FLEXIBILITY AND FAIRNESS: EFFECTS OF THE NETWORK FORM OF ORGANIZATION ON GENDER EQUITY IN LIFE SCIENCE CAREERS

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ABSTRACT: *Why do women have more opportunities in some employment settings? I investigate how organizational form affects gender stratification among life scientists. I propose that firms governed by networks, rather than bureaucracies, allow for greater equity. Hierarchy and rules hide gender bias, while reliance on ties outside the organization provides transparency and flexibility. I analyze the careers of 2,062 U.S. life scientists and interviews with 41 scientists. I examine employment data by gender for two patterns: early entrance into the biotechnology industry and promotion within network and hierarchical organizations. Gender does not affect when a scientist enters the biotech industry but is related to promotion. Men are more likely to attain early supervisory-level positions across organizational settings. Female scientists are nearly eight times more likely to supervise in biotech firms than in more hierarchical settings. The two organizational forms—network and hierarchy—provide different employment experiences for female scientists.*

Gender inequality tends to be hidden in organizations. To understand the different labor market opportunities for men and women, we must know something about the organizations in which they work. Organizations have undergone rapid changes since the Cold War era. DiMaggio (2001:4–5) summarizes scholars' understanding of key changes in economic organization: "Throughout the world, the strong boundaries that once separated firms have become less distinct, while traditional arms-length market transactions have become more intimate. New forms of coordination—'relational contracting'—have emerged that entail much less commitment and control than bureaucracy, but more binding ties than simple market exchange." At the end of the twentieth century, some organizations held on to traditional bureaucratic forms while others had flatter hierarchies and more permeable boundaries. My focus is gender inequality across these two organizational forms—network and hierarchy—in the context of the life sciences. This

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Sociological Perspectives, Volume 47, Number 1, pages 25–54.

ISSN: 0731-1214; online ISSN: 1533-8673

context is unusual in that as the biotechnology industry emerged and firms employed interorganizational networks to develop the commercial potential of rapidly expanding knowledge in the life sciences, by and large biotech firms were not absorbed into the existing multinational pharmaceutical corporations. Thus the career options available to life science PhDs now include positions in firms governed by networks, as well as in the more traditional hierarchical settings of universities and large drug companies.

I investigate the gender stratification aspect of these organizational forms and examine whether female scientists have greater career opportunities in network organizations than in hierarchies. Bureaucracy is said to aid women, in that rules correct gender discrimination in hiring and promotion decisions (Padavic and Reskin 2002; Reskin and McBrier 2000). Yet we know from classic ethnographies of organizations (Dalton 1959; Gouldner 1954) that instituting more bureaucratic rules and levels of hierarchy tends to increase the power and salience of informal, hidden modes of operation. In certain contexts, then, hierarchy and formalized rules might not help women's careers; instead more flexible organizations with interfirm connections may permit the transparency that dispels bias in decision making. I analyze employment data on 2,062 life sciences PhDs in the United States to look for two patterns by gender: early entrance into the biotechnology industry and promotion within network and hierarchical organizations. Data from interviews with forty-one scientists illustrate how the two organizational forms—network and hierarchy—provide different employment experiences for female scientists. If innovative, flat network structures are key to the future of world economic organization (Castells 2000; Powell 2001), what does this mean for the representation of women in visible positions of power?

STUDYING ORGANIZATIONS, GENDER, AND SCIENCE

Understanding the connection between organizational form and gender equity in the life sciences can contribute important knowledge to three substantive areas of sociology: organizations, gender, and science. Sociologists have provided many insights into the informal workings of organizations. Dalton's (1959) study of a chemical manufacturing plant showed that top executives' move to formalize the assignment of maintenance repairs to departments simply led to savvy middle managers using even more covert means to get their repair jobs done. Managers powerful in the informal organization had greater access to maintenance, allowing them to keep their production figures up, while those outside informal cliques experienced longer delays. Kanter (1977) found that women, excluded from informal sources of power in a large bureaucracy, faced barriers to management mobility. The few women who were able to move up the management track successfully had to have powerful male sponsors. Other studies of managers in large corporations continue to find the same result. Mentoring differs by gender (Ruderman, Ohlott, and Kram 1995). Women need to establish a strong informal tie to a male mentor—essentially borrowing his social capital—to move up the career ladder, whereas male colleagues form their own informal ties to advance their careers (Burt 1998; Ibarra 1992; Morrill 1995). Large bureaucracies have slowed the career mobility of women in other industrialized nations as well, showing the generality of this structural disadvantage. In Brinton's (1993) study of Japan, she found that men and women enter large firms in equal proportions but that 22 percent of men enter the permanent employment career track while only 7 percent of women do. Women in Japan are much more likely to shift from larger to smaller firms over their employment lives, again suggesting that hierarchies are unfriendly to women. What we do not know from the existing literature is whether other modes of organizing—such as the network form—will foster women's careers or make things worse.

