORT

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Women in Health Care & Bioscience Leadership State of the Knowledge Report: Bioscience, Academic Medicine, and Nursing

"Glass Ceilings or Sticky Floors?"[1]

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[1] While the term "glass ceiling" has been in wide use for several years, the term "sticky floors," which refers to a gender wage gap in returns to promotion, was first coined in the social science literature by Allison Booth, M. Francesconi, and J. Frank, "A Sticky Floors Model of Promotion, Pay, and Gender," *European Economic Review*, vol. 47, no. 2, (April 2003): p. 295-322.

[2] Acknowledgments: We would like to thank the advisors to the Women in Health Care & Bioscience Leadership project whose expertise and insights enriched the project in many ways. Jeanne Yhouse, former Executive Manager, Women's Health Program, University of Michigan Health System, Ann Arbor, provided important contributions to research focus, methodologies, and advisory board development. We would also like to thank several people at Catalyst. Ilene H. Lang, President, and Nancy Carter, Ph.D., Vice President, Research, provided support and leadership. Staci Kman, former Associate, Research, co-authored the section on Academic Medicine, and Laura Sherbin, Ph.D., Graduate Research Intern, co-authored the section on Nursing. Qian Cai, Graduate Research Intern, and Alicia Schneebaum, Graduate Research Intern, contributed to data analysis. Sharon Peters, Assistant, Research, maintained the bibliography and the list of contacts, and Cheryl Yanek, Associate Librarian, provided extensive help building our bibliography. Sarah Dinolfo, Senior Associate, fact-checked the report; Joy Ohm, Senior Associate Editor, edited the report; and Sonia Nikolic, Graphic Designer, laid out the report and designed the cover. The report was produced and edited under the leadership of Deborah M. Soon, Vice President, Marketing & Executive Leadership Initiatives, and Liz Roman Gallese, Vice President & Publisher.

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COLLABORATING ORGANIZATIONS

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The Women's Health Program at the University of Michigan Health System coordinates direct care, educational, and research programs in women's health. The program provides a comprehensive range of services and resources to serve the interests of women, while enhancing the research and education missions of the University of Michigan. More than 30 departments and clinics, five schools, 30 satellite sites, and several special initiatives adhere to the Women's Health Program mission and standards.

The Griffith Leadership Center at the University of Michigan Department of Health Management and Policy strives to enhance understanding of excellent leadership in healthcare finance and delivery by increasing communication between department faculty, students, and outstanding practitioners. The Center works to improve learning opportunities for students, identify innovations in healthcare leadership, expand opportunities to exchange information with practitioners, and increase collaborative research.

RESEARCH SUMMARY

Bioscience

- Women's share of all scientific, mathematical, and engineering degrees has outpaced their representation in the bioscience workforce, even at the Ph.D. level.
- Once they entered the bioscience sector, female scientists earned substantially less than similarly qualified male scientists. The wage gap rose at higher levels of management.
- Women with Master's or Ph.D. degrees were as likely as men to be promoted to middle-level management positions, but less likely than men to be promoted into top management.
- The wage premium for male managers rose between 1993 and 2003.

Academic Medicine

- Even though women have swelled the ranks of graduates with medical degrees, they have had difficulty moving from adjunct and post-doc positions into more promising tenure-track research jobs.
- Female research physicians remained underrepresented at all professorship ranks and as heads of medical departments and deans.
- Research has documented pervasive and unexplained gender wage gaps throughout the medical research pipeline.

Nursing

- In the nursing profession, we observed that women were *more* likely than men to hold leadership positions, mainly due to their higher qualifications. Still, male nurses and nurse leaders earned significantly more than their female counterparts.

FINDINGS AT A GLANCE

Women Represent a Growing Share of the *Potential* Bioscience Workforce.

- Between 1966 and 2004, women's share of scientific and engineering (S&E) doctoral degrees rose 422 percent; their share of S&E Master's degrees rose 233 percent, and their share of S&E Bachelor's degrees rose 137 percent.
- Between 1966 and 2004, women's share of medical degrees rose 447 percent.

Yet, Women Remain Underrepresented in the Bioscience Workforce and Leadership.

- Between 1992 and 2002—while women's overall unemployment rates were less than men's—for the science and technology workforce, women's unemployment was 14 percent higher, on average, than men's.
- In 2003, the overall share of full-time doctoral-level S&E positions held by women (23 percent) was considerably lower than the share of doctoral degrees acquired by women in the preceding ten years.[3]
- In 2000, 32 percent of women and 41 percent of men were employed as managers, but only 1.6 percent of women—compared with 5.2 percent of men—were employed as top managers.

Women Remain Underrepresented in Academic Medical Center Workforce and Leadership.

- In 2006, women comprised only 32 percent of the full-time faculty members at accredited medicals schools in the United States and Puerto Rico.
- Only 11 percent of all women faculty members were in tenured positions, while 24 percent of all men faculty were.
- At the associate professor level, women comprised only 28 percent of the faculty, while among full professors, women held the fewest positions, with a share of only 16 percent, despite the fact they comprised 41 percent of medical school graduates in 1996 and 31 percent of graduates in 1986.
- In 2006, women held only 19 percent of division or section chief positions, 10 percent of department chair positions, and 11 percent of medical dean positions.

Gender Salary Gaps Persist at All Levels in Bioscience and Healthcare.

- In the bioscience industry, female mathematicians, pharmacists, managers, and top managers earned less than 70 percent of what men earned. Male Ph.D.-level scientists earned 25 percent more than female Ph.D.-level scientists.
- Male academic physicians earn significantly higher salaries than their female counterparts.
- Male nurses employed full-time earned 6 percent more than female nurses employed full-time. In addition, men received higher nursing wage offers than women did, and the wage offers to women were not high enough to bring them into the market.

[3] Between 1997 and 2004, women earned on average 40.9 percent of all science doctoral degrees and 15 percent of all doctoral-level engineering degrees. (See National Science Foundation, Division of Science Resources Statistics, Survey of Earned Doctorates, 1997–2004.)

INTRODUCTION

Do women in the bioscience and healthcare workforce face barriers to advancement? In their extensive review of women in academic science, the National Academy of Sciences concluded that observed gender differences in promotion and pay could not be attributed to gender differences in cognitive ability, family responsibilities, or even productivity.[4] Rather, many barriers to advancement for women stemmed from stereotypes and institutional biases that disadvantaged women in academic science. These biases included work environments that favored men, stereotypes biased against women scientists, arbitrary and subjective evaluation practices, and academic structures that undervalued women's contributions. In this report, we explore whether the same factors may be at work for bioscientists, academic physicians, and nurses. We chose these groups because we are interested in career paths to leadership in bioscience firms and academic research hospitals.[5] In addition, since nursing is a female-dominated profession, it adds a unique vector to our exploration of gender gaps in leadership.[6]

The representation, status, and pay of women in the bioscience and healthcare workforce remain underexplored. Yet, for the past two decades, science, medicine, and engineering have been the fastest growing occupational fields in the United States. According to U.S. Census data, between 1990 and 2000, the number of science and engineering (hereafter abbreviated as S&E) occupations increased by an average of 3.6 percent per year—a rate three times as great as those of other occupations. Projections by the Bureau of Labor Statistics have indicated that this trend will continue: between 2002 and 2012, S&E occupations are projected to grow by 26 percent, compared with 15 percent for other occupations.[7] Within all the science occupations, demand for skilled employees is projected to grow fastest in bioscience and healthcare.

Our research shows that women are underrepresented in bioscience and healthcare management and are less likely than men to be promoted to the top levels of executive and science management. When women are promoted into management, they earn substantially less than similarly qualified men—a phenomenon known as "sticky floors." Furthermore, gender pay gaps rise as women advance into higher levels of management.

Gender gaps in promotions, pay, and representation at top management levels have consequences beyond their effects on the careers and aspirations of individual women, whose aspirations may be dampened by these gender inequities in recognition and opportunities to succeed. To thrive, bioscience and healthcare companies must be agile enough to manage and

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[4] National Academy of Sciences, *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering* (Washington, DC: National Academy of Sciences, National Academy of Engineering, Institute of Medicine, 2007).

[5] The third group of health or science professionals who also lead bioscience organizations and hospitals are public health professionals. An assessment of gender gaps in the leadership among this group is provided in Paula Lantz's paper entitled "Women in Health Care and Bioscience Leadership: Hospital Executives and Public Health Professionals," available at: http://sitemaker.umich.edu/womeninleadership/home.