Economic Organization

We do know that organizations governed by networks are more conducive to speed, innovation, and learning than are hierarchies (Podolny and Page 1998; Powell 1990). Hierarchies tend to follow Thompson's (1967) maxim that organizations buffer their core competencies from the external environment, while networks use collaborations to develop new technologies and bring products to market. A key asset of networks is the ability to collaborate with other partners, learn across relationships, and become central in webs of interorganizational relationships (Smith-Doerr and Powell 2004). To cope with uncertainties, network actors pursue collaboration with familiar sources of relevant expertise (Burt 1992; Granovetter 1985). The basis of trust for interorganizational relationships can be founded on common ownership and cross-holdings such as the Japanese *keiretsu* (Gerlach 1992), on location and kinship ties as in the Third Italy (Piore and Sabel 1984), or on membership in a common technology community such as Silicon Valley (Saxenian 1994). Internally, network forms of organization are flatter, are based on cross-departmental teams, and have fluid boundaries. These factors underscore that the network form is based on a different organizational logic than is the more hierarchical form (Powell 1990).

High-technology sectors may benefit especially from organizing through networks rather than hierarchies. The biotechnology industry is rife with interorganizational networks, and the firms more centrally located in industry circles are the most innovative and profitable (Baum, Calabrese, and Silverman 2000; Powell, Koput, and Smith-Doerr 1996; Stuart, Hoang, and Hybels 1999). Simultaneously managing ties with universities and research institutes for basic science, with pharmaceutical corporations and hospitals for clinical testing, and with venture capital for funding and management advice contributes to a biotech firm's ability to remain on the cutting edge in a fast-paced industry. In information technology, Saxenian (1994) documented the greater flexibility and learning that occurred in densely connected, permeable Silicon Valley firms in contrast to the more hierarchical companies lining Route 128 in Massachusetts.

The study of contrasts between networks and hierarchies, however, has not considered the implications for gender stratification. The effects of organizational form on gender equity are important because they can reveal whether technological innovation and equality are a zero-sum game. Do we need to assess the tradeoffs between medical breakthroughs and equitable distribution of scientific resources, or is there a positive relationship such that greater diversity leads to increased innovation? Feminist critiques of organization studies and economic sociology (Acker 1990; Britton 2000; Milkman and Townsley 1994) have pointed out the lack of attention to gender issues in organizations, yet the question remains of how gendered different forms of economic organization might be.

Gender Inequality

The literature on gender and work provides useful leads on the question of why inequality persists in the labor market as a whole. Job queuing is a theory that has been offered to explain how men and women are segregated in different jobs and how certain jobs change from being "male" to "female" (Reskin and Roos 1990). Employers implicitly value male applicants more highly and hire them before female applicants. When jobs become less desirable in prospects for income, status, or mobility, they become feminized. Because men no longer want the jobs, employers are led to hiring female workers farther down the queue. Historical examples of American jobs that became devalued and then feminized are clerical work, book editing, and pharmacy work (Reskin and Roos 1990).

Literature on the gendering of fledgling jobs is especially relevant for the consideration of queues into the new biotechnology industry. Research on new fields shows that as jobs become more desirable they change from being viewed as "women's work" to "men's work." For example, women were selected for the first computer programming jobs in the 1940s because the work superficially resembled clerical tasks (Donato 1990). Once men recognized that programming demanded logical, mathematical, and electronic skills, they filled the jobs. Later, when programming was parsed into skilled and deskilled work in the 1960s, women were employed for the lower-paying, less prestigious jobs such as keypunching. Similarly, in Victorian England, women became novelists when the occupation was déclassé (Tuchman 1989). As novels increased in readership and novelists were afforded more visibility and reward, men redefined the field. And after the turn of the century, highbrow literature was defined by "manly" realist novels written by male authors, who closed the field to women.