[6] This builds on prior Catalyst research exploring the specific barriers to advancement faced by women scientists and technologists in industry including: Heather Foust-Cummings, Laura Sabattini, and Nancy M. Carter, *Women in Technology: Maximizing Talent, Minimizing Barriers* (2008); Catalyst, *Bit by Bit: Catalyst's Guide to Advancing Women in High Tech Companies* (2003); Catalyst, *Women Scientists in Industry: A Winning Formula for Companies* (1999).

[7] National Science Board, *Science and Engineering Indicators 2006, Volumes 1 and 2* (Arlington, VA: National Science Foundation, 2006).

support the creative R&D backbone of their organizations within a global context. As we argue below, cultivating and utilizing women's scientific and management talents are fundamental to organizational success.

This paper is divided into four parts. In the first part, we explore gender differences in the scientific pipeline by examining the science, medical, and nursing degrees earned by women and men over the last 30 years. Since the bioscience and healthcare workforce is fueled by scientific and medical expertise, a first step in understanding women's status in this workforce is to document their representation in the education pipeline. We next move to the bioscience workforce to examine gender gaps in representation, rank, promotion, and pay. We pay close attention to underlying differences in men's and women's education, experiences, and family situations that may account for observed gender gaps in these factors. For comparison, we also assess women's experience in bioscience R&D in relation to their experiences in the R&D functions of other industries. To capture changes over time, we also examine women's opportunities for promotion in bioscience ten years previously.

In part three, we explore gender differences in the career paths of research physicians employed primarily in academic medical centers. Along with the scientists employed in the bioscience industry, these physicians are responsible for the bulk of the research done to understand and cure human disease around the world. We end our labor market analysis, in part four, with new research on gender differences in nursing careers, pay, and leadership. In a final summary chapter, we pull together findings from the previous sections to map out and assess the status of women in bioscience and healthcare research and administration.

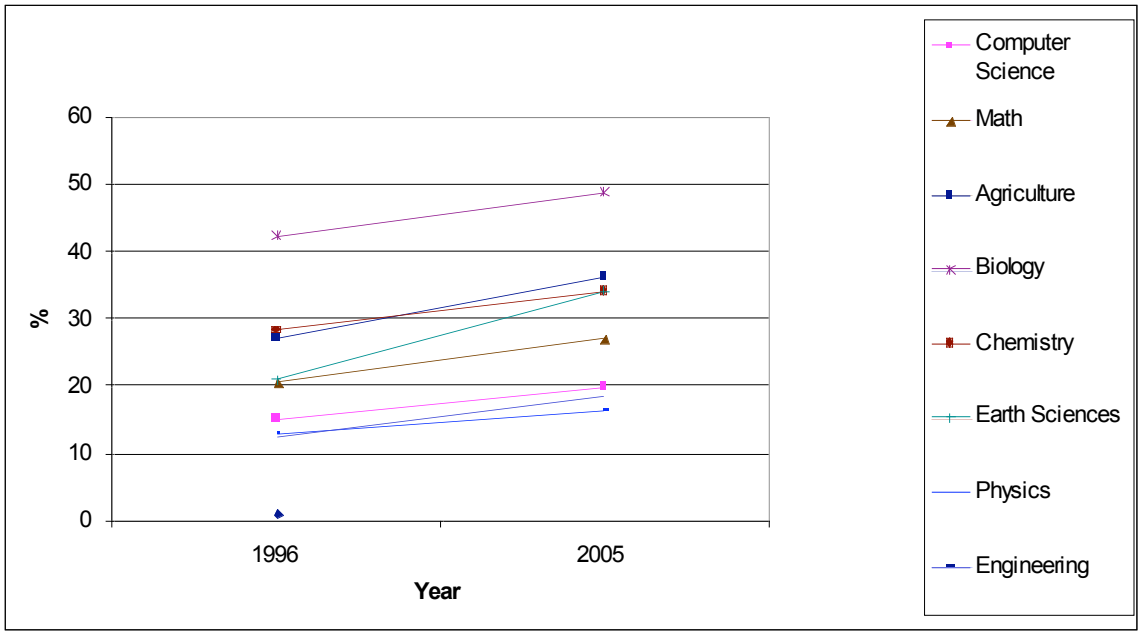
EDUCATION PIPLINE FOR SCIENTISTS, PHYSICIANS, AND NURSES

Advanced Science Education

The bioscience industry relies on a highly educated workforce. In 2000, 27 percent of the female workforce and 27 percent of the male bioscience workforce had a Master's or Ph.D. degree.[8] For the workforce as a whole, only 8 percent had a Master's degree and 1.5 percent had Ph.D.'s.[9] Industry, as opposed to government or academia, employs the majority of individuals whose highest educational degree was in an S&E field (59 percent). Among individuals who received Bachelor's or Master's degrees in S&E fields between 1998 and 2002, 57 percent of Bachelor's holders and 49 percent of Master's holders were employed by the private sector in 2003.[10] A total of 33 percent of S&E doctoral-level workers held jobs in the private sector in 2003, while 44 percent were employed by academia.

As measured by degrees earned, women comprise a significant share of the *potential* bioscience workforce. In the past ten years, the number of advanced science degrees awarded to women has grown dramatically. Between 1996 and 2005, the percentage of women doctoral recipients in science and engineering fields increased from 24.6 to 31.3 percent, representing an overall growth of 27.2 percent. Although women have continued to comprise a larger share of doctorate holders in the sciences than in engineering, the level of growth in engineering was more than twice as high as that in the sciences (48.8 percent and 22.4 percent, respectively).

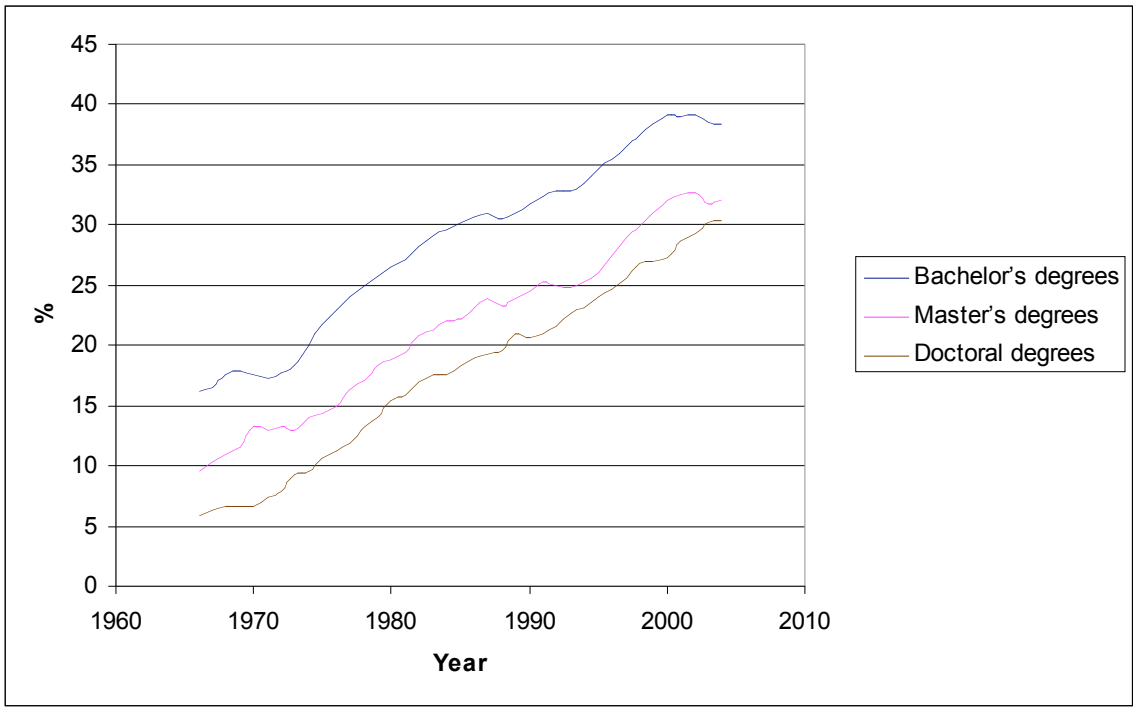
Figure 1: Women's Share of S&E Degrees 1996, 2005[11]



[8] U.S. 2000 Census, 5 Percent Public-Use Micro-Sample.
[9] Bureau of Labor Statistics, 2005, http://www.bls.gov/cps/wlf-table8-2005.pdf.
[10] National Science Board.
[11] National Science Foundation, Division of Science Resource Statistics, Tables 1 and 2, *Science and Engineering Doctorate Awards: 2005*, Arlington, VA (2006).

Between 1966 and 2004, women's share of all S&E doctoral degrees rose 422 percent, from a low of 5.8 percent in 1966 to a high of 30.3 percent in 2004. The percentage of women receiving Master's degrees in S&E fields rose from 9.6 percent in 1966 to 32.0 percent in 2004, an overall increase of 233.3 percent. Among Bachelor's degree recipients, the share of women rose from 16.2 percent in 1966 to 38.4 percent in 2004, an overall increase of 137.0 percent.[12]

Figure 2: Women's Share of S&E Degrees 1966–2004[13]



In 2004, women earned 30 percent of the Ph.D.'s granted in the top 50 departments in chemistry, 27 percent in mathematics and statistics, and 25 percent in physics and astronomy. Even in engineering, where women have been persistently underrepresented, women now earn 25 percent and 15 percent, respectively, of the Ph.D.'s granted in chemical engineering and engineering in the top 50 departments.[14] The subfield with the largest share of female doctoral graduates was biological/agricultural sciences (47.0 percent), an important field for bioscience and healthcare research and administration.

Physicians: Students and Residents

[12] National Science Foundation, Women, Tables 2-4, 2-5, 4.1, 4.2, 4.9, 4.10, *Minorities and Persons with Disabilities in Science and Engineering: 2000*, Arlington, VA (2000); National Science Foundation, Division of Science Resource Statistics, Tables C-4, E-2, and F-2 and Figures C-1, E-1 and F-1, *Women, Minorities, and Persons with Disabilities in Science and Engineering: 2004, December 2006 Updates*, Arlington, VA (2006), www.nsf.gov/statistics/wmpd/sex.htm.

[13] National Science Foundation, Women, Tables 2-4, 2-5, 4.1, 4.2, 4.9, 4.10, *Minorities and Persons with Disabilities in Science and Engineering: 2000*, Arlington, VA (2000); National Science Foundation, Division of Science Resource Statistics, Table H-5, *Women, Minorities, and Persons with Disabilities in Science and Engineering: 2004, December 2006 Updates*, Arlington, VA (2006), www.nsf.gov/statistics/wmpd/sex.htm.

[14] National Academy of Sciences.

The percentage of women medical school applicants, students, and graduates increased dramatically between 1966 and 2006. In 1966, women comprised only 9.0 percent of total applicants and 8.9 percent of accepted applicants. By 2006, these figures had risen to 49.8 and 48.7 percent—overall increases of 453.3 and 447.2 percent, respectively. In 2006, women comprised 48.5 percent of all medical school students and 48.7 percent of medical school graduates, up from 9.3 percent and 6.9 percent in 1966 (representing total increases of 422 percent and 606 percent respectively).[15] The greatest changes occurred in the decade between 1970 and 1980, after the passage of Title IX, in which the share of women medical school graduates nearly tripled.[16]

In the ten-year span between 1995 and 2005, the share of women residents increased by 25.0 percent overall, from 34.0 percent in 1995 to 42.5 percent in 2005. There were several fields of specialty in which women comprised a significantly larger portion of residents than men. These fields included obstetrics and gynecology (75.7 percent women), pediatrics (66.6 percent), medical genetics (60.0 percent), and dermatology (59.6 percent). Incidentally, three of these specialties were the only areas in which women were more than 50 percent of the total number of residents in 1995 (obstetrics and gynecology at 57.9 percent, pediatrics at 58.1 percent, and dermatology at 51.1 percent).[17]

There were five specialty fields that experienced a large-scale increase of the share of women residents between 1995 and 2005: thoracic surgery, urology, surgery subspecialties colon and rectal, and medical genetics. The share of women in each of these specialties increased more than 100 percent in this ten-year period, with the largest growth occurring in the field of thoracic surgery, which rose from 4.0 percent in 1995 to 10.7 percent in 2005, an increase of 167.5 percent.

It is interesting to note that in both 2004 and 2005, the areas with the largest overall growth of women were surgical specialties—an area that previous research has shown women less likely than men to consider.[18] Although women residents have tended to self-select into certain fields (obstetrics and gynecology, pediatrics, and dermatology), since the advent of the medical genetics specialty in 1995, women have kept pace with men in this field. As of 2005, women were overrepresented at 60.0 percent, making medical genetics the specialty with the third-largest share of female residents.

Nursing Education

Students wishing to obtain their registered nursing license can do so via three different avenues: earning an Associate degree at a two-year college, earning a diploma degree through a three-year hospital-sponsored program, or earning a Baccalaureate degree at a four-year institution. Compared to an Associate or Baccalaureate degree, a diploma program offers a more hands-on learning approach, with less classroom time. According to Lehrer, White, and Young (1991) the choice among the different paths to a RN license affects labor market

[15] Association of American Medical Colleges, *Table 1: Medical Students, 1965-2006*, www.aamc.org/members/wim/statistics/stats06/start.htm.

[16] American Medical Association Women Physicians Congress and AMA Archives, "Women in Medicine: An AMA Timeline" (2007), http://www.ama-assn.org/ama1/pub/upload/mm/19/wimtimeline.pdf.

[17] For all residency specialty data for 1995 and 2005, see American Medical Colleges, Table 2: Distribution of Residents by Specialty, 1995 Compared to 2005, www.aamc.org/members/wim/statistics/stats06/start.htm.

[18] Nancy Baxter, Robert Cohen, and Robin McLeod, "The Impact of Gender on the Choice of Surgery as a Career," *American Journal of Surgery* (1996): p. 372-376.

outcomes such as work setting, salary, and promotion potential.[19] They found that an Associate degree was a far better option than a diploma degree because additional earnings gained by diploma degree holders was shown to occur only during the first few years after completion of schooling and was not substantial enough to compensate for the additional year of schooling both in terms of tuition cost and wages foregone.

Similarly, these researchers found that an Associate degree was a more attractive option than a Baccalaureate because the two additional years of tuition coupled with two years of sacrificed earnings was not compensated for by the salary premium when assuming a positive interest rate. Other researchers have also shown that the financial gains to a nurse from obtaining a Baccalaureate degree were minimal and did not compensate for the extra educational investment due to the small salary increases realized by more educated nurses.[20]

According to the National Sample Survey of Registered Nurses (NSSRN) 2000[21]—a nationally representative sample of the U.S. nursing workforce conducted every four years by the U.S. Department of Health and Human Services—the majority of both female and male nurses earned Basic Nursing Associate degrees. Women were slightly more likely than men to earn the Advanced APN nursing degree. Women were also more likely than men to have earned only a Basic Nursing diploma.