Wright and Jacobs (1994) study job queuing in computing—a high-tech industry located in many of the same areas as the biotechnology industry. They argue that the queuing dynamic of lowered rewards leading to feminization, as described by Reskin and Roos (1990), does not seem to explain what has occurred in computer occupations. Computing actually increased in desirability as more women entered the field.

The queuing literature provides some important indicators of inequality on occupations but misses a vital aspect of the context of work. As the structural mobility literature has taught us, work—and the gender inequality that may accompany it—is performed in organizations. Measures sensitive to the organizational context of work are often missing in studies of stratification (Baron and Bielby 1980; Reskin 2000). Criticisms of inequality research for missing the context of work are useful, but the response has mostly been studies that look at the effects of such organizational differences as age and size (e.g., Baron et al. 2001). The more substantial variation of organizational form has not yet been considered.

Attention to the relative positions of men and women in organizations can reveal a fuller picture of gender equity. For example, Wright and Jacobs's (1994) study of the computer industry demonstrates that the proportion of female workers is increasing but that women are more likely than men to leave the labor force. What might be occurring is that more women are entering computing but not staying long enough to move into supervisory positions. More detailed information on workers' organizational positions, rather than general job categories, could help to sort out the difference between ghettoization (women work in a lower-paying subfield) and inequity in level of authority (women are less likely to be promoted). One deterrent to studying the organizational structure of gender relations is that data often are not readily available at the organizational level. This study of life scientists has the advantage of looking at relatively stable job roles and organizations that can be categorized into (1) academic settings or pharmaceutical corporations traditionally organized with hierarchical career ladders or (2) biotechnology firms with project-based teams, flatter organizational structures, and multiplex relations with external collaborators.

Women in Science

The natural sciences present no exception to the rule of gender inequality. Female PhDs spend more time delayed in low-paying postdoctoral, nontenure-track positions (Fox 2000; Fox and Stephan 2001). While the life sciences have a larger percentage of female PhDs than physics or engineering, female life scientists earn the lowest median income among their scientific and engineering sisters (NSF 1998:table 3-13). This low pay probably results from their more extensive periods as postdoctoral researchers. Across scientific disciplines, male PhDs are more likely than their female counterparts to achieve higher academic ranks (Cole and Zuckerman 1984), and male scientists are found in higher proportion in research universities compared to other educational institutions (Fox 1996). Cole and Singer (1991) attribute the gender gap in science to "limited differences" for women. A lack of encouragement to apply for prestigious postdoctoral fellowships, a rejection instead of a request to "revise and resubmit" on the first grant application, family responsibilities taking up even just a little more time per week—these limited differences add up to larger differences for women relative to men in later career positions.

The study of stratification in science focuses almost solely on academic scientists (for reviews, see Long and Fox 1995; Zuckerman 1988). A National Academy report edited by Long (2001) suggests that gender inequality in the university may be on the decline. Yet without systematic comparisons of different organizational contexts of scientific work, it is difficult to pin down the mechanisms that lead to more equal career outcomes. Gender differences among scientific professionals have not been well researched in the industrial sector (Rayman and Jackson 1996). The lack of variation in types of science organizations studied means that the interesting question of how the form of organization affects gender inequity among scientists is left unanswered.

The Life Sciences Context

The number of PhDs in the life sciences has been growing since the early 1990s (NRC 1998), as the knowledge expanding field has attracted students interested in breakthroughs in therapeutics, the human genome, and genomics, the latter integrating computing and biological research. Much of the cutting edge research is being conducted in biotech firms as well as universities (Kenney 1986). Women now make up about 40 percent of PhDs, compared to 13 percent female in 1970 (NSF 2002:appendix table 2-24). As female PhDs in the life sciences are no longer at token numbers, the continued existence of gender inequality requires explanation (Etzkowitz, Kemelgor, and Uzzi 2000). Further, because significant numbers of female scientists are found in all sectors, it is now possible to study the question of whether gender inequality is constant or varies by type of organization.

The emergence of the biotechnology industry is a result of (1) the applications of life science discoveries, through melding of the basic and applied sides of science to a greater extent than previously done in other scientific organizations, and (2) innovation in reliance on extensive collaboration among firms in most activities. Typically, biotechnology companies are founded by academic scientists with venture capital backing. The industry is populated by relatively small firms, in contrast to the pharmaceutical industry, which is made up of large corporations. Dedicated biotechnology firms, the core of the industry, are research-intensive organizations primarily concentrating on genetic engineering and molecular biology for human therapeutic and diagnostic applications.[1]

Because biotechnology is an expanding, knowledge-intensive industry, organizational learning occurs across interorganizational networks rather than solely inside individual firms. Previous research has shown that firms with the most collaborative experience in research and development (R&D) and the most centrality in industry networks develop more ties and more diverse portfolios of collaboration, are more likely to go public (Powell et al. 1996), and have more employees (Koput, Smith-Doerr, and Powell 1997). More central biotech firms are less likely to exit the industry or fail, and garner more nonoperating income and sales (Baum, Calabrese, and Silverman 2000). Thus, at the industry level, rewards come to firms that have extensive, diverse interorganizational connections, that is, many partners for different functions (e.g., R&D, distribution, licensing). Consequently, the biotechnology industry provides an exemplar of the network form of organization and an alternative for life scientists to organizations based on a more hierarchical model. This naturally occurring organizational variation in the traditionally gender-stratified field of the life sciences sets the stage for the questions I address in this article.

Are male or female PhDs more likely to seek out positions in biotechnology firms early in the industry's growth? From a queuing perspective, men are more likely to be the first entrants into a new job arena if it is a desirable one. Since the advent of the industry, male academic "star" scientists have founded biotech firms, and some of the most frequently cited papers in molecular biology have been published by scientists affiliated with biotech firms (Zucker, Darby, and Brewer 1998). Men may disproportionately have better access to information about the desirability of biotech jobs compared to traditional industry jobs. Gendered hiring queues should thus lead men into the industry earlier than women. Thus:

> *Hypothesis 1:* Male PhDs will be more likely to enter biotechnology industry positions before female PhDs.

A related question to that of the gendering of an employment arena is, who is likely to have upward mobility in organizations? Natural science careers are notoriously stratified by gender; my sample of life scientists is not expected to be exceptional in this regard. The following hypothesis arises from the consistent findings in the literature on gender stratification among scientists and other professionals.

> *Hypothesis 2:* Male PhDs are more likely than female PhDs to obtain supervisory positions.

Yet the flexibility of the network form, in contrast to more constrained roles in traditional hierarchies, leads to the expectation that gender inequity will be relatively less in these organizations. The few scholars who have looked at network-like organizations for gender equality have found opposite effects. McIlwee and Robinson (1992) found that female engineers were disadvantaged in startups, which they argue are more network based. One line of argument is that the formal rules in hierarchies provide an advantage for women. Women are often disadvantaged by informal norms, especially in technical jobs (Tierney 1995). On the other hand, Brinton (1993) found that women professionals in Japan achieved greater equity in subcontracting firms having more balanced network relations rather than those more dependent on parent corporations. Systematic comparisons across organizational forms have not been made in the gender and organizations literature.

When will gender be a less important characteristic for sorting people into different organizational roles? In biotechnology firms, the tasks are less minutely specialized than in pharmaceutical corporations, and scientists are less dependent on one principal investigator as a powerful sponsor than in academia. "Teamwork" is more than just rhetoric in network organizations; it is the basic organizational structure. One might expect that gender becomes more salient to work roles in a network organization because of fewer rules governing fair apportionment. I have a different expectation. Work organized into project teams may mean that less attention is drawn to gender differences than to individual contributions to the group.

Incentives at the team level change the predisposition to stereotypical roles. In one biotech firm laboratory that I studied, when a project team had successfully reached a breakthrough the company held a party in its honor. Congratulations for the research and the team's name were printed on special labels affixed to the champagne bottles distributed at the festivities. The team was honored as a whole. In contrast, the academic laboratories I observed always seemed to have the background agenda of credit for the individual. Because academic rewards accrue to individuals (tenure is a notable example), scientists are given credit (i.e., name order on publications) based primarily on their hierarchical role. When roles must be assigned hierarchically because of the connection to rewards, with relative level of subordination and power clearly marked, women are more likely to take assisting rather than leading roles. When less attention is paid to differentiation of work roles, men and women move more equally into supervisory roles. In my example, the leader of the team honored at the champagne party was a woman who had not been able to lead research projects in academic positions she had held. Among life science organizations, I argue that networked biotech firms will display more gender equity than more hierarchical organizations.