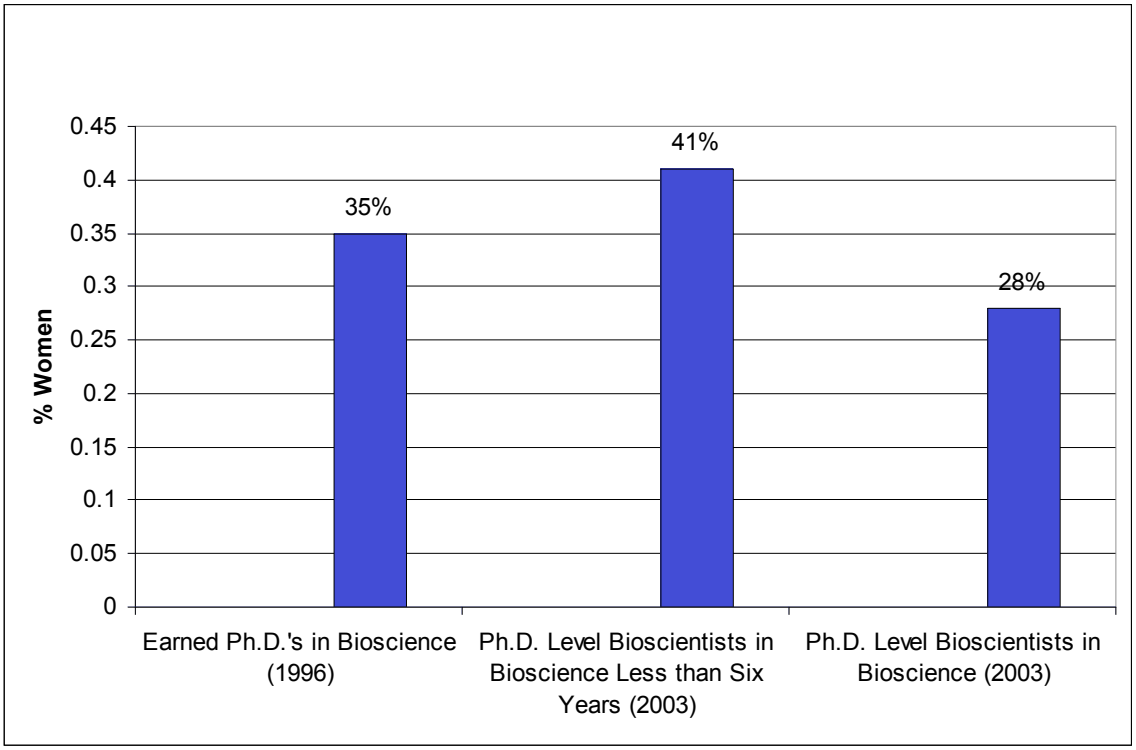
[19] Evelyn L. Lehrer, William D. White, Wendy B. Young, "The Three Avenues to a Registered Nurse License: A Comparative Analysis," *The Journal of Human Resources*, vol. 26, no. 2 (Spring, 1991): p. 362-379.
[20] Charles Link, "Labor Supply of Registered Nurses in the Future," in Ronald Ehrenberg, ed., *Research in Labor Economics*, Vol. 13. (Greenwich, CT: Jai Press, 1992); Edward Schumacker and Barry Hirsch, "Compensating Differentials on Unmeasured Ability in the Labor Market for Nurses: Why Do Hospitals Pay More?" *Industrial and Labor Relations Review*, vol. 50, no. 4 (July 1997): p. 557-579.
[21] At the time of our research, the NSSRN 2004 was not yet available for public use.

BIOSCIENCE WORKFORCE AND LEADERSHIP

Employment Trends

Over the 20 year period from 1983 to 2003, women's share of the overall scientific and technology workforce has grown in proportion to women's increased share of the overall labor force.[22] In 1983, women comprised 44 percent of the workforce. By 2003, women's share had grown to 47 percent. In comparison, women's share of the overall managerial and professional workforce grew from 41 percent in 1983 to 50 percent in 2003. Within the science and technology workforce, women's labor force participation grew most rapidly in the natural sciences. In 1983, women held 20.9 percent of natural science positions. By 2003, women comprised nearly 35 percent of these positions. By 2003, 41 percent of new S&E Ph.D.-level entrants into the bioscience workforce were women, compared with their 28 percent share of the entire workforce.

Figure 3: Women in Bioscience—Education and Workforce[23]



In contrast, women's share of the mathematical and engineering workforce has barely budged during the same 20-year time period. Still, unemployment in science and technology fields tended to be much higher for women than their share of unemployment in the overall workforce. Between 1992 and 2002, while women's overall unemployment rates were less than men's, for the science and technology workforce, women's unemployment was 14 percent

[22] Commission on Professions in Science and Technology, "STEM Workforce Data Project: Report No 2, Women in Science and Technology: The Sisyphean Challenge of Change," 2004.
[23] National Science Foundation, 2003 Survey of Doctoral Recipients (SDR03), http://128.150.4.107/statistics/showsrvy.cfm?srvy_CatID=3&srvy_Seri=5.

higher, on average, than men's.[24] Importantly, when compared with their educational gains, women's entrance into the S&E workforce has been disappointing. In 2003, the overall share of women among full-time doctoral-level S&E employees (23.2 percent) was considerably lower than their share of doctoral degrees from the preceding ten years.

Career Ladders in Bioscience

Scientists in bioscience organizations can advance via one of two tracks. In the "Science Track," scientists advance by managing larger labs, leading multiple projects, and overseeing bigger budgets. In the "Executive Track," scientists advance from a scientific research position into an executive management position. The main difference between the two tracks is that for the "Science Track," scientists never leave bench science, whereas for the "Executive Track," scientists make the break from scientific research to administration. However, executive positions require management and leadership skills that span an organization, which makes it challenging for bioscience organizations to find scientists that are both interested in and capable of executive leadership. Because seasoned scientists bring important perspectives and expertise to strategic bioscience management, organizations that are able to cultivate executive leadership among their scientists will be better able to compete than those who are unable to bring scientists into the executive management ranks.

For women, there are potential barriers to advancement on either track. In the "Scientific Track," scientists must develop international reputations as reflected in peer-reviewed publications, invitations to present research at conferences, and invitations to join prestigious scientific associations. At the same time, scientists need to be able to marshal the internal financial and human capital resources required to successfully develop new drugs and bring them to market. Stereotypes that view women's leadership and scientific skills and commitments as inferior, as well as a lack of access to the informal networks where reputations are built, can make it difficult for women to advance along this track.

As noted by Carnes et al. (2005), "A substantial body of research shows judgments about expertise contains arbitrary and subjective components that disadvantage women. The criteria underlying the judgments developed over many decades when women scientists and engineers were a tiny and often marginal presence and men were considered the norm."[25]

Advancement along the "Executive Track" requires scientists to exhibit actual or potential leadership on cross-department committees as well as a broad understanding of the complex operations and business of drug development, production, human resources allocation, marketing, and sales. Again, since women face negative stereotypes about their leadership capabilities and lack mentors and informal networks to facilitate their gaining opportunities to learn and exhibit executive management skills, they have more difficulty advancing than men. In either case, by denying women options for advancement, bioscience organizations risk losing and underutilizing important R&D talent and experience.

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[24] Commission on Professions in Science and Technology 2004.

[25] Molly Carnes, Stacie Geller, Eve Fine, Jennifer Sheridan, and Jo Handelsman, "NIH Director's Pioneer Awards: Could the Selection Process Be Biased Against Women?" *Journal of Women's Health*, vol. 14, no. 8 (2005): p. 684-691; Laurie Rudman and Stephen Kilianski, "Implicit and Explicit Attitudes Toward Female Authority," *Personality and Social Psychology Bulletin,* vol. 26, no. 11 (2000): p. 1315-1328.

Gender Differences in Promotion

We used two datasets to explore gender differences in promotions in the bioscience workforce: the 2000 U.S. Census 5 Percent Public-Use Micro-Sample (PUMS00) and the National Science Foundation Survey of Doctoral Recipients 1993 and 2003 (SDR93, SDR03). PUMS00 contains detailed occupational, industry, salary, and demographic information for a 5 percent sample of the 2000 U.S. Census. It is one of the best datasets available to evaluate trends in the overall U.S. workforce by educational level, experience, gender, race, and family status. We included in our analysis the scientists, technicians, physicians, nurses, and managers employed in the bioscience industry.[26] The sample includes the bioscience workforce at all educational levels.

In contrast, the SDR93 and SDR03 is a much smaller (but more detailed) source of data on the bioscience workforce; SDR93 and SDR03 capture the workforce history of Ph.D.-level scientists from the time they obtained their degree and entered the workforce. SDR93 includes scientists who earned their Ph.D.'s between 1975 and 1993, while SDR03 captures scientists who earned degrees between 1975 and 2003. By analyzing SDR93 and SDR03, we can evaluate how gender differences in promotions may have changed during the ten-year period when the bioscience industry experienced dramatic growth.

The Census and the SDR datasets complement each other. While PUMS00 provides a representative U.S. sample of all scientists employed in the bioscience industry, it lacks detailed information on family relationships, job descriptions, field of degree, individual career paths, and places of employment. In contrast, while SDR93 and SDR03 include information on many fewer scientists, there are more variables on each scientist, allowing for an in-depth analysis of the determinants of gender gaps in promotion. Together, the Census and SDR datasets provide a rich and current overview of the status of female scientists in the biosciences.

As in other areas of the labor market, occupational segregation by gender persists in the bioscience industry. In 2000, while 32 percent of women and 41 percent of men were employed as managers, only 1.6 percent of women, compared with 5.2 percent of men, were employed as top managers.[27] Overall, 2.5 percent of the women scientists, compared with 4.3 percent of the men scientists, held Ph.D.'s. Men were more likely than women to be chemists, physicians, and computer scientists; women were more likely than men to be employed as biologists, technicians, pharmacists, and nurses.

Gender differences in management positions were accounted for primarily by gender differences in education. When controlling for race, age, and marital status, regression results showed no gender gap in management or scientific management positions for men and women who held Ph.D.'s.[28] However, for those women and men with Master's degrees (but no Ph.D.), men were 2.7 percent more likely than women to be top managers and 3.7 percent more likely to be managers.[29]

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[26] For simplicity, we combined pharmaceutical and medicine manufacturing (NAICS 3254) and medical equipment and supplies manufacturing (NAICS 3391) to construct the bioscience industry. Since NAICS 5417 (Scientific Research and Development Services) might also contribute to bioscience research, we also separately conducted the analysis for this industry calling it the science R&D industry. To capture those who are full labor market participants, we included only those employees who were employed 35 hours per week or more in this analysis.

[27] Defined here as CEO (Source: 2000 US Census 5 Percent Public Use MicroSample [PUMS00]).

[28] Source: PUMS00

[29] Source: PUMS00

For Ph.D.-level scientists, the results for top management positions were somewhat different. Men's (slight) promotion advantage was explained by gender differences in the effect of family on promotion. In particular, male scientists, but not female scientists, who were married to non-working spouses, obtained a 2.7 percent promotion advantage into top management positions.[30]

Gender Differences in Pay

We also used PUMS00 and SDR93 and SDR03 to examine gender pay gaps in the bioscience workforce. In bioscience and science R&D, full-time working women earned less than full-time working men in every occupational category.

Table 1: Gender Differences in Bioscience Salaries, 1999[31]

Occupation	Men	Women	Women/Men
Chief Executives	$161,071.69	$109,006.48	0.68
General and Operations Managers	$113,198.09	$77,990.03	0.69
Engineering Managers	$95,430.89	$74,689.66	0.78
Medical and Health Services Managers	$80,686.65	$53,179.85	0.66
Natural Sciences Managers	$109,383.07	$75,977.27	0.69
Managers, All Other	$100,537.29	$62,419.96	0.62
Logisticians	$66,906.82	$43,666.67	0.65
Management Analysts	$62,900.00	$68,829.67	1.09
Computer Systems Analysts	$86,450.00	$53,791.08	0.62
Computer Programmers	$63,541.99	$54,290.13	0.85
Computer Software Engineers	$72,939.19	$57,304.27	0.79
Operations Research Analysts	$79,398.59	$57,968.97	0.73
Miscellaneous Mathematical	$73,841.96	$47,493.27	0.64
Chemical Engineers	$77,199.64	$64,736.62	0.84
Computer Hardware Engineers	$63,025.40	$49,244.44	0.78
Biological Scientists	$56,632.76	$44,084.39	0.78
Medical Scientists	$68,475.00	$49,291.61	0.72
Chemists and Materials Scientists	$64,515.32	$48,834.14	0.76
Biological Technicians	$58,737.97	$40,976.74	0.70
Chemical Technicians	$50,728.75	$39,477.54	0.78
Postsecondary Teachers	$337,413.70	$50,774.37	0.15
Pharmacists	$71,168.79	$53,613.54	0.75
Physicians and Surgeons	$168,154.85	$99,884.23	0.59
Health Diagnosing	$75,913.04	$55,770.59	0.73
Clinical Laboratory Technologists	$44,933.52	$35,219.61	0.78
Diagnostic Related Technologists	$46,949.08	$34,273.12	0.73
Health Diagnosing Support	$33,642.47	$26,915.16	0.80
Licensed Practical Nurses	$33,996.86	$26,845.92	0.79
Miscellaneous Health Technologists	$75,875.00	$38,466.38	0.51
Other Healthcare Practitioners	$51,027.17	$41,715.25	0.82

[30] Results for 1993 and 2003 cohort were strikingly similar (Source: SDR93, SDR03).
[31] Source: 2000 US Census 5 Percent Public Use MicroSample (PUMS00).

Men also earned more than women for each educational level. Female mathematicians, pharmacists, managers, and top managers earned less than 70 percent of what men earned, while women in operations positions earned 96 percent of what men earned. Male Ph.D.-level scientists earned 25 percent more than female Ph.D.-level scientists.[32] Furthermore, even when controlling for gender differences in demographic, education, and labor market variables—which are important human capital determinants of gender differences in pay[33]—gender salary gaps for Ph.D.-level scientists and mangers persisted. Specifically, male scientists earned 8 percent more per year than similarly qualified female scientists; male managers earned 10 percent more than similarly qualified female managers; and male top managers earned more than 23 percent more than similarly qualified female top managers.[34]

Summary and Discussion of Findings: Bioscience Workforce

Our research showed that, even though women made up a growing and large segment of those earning S&E advanced degrees, they were more likely than men to be unemployed and remain underrepresented in the bioscience management workforce. While there were no gender gaps in promotion to management for Ph.D.-level scientists in either 1993 or 2003, at the Master's level, men had a distinct promotion advantage. This suggests that women were required to be more qualified than men before they were considered for promotion. Results also showed that men were more likely than women to be promoted into the top management positions largely due to the positive benefits of having a non-working spouse.[35] Women scientists obtained no such benefit from a non-working spouse. Finally, the pay analysis revealed male managers earned significantly more than female managers even after controlling for manager level and other labor market, education, and family variables that could account for gender differences in qualifications related to pay.[36] This phenomenon—whereby women obtained lower rewards to promotion than similarly qualified men—has been termed a "sticky floor" that has apparently grown in strength between 1993 and 2003.[37]

[32] Result not shown in table but from analysis of SDR03 data.

[33] Francine Blau, Marianne Ferber, Ann Winkler. *The Economics of Men, Women, and Work* (Prentice Hall: 2004).

[34] Gender wage gaps for Ph.D.-level scientists and managers have actually risen in the last ten years (Source: SDR93, SDR03).

[35] The "wife" factor has been noted in other professions. See Shira Boss, "Wedded to Work, and in Dire Need of a Wife," *The New York Times*, August 11, 2007.

[36] In similar research conducted for academic scientists and using the survey of doctoral recipients, Ginther (2001) finds different results. Namely, Ginther found *significant* differences in promotion up the faculty ranks and substantial differences in salary within ranks. At all faculty levels, women scientists were less likely than their male counterparts to be promoted to the next level, while within each level, women earned less than similarly qualified men. Donna K. Ginther, "Does Science Discriminate Against Women? Evidence From Academia, 1973-1997," (February 2001). FRB Atlanta Working Paper No. 2001-2. Available at SSRN: http://ssrn.com/abstract=262438 or DOI: 10.2139/ssrn.262438.

[37] Booth et al.

PHYSICIANS IN ACADEMIC MEDICINE

For the past two decades, research has indicated persistent gender discrepancies between the academic careers of U.S. men and women scientists and engineers. Do these discrepancies hold for academic physicians? Women have made important advances in the medical field since the 1972 passage of Title IX of the Higher Education Act—legislation that prohibited discrimination based on sex in schools that were federally funded.[38] Yet, more than thirty years later and despite the fact that women have achieved near parity in their share as applicants, first-year enrollees, students, and graduates of medical schools, national statistics show significant gender differences persist in the academic medicine workforce.

Promotions in Academic Medicine

In academic medicine, only those physicians employed on a tenure track are eligible for promotions through the faculty ranks. Outside of this track, physicians can be hired as adjunct professors or as post-doctorate researchers, but these positions are not permanent, can depend on grant funding, and typically must be renewed every year or two. Importantly, unlike researchers in tenure-track positions whose salaries are automatically raised periodically, people in post-doctoral or adjunct positions must raise their own salary through negotiation or job changes.[39] Post-doctoral positions are most often held by new graduates seeking to build research skills, projects, and reputations required for application to tenure-track positions. Colleges and universities are increasingly relying on temporary adjunct positions to cover classes. In the past, these temporary teaching positions were held mainly by newly minted Ph.D. recipients, but the last ten years has seen an increase in the number of academics making a long-term career of adjunct positions.

On the tenure track, physicians can be employed in either a research or clinical path. Both functional paths can require physicians to conduct research and teach as well as provide health services; however, the emphasis between these job duties differs by function. The primary focus of research physicians is research, and promotion through the tenure ranks is dependent on how successful the researcher is at publishing in peer-reviewed journals, establishing an international reputation, and securing large federal and corporate grants to support research.[40] Physicians on the clinical track can also do research, but the emphasis for promotion is more on their work teaching students and providing health services. Research positions are considered the most prestigious and are the most intensely competitive.[41]

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[38] American Medical Association Women Physicians Congress and AMA Archives, Women in Medicine: An AMA Timeline, http://www.ama-assn.org/ama1/pub/upload/mm/19/wimtimeline.pdf.

[39] Thanks to Abigail Stewart, Sandra Schwartz Tangri Professor of Psychology and Women's Studies, and Director, ADVANCE Project, Institute for Research on Women and Gender, University of Michigan, Ann Arbor, for pointing this out.

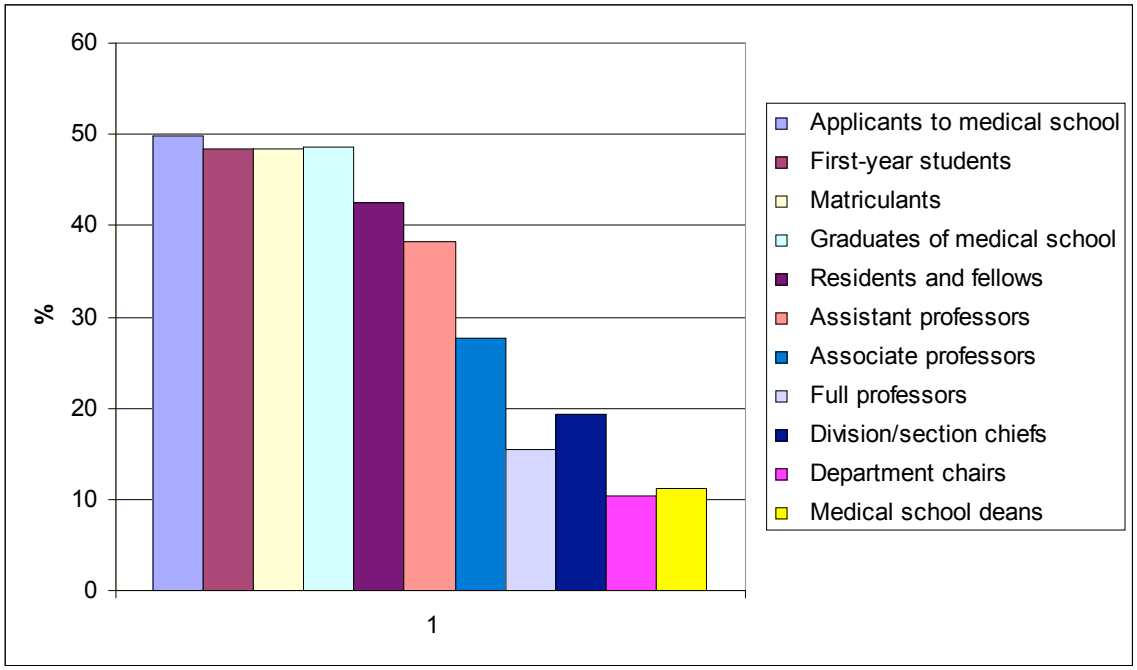
[40] "In two and a half decades, drug companies' funding of biomedical research—much of it conducted at universities—has risen from $1.5 billion to $55 billion. In the United States, pharmaceutical investment in biomedical research has outpaced and, ultimately, overtaken the federal government's investment in such research, expected to be about $36 billion in 2008. See Melissa Healy, "Drug Research: From Funding to Findings," *Los Angeles Times*, August 6, 2007.

[41] Information gathered through interviews with Academic Hospital Research Administrators.

Gender Differences in Rank and Promotions

According to the Association of American Medical Colleges (AAMC)[42], in 2006, women were less likely to hold full professor positions, have tenure, and to serve as department chairs or hold top-level decanal positions.

Figure 4: Snapshot of Women in Medicine, 2005[43]



Women held only 43 percent of residency and fellowship positions, 32 percent of total medical faculty positions, 19 percent of division or section chief positions, and 10 percent of department chairs. Although 43 percent of medical school assistant deans were women, women held only 11 percent of medical dean positions.

In 2006 women comprised only 32.3 percent (38,287) of the 118,700 full-time faculty members at accredited medical schools in the United States and Puerto Rico. The greatest share of women was among assistant professors, where women held 38.3 percent (18,336) of all positions. In the next, higher-ranked level of associate professors, women comprised only 27.7 percent (6,936) of the faculty. Among full professors, women held the fewest positions, with a share of only 15.5 percent (4,349), despite the fact they comprised 40.9 percent of medical

[42] Each year, the AAMC publishes a statistical benchmarking report on the status of women in academic medicine. The most recent reports for the 2005 and 2006 academic years document the share of women among medical school applicants, students, graduates, residents, and fellows, as well as the percentage of women in medical school faculty and high-level administrative positions.

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school graduates in 1996 and 30.8 percent of graduates in 1986.[44] An additional 22.6 percent (8,666) of positions in other ranks, including instructor, were held by women faculty.

Totaled across all faculty ranks, women were underrepresented in every teaching specialty in 2006. The specialty areas with the largest share of women professors overall were pediatrics (46.5 percent), obstetrics and gynecology (46.4 percent), public health and preventative medicine (45.7 percent), and dermatology (41.4 percent). Within these four specialties, the share of women professors bore an inverse correlation to faculty rank. The only rank with shares of women larger than 50.0 percent was assistant professor, where women were slightly overrepresented in pediatrics (54.2 percent), obstetrics and gynecology (53.7 percent), public health and preventative medicine (52.9 percent), and dermatology (51.0 percent). These numbers declined as professorial rank increased to associate and full professor. Interestingly, although women are consistently overrepresented among obstetrics and gynecology residents, the most dramatic decrease between professorial ranks occurred in this field, as women comprised 35.6 percent of associate professors and only 17.1 percent of full professors.

Table 2: Teaching Specialties With the Largest Share of Women Professors, 2006[45]

Discipline	Assistant Professor	Associate Professor	Full Professor	Total Across Ranks
Dermatology	51.0	40.2	19.6	41.4
Obstetrics and Gynecology	53.7	35.6	17.1	46.4
Pediatrics	54.2	41.1	23.0	46.5
Public Health and Preventive Medicine	52.9	42.6	24.3	45.7

In 2005, 39 percent (4,279) of all new hires at accredited medical schools were women, a slight increase from 2000, in which women comprised 36 percent of new hires. There were only eight schools that filled 50 percent or more of their open faculty positions with women,[46] and six schools filled 25 percent or less of their open positions with women.[47] Of faculty departures, women comprised 36 percent (3,274) of the total; approximately 9 percent of all women faculty members left their positions in 2005.[48]

In 2005, 261 women were awarded new tenures, comprising 27 percent of the total. Overall, women held 18 percent of tenured faculty positions across all accredited medical schools, up from 15 percent in 2000. Only 11 percent of all women faculty members were in tenured positions, in contrast to 24 percent of all men. The share of both tenured women and men

[44] American Association of Medical Colleges, *Table 1: Medical Students, Selected Years, 2006*, www.aamc.org/members/wim/statistics/stats06/start.htm.

[45] The total column includes women faculty holding positions at other ranks, including instructor; See American Association of Medical Colleges, *Table 3: Distribution of Faculty by Department, Rank, and Gender, 2006*, www.aamc.org/members/wim/ statistics/stats06/start.htm.

[46] The percentages of women hired at seven of these eight schools ranged from 50 percent to 64 percent; Universidad Central del Caribe School of Medicine was an outlier with women comprising 100 percent of new hires.

[47] The percentages of women hired at five of these six schools ranged from 22 to 25 percent; the University of North Dakota School of Medicine and Health Sciences was an outlier with women comprising 0 percent of new hires.

[48] See American Association of Medical Colleges, *Table 6: New Hires and Departures, 2005*; and *Table 7: 2005 Benchmarking: Full-Time Faculty by Gender, Rank, and Tenure*, www.aamc.org/members/wim/ statistics/stats06/start.htm.

faculty members, however, decreased from 2000, from 16 percent and 33 percent, respectively.[49]

Women in Academic Medical Leadership Positions[50]

In 2005, women held 19.4 percent (887) of division/section chief positions and 22.6 percent (236) of associate and vice chairs at accredited medical schools. Across all departments, including basic science, clinical science, and other departments, women held 10.4 percent (303) of all department chairs. Within the departments, women held the greatest percentage of chairs in other departments, at 30.3 percent (27), followed by basic sciences, with 13.1 percent (102), and finally clinical sciences, with 8.5 percent (174). There were five medical schools with no women serving as department chairs, and 28 schools with one woman department chair.

Among decanal positions, women were underrepresented at every level in 2005. Similar to the relationship between professorial rank and share of women, there was an inverse correlation between level of decanal position and share of women. At the assistant dean level, women comprised 43.1 percent of the total positions. The percentage of women at the associate dean level was smaller, at 32.4 percent, and women held the smallest portion among senior associate deans, at 26.8 percent. Lastly, only 14 (11.2 percent) out of the total 125 medical school deans were women. As of 2005, two of these 14 women were either acting or interim deans.

Summary and Discussion of Findings: Physicians in Academic Medicine

Women are steadily increasing their share of the medical school student community; as of 2006, women were nearly at parity with men applicants, students, and graduates. An increasing number of women are continuing their medical training in residency positions after graduation. Although women continued to be overrepresented in three specialty fields—obstetrics and gynecology, pediatrics, and dermatology—it is interesting to note that with the exception of medical genetics, the resident specialties showing the most overall growth of women are in surgical fields, including rectal and colon surgery and thoracic surgery.

The trend toward parity between women and men declined as women exit medical schools and their residencies and join the academic workforce. Across the board, women were less well represented in the academic workforce, especially as full-time professors and in top decanal positions. Taken as a whole, these findings generate more questions than answers. For example, why did women, who represented more than three-fourths of all obstetrics and gynecology residents, only comprise 53.7 percent of assistant professors, 35.6 percent of associate professors, and just 17.1 of full professors in this same specialty? Are women specialists in obstetrics and gynecology overwhelmingly choosing to go into practice? Or is there another factor serving as a barrier to their overall advancement? One can follow a similar line of reasoning for many of the other statistics presented in this summary; as of yet there is no discernable explanation.

Previous research has shown that implementing structural changes to departments within medical schools, such as using the promotions committee to monitor the progress of women

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[49] See American Association of Medical Colleges, *Table 8: 2005 Benchmarking—New Tenures and Promotions*, www.aamc.org/members/wim/ statistics/stats06/ start.htm.

[50] American Association of Medical Colleges, See *Table 9: 2005 Benchmarking: Division/Section Chiefs and Department Chairs*; *Table 10: 2005 Benchmarking: Decanal Positions*; and *Table 12: Women Deans of the U.S. Medical Schools, October 2006*; www.aamc.org/ members/wim/statistics/stats06/start.htm.

physicians, offering improved mentoring programs for women, and creating a career development program for women, leads to an increase in the share of women among faculty members and in rates of promotion. It would be interesting to see how many, if any, of U.S. medical schools have implemented these programs over the past ten years and if they have seen any corresponding improvement.

WHO LEADS NURSING?

Gender Differences in Nursing Pay and the Decision to Enter Nursing

To begin our analysis of the nursing profession, we examined the determinants of salary for all nurses to see how the qualifications and labor market experiences of men and women affected their earning potential. Previous research has attempted a similar analysis; however, the research failed to account for selection of registered nurses into the nursing workforce. A registered nurse does not necessarily work in nursing. The decision to enter nursing is based on variety of reasons, many of which differ by gender in ways that can also influence salary.[51]

Approximately 88.4 percent of male registered nurses reported working in nursing, whereas only 81.5 percent of female registered nurses reported holding a job in nursing. Those that reported not holding a job in nursing were either not employed at all or simply employed in another field. Of the men that reported not working in nursing 54.9 percent of them were employed elsewhere. However, for the women, only 26.8 percent of those not working in nursing held another type of job.

Gender differences were evident in the reasons that respondents provided for not working in nursing. Men were more likely to say that they didn't work in nursing because they could earn more at their current (non-nursing) job or they found their current job more rewarding. Women were more likely to report that they did not work in nursing because their nursing skills were out-of-date or they were taking care of their family.

Women who chose to work in nursing were less likely than men to make a full-time commitment to the profession. Seventy percent of female nurses worked full-time, whereas almost 90 percent of male nurses worked full-time. Thus, not only was selection into nursing important, but there were gender differences in the underlying selection of a nursing career.

Analysis of wage data showed that male nurses employed full-time earned 9.3 percent more than female nurses. Further analyses showed that men received higher wage offers than women, and the wage offers to women were not high enough to bring them into the market.

Gender Difference in Nursing Leadership and Pay

We next focus on gender gaps in nursing leadership. Nurses were asked to provide the title of their position. From the list of position titles provided, six positions were identified as positions of leadership including: administrator of organization/facility/agency or assistant; administrator of nursing or assistant; dean, director, or assistant/associate director of nursing education; head nurse or assistant head nurse; nurse manager; supervisor or assistant supervisor.

Table 3 profiles the gender differences in nursing leaders. The majority of nursing leaders—94 percent—were female, and 6 percent were male. However, it is important to note that only 6 percent of the nursing workforce was male. Thus, males were proportionally represented, which is usually not the case for females in male-dominated jobs where women's underrepresentation in the workforce is reflected to an even greater degree in leadership.[52]

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[51] Charles Link, "Returns to Nursing Education: 1970-1984," *Industrial and Labor Relations Review*, vol. 23, no. 3 (1998): p. 372-387

[52] Catalyst, *2005 Catalyst Census of Women Board Directors of the* Fortune *500* and *2005 Catalyst Census of Corporate Officers and Top Earners of the* Fortune *500* (2005).

Table 3: Characteristics of Nursing Leaders by Gender[53]

	Female	**Male**
Total	3022 (94.00%)	199 (6.00%)
Average Annual Salary	$52,790	$56,123
Average Age	46	43
Highest Educational Attainment		
Diploma	585 (19.72%)	13 (0.08%)
Associate Degree	1024 (34.07%)	81 (37.52%)
Baccalaureate Degree	955 (31.00%)	80 (41.38%)
Master's or Doctorate	454 (15.21%)	25 (13.25%)
Average Years Since Highest Educational Attainment	15.61	11.44
APN Degree		
Hold an APN Degree	163 (5.45%)	9 (4.49%)
Do Not Hold an APN Degree	2859 (94.55%)	190 (95.51%)
Marital Status		
Married	2110 (69.47%)	152 (74.85%)
Widowed, Divorced, or Separated	684 (22.52%)	12 (0.06%)
Single	215 (0.08%)	33 (18.89%)
Have Children		
Yes	1630 (54.01%)	126 (63.02%)
No	1363 (45.99%)	68 (36.98%)
Race		
White	2598 (87.39%)	162 (85.10%)
Other	408 (12.61%)	35 (14.90%)

Salary premiums also exist for males in nursing leadership positions: women earned $3,333 less per year than their male counterparts did. Additional differences existed in personal and professional characteristics. The women at the top of nursing were, on average, three years older than men and had 4.17 years of additional experience.[54] Additionally, women who made it into leadership positions were more likely than men to hold a Master's or doctorate degree and APN degrees. The personal lives of men and women in leadership positions also differed. Women in leadership positions were less likely than men to have children and more likely to report being widowed, separated, or divorced.

Regression results that controlled for gender differences in education, demographics, experience, sector, and region showed that women were more likely than men to be nursing leaders. This means that women were the high attainment group or, after controlling for individual characteristics, were more likely than men to be in a leadership position.

Approximately 39 percent of the gap was explained by differences in characteristics of men and women, and 61 percent remained unexplained. The explained portion of the gap was mostly

[53] National Sample Survey of Registered Nurses, http://datawarehouse.hrsa.gov/NSSRN.htm.
[54] However, since experience is measured by proxy as the number of years since highest degree and women are more likely than men to have breaks in labor market participation, women's labor market experience may be overestimated.

due to gender differences in education and employment. Specifically, women had a higher average number of years since high school, which is a proxy for labor market experience. The portion of the gap explained by employment setting seems to be accounted for by the higher prevalence of women working in nursing homes. This may be evidence of women choosing to work in a setting where they have a greater opportunity to advance.

The estimated salary gap for nurses in leadership positions was 6.53 percent, meaning that, on average, female nursing leaders earned 6.53 percent less than similarly qualified male nursing leaders. It is interesting to note that this wage gap for nursing leaders was slightly larger than the wage gap for the entire nursing workforce. So, even though women nurses were able to attain positions of leadership, they were paid disproportionately less.

Summary and Discussion of Findings: Who Leads Nursing?

This study has revealed several important conclusions for the women of nursing. In this field dominated by women, women were actually more likely than men to advance into leadership positions. Part of the reason women were more likely than men to reach leadership positions is that women had higher educational credentials and more labor market experience. Still, most of the gender gap in leadership (positive for women) remained unexplained by gender differences in qualifications.

Regardless of leadership position, male nurses and nurse managers earned more than their female counterparts by 6.4 percent. Unlike in other industries, including bioscience, the male-female salary gap did not widen along the career hierarchy. For both nurses and nurse leaders, most of this gender gap in salary was unexplained by gender differences in personal characteristics, education, and labor market experiences.

Another significant finding was that male nurses received higher wage offers than women. There may be several reasons for this selectivity effect. First, due to wage discrimination and occupational segregation, men have access to higher wages outside of nursing than do women. Second, because nursing is so heavily female-dominated, men may face non-wage costs to entering nursing including threats to their masculinity and a drop in job status. These non-wage costs would in effect cause men's reservation wage for nursing to be greater than women's. Organizations facing nursing shortages or wanting to create more gender balance in their nursing workforce may be willing to pay men rents to attract men to their workplaces.

The research presented here suggests that men do not enjoy a "glass escalator" to advancement in nursing like those found in other female-dominated occupations.[55] Women were more likely than men to obtain leadership positions in nursing due in part to greater educational credentials and labor market experience. At the same time, female nurses faced a slight "sticky floors" model of promotions whereby leadership positions paid them less than similarly qualified men.

[55] Christine Williams coined the phrase "glass escalator" to describe men's more rapid advancement in female-dominated occupations in "The Glass Escalator: Hidden Advantages for Men in the Female Professions," *Social Problems*, vol. 39, no.3 (1992): p. 253-267.

CONCLUDING REMARKS: GLASS CEILINGS AND STICKY FLOORS

This research has documented gender gaps in representation, promotion, and pay throughout the bioscience and healthcare workforces. In bioscience, women's share of all scientific, mathematical, and engineering degrees has outpaced their representation in the bioscience workforce. Even at the Ph.D. level, women's representation in the bioscience workforce falls short of women's share of the Ph.D.'s earned over the last ten years. Once they enter the bioscience sector, female scientists earn substantially less than similarly qualified male scientists. At both the Master's and Ph.D. levels, women were as likely as men to be promoted to middle-level management positions but less likely than men to be promoted into top management. Within management, women earned less than men, and this gap widened as they moved up the career ladder over the ten-year span from 1993 to 2003, when the bioscience industry was growing rapidly.

Female research physicians faced stronger barriers to promotion than did their scientific counterparts in industry. Even though women have swelled the ranks of graduates with medical degrees, they have had difficulty moving from adjunct and post-doc positions into more promising tenure-track research jobs. Female research physicians remain underrepresented at all professorship ranks and as heads of medical departments and in dean positions. Research has also documented pervasive and unexplained gender wage gaps throughout the medical research pipeline.

The situation for nurses is slightly different. In the nursing profession, we observed that women were more likely to hold leadership positions, mainly due to their higher qualifications. Still, male nurses and nurse leaders earned significantly more than their female counterparts.

Academic Medicine Versus Bioscience Industry

Why might the barriers to women's advancement in academic medicine differ from those facing female scientists in the bioscience industry? Research physicians and bioscientists are both highly qualified, having committed many years to the development of their specialized skills. Several of the medical university leaders we interviewed for this project told us that to be successful, research physicians, like their counterparts in industry, need to develop international reputations, be invited to speak at important scientific conferences, publish extensively in peer-reviewed journals, and secure large research grants. Whereas scientists in the bioscience industry may also be expected to develop international reputations, their success at a bioscience organization will most importantly be based on whether the work they do and manage leads to new products. Profitable product development may be a more objective measurement of success than the harder-to-pin-down metrics for reputation. Because women are subjected to negative stereotypes of their leadership and scientific abilities, promotion criteria that are more subjective could make advancement more difficult for women.[56]

A second area where the work environments between the two sectors differ has to do with product creation. Whereas bioscience firms operate in a highly competitive market environment, academic medical systems are more insulated from these market pressures. Bioscience firms

[56] For research on biased stereotypes against women see: Catalyst, *The Double-Bind Dilemma for Women in Leadership: Damned if You Do, Doomed if You Don't* (2007); Catalyst, *Different Cultures, Similar Perceptions: Stereotyping of Western European Business Leaders*; Catalyst, *Women "Take Care;" Men "Take Charge:" Stereotyping of U.S. Business Leaders Exposed* (2005).

spend billions of dollars over many years on R&D for new drugs and medicines. Only a fraction of the drugs developed successfully make it to market. In such an environment, it becomes important to support the talent and human resources that can best develop new drugs. In comparison, in academia, where there not as much pressure to create a product for market and where much more basic research is undertaken—as well as teaching—the criteria for who has "talent" can be more subjective. In an environment where achievement is measured by a global network of peers and no one criteria exists for measuring what is "good" or "best," women may have more difficulty making the case for their advancement.

Why Sticky Floors?

While the "glass ceiling" is a well-documented phenomenon facing women across the labor market, the rising wage gaps that women face with promotion—"sticky floors"—are less well known.[57] In this report, we document sticky floors for women physicians employed in academic medical centers, Ph.D.-level scientists employed in bioscience, and nurses. Theory would suggest several factors contributing to women's slower wage growth with advancement.

The first is that the management positions that women hold may be at a lower level in scope, rank, power, or influence than the management positions that men hold. If these distinctions in management positions are not well captured in the broad management categories used in our data, we might observe gender parity in promotions but gaps in wage growth. So, while we may see which scientists are in top management positions and in what kind of organizations, there may be finer-grained distinctions in the scope and influence of these positions that could account for the gender gaps in pay.

A second factor contributing to the sticky floor has to do with the observation that women are often paid less than similarly qualified men *prior* to promotion. Since wages obtained after promotion are often tied to wages earned currently, women would be at a disadvantage when negotiating for post-promotion wages.

Finally, if women are offered fewer other advancement opportunities than men—if, for example, due lack of access to informal networks they have fewer other advancement prospects than men[58]—they will be in weaker bargaining positions than men when negotiating starting salary. Further eroding women's bargaining power in salary negotiation may be women's inability or low willingness to relocate.[59]

[57] Booth et al.

[58] For research on how the lack of access to informal networks hinders women's career advancement see Catalyst, *Women and Men in U.S. Corporate Leadership: Same Workplace, Different Realities?* (2004).

[59] Linda Babcock and Sara Laschever, *Women Don't Ask: Negotiation and the Gender Divide* (Princeton University Press, 2004).

NEXT STEPS

These gender gaps in promotions, pay, and representation at top and middle scientific and management levels affect more than just individual women, whose careers and aspirations may be cut short by a lack of opportunities and/or recognition of their contributions. Importantly, the promotion and pay gaps identified in this research can affect an organization's ability to innovate and grow. If companies are to manage and support the creative R&D and services backbone of their organizations within a global context, they must cultivate and utilize women's scientific and management talents.[60]

Research by Turner (2006) suggests that companies that are unable to recruit and retain female scientists may lose productivity and creativity gains.[61] In her firm-level analysis of R&D team productivity, Turner found that gender diversity had a positive impact on individual performance. In particular, gender diversity led to an increase in the ratio of research bonuses to salary in an estimation that controlled for age, gender, position, nationality, team age, and job group diversity effects. Her model calculated a 0.7 percent increase in individual performance for every 10 percent increase in the team's gender diversity. Turner further found that gender diversity had a positive impact on the date of delivery of a product and a negative effect on costs.

As Shirley Tilghman, President of Princeton University, said at a 2005 speech recognizing the importance of women for science:

> By encouraging women to embrace science, we likely increase the range of problems under study, and this will broaden and strengthen the entire enterprise…. If women continue to be under-represented in science, engineering, and mathematics, these fields will look increasingly anachronistic to students, and we risk losing the most talented among them, who will, after all, have an infinite range of career options from which to choose.[62]

Science needs women. Organizations that are best able to recruit, support, and promote women's contributions to research, innovation, and creativity will be in the best positions to provide excellent healthcare and medicines worldwide.

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[60] To further this research, two forthcoming Catalyst reports examine gender differences in career paths in more depth. One explores the specific challenges to advancement that women scientists employed in the R&D functions of bioscience organizations may face. The other examines career path experiences of women and men M.B.A. degree recipients.

[61] Laure Turner "Gender Diversity: A Business Case?" in European Commission, *Women in Science and Technology: The Business Perspective* (Brussels: European Commission, 2006).

[62] Shirley Tilghman, "Changing the Demographics: Recruiting, Retaining, and Advancing Women Scientists in Academia" (presented at the launch of the Earth Institute ADVANCE Program, Columbia University, March 24, 2005).

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