> *Hypothesis 3:* Employment in a network organization, compared to a more hierarchical setting, will increase the likelihood of a female PhD obtaining a supervisory-level position.

DATA AND METHODS

Quantitative Sample

Available national data sets on scientists (e.g., SESTAT) do not allow a researcher to disaggregate the occupation category "industry," which perhaps explains why sociologists of science have not looked inside the industrial context quantitatively. My theoretical focus on the difference between network and hierarchical forms, as operationalized by the difference between biotechnology firms and other settings, compelled me to look elsewhere to construct an appropriate data set. In the end, I selected the quantitative sample of life science PhDs through their graduate or postdoctoral university program's participation in an institutional national research service award, granted by the National Institute of General Medical Sciences (NIGMS). Among the twenty-six institutes in the National Institutes of Health (NIH), the NIGMS provides universities with the largest number of these training grants, as they are more commonly known. From a list of forty-two university programs awarded training grants in the areas of cellular and molecular biology, I drew a random sample. I selected this area in consultation with NIH program directors as one of those that are the broadest, that is, cover a large number of specialties.

In the training grant applications, university programs created tables to list the faculty members' students, current and past, and the PhD student's current organizational position. All students in a university program are included in the grant application information, not just those funded by the training grants. I coded the entire group of past doctoral and current and past postdoctoral students for each university program into my database, 3,395 PhD careers.[2] The university programs vary in prestige of school (from top 5 to middle 50) and region (West, Midwest, Northeast). Furthermore, the addition of career information from postdoctoral researchers educated at other universities adds diversity to the education variable. Although only six universities provide the database foundation, the information from those schools generates data for PhDs from more than one hundred U.S. universities (out of a population of nearly 200 ranked programs). Incentive to retain an NIH training grant is high, both for financial and prestige benefits; thus information on former students' careers is mostly complete.

A data-driven limitation of the sample is that it is composed primarily of PhDs who have recently received their degrees; calendar age is not available. Early career trajectories are good indicators of future ones (Cole and Cole 1973; Cole and Zuckerman 1984; Merton 1973; Zuckerman 1977), however, so we might reasonably assume that the findings based on early job placements generalize to subsequent careers for this sample of PhDs.

Measures

Table 1 presents descriptions of the measures used for logistic regression analyses. Gender was coded from first names. The gender ratio is proportionate to other national samples of PhDs in the biological sciences (Davis et al. 1996; Fox 1996; NRC 1998). Nationally, women make up 28.6 percent of life science PhDs (NSF 2002); likewise, they constitute 28.3 percent of my sample.

I derived the measure for educational classification from a ranking published by the National Research Council (1995) on PhD programs in molecular biology and biochemistry. Universities are ranked from 1 ("most effective," in NRC terms) to 200.[3] Prestige of education is collapsed into three categories: schools ranked 1–10, 11–50, and 51 or more. These categories match scientists' discussion of "top" schools, "B-level" schools, and "others" in qualitative interviews. For postdoctoral students listed in the data source, I recorded the ranking of the universities from which their PhDs were received. The sample parallels the population in terms of where PhDs received their degrees. On average, 75 percent of life science PhDs come from schools ranked in the top 50 (NRC 1995); in my sample, 67 percent of PhDs graduated from these programs. "Years since PhD" is the number of years

TABLE 1
Description of Variables Used in Logistic Regression Analyses

Variable	*Minimum-Maximum Value*	*Percent in Category or Mean (S.D.)*
Gender	0 = male	71.7
	1 = female	28.3
Rank of PhD education	1 = 50–200	33.3
	2 = 11–50	43.9
	3 = 1–10	22.9
Years since PhD	0–39 years	5.30 (4.50)
Biotech affiliation	0 = nonbiotech	93.7
	1 = biotech	6.3
Period of entry into biotech industry	0 = after 1988	61.6
	1 = to 1988	38.4
Supervisory position	0 = nonleader	71.3
	1 = leader	28.7

N = 2,214.

from degree completion to the time the information was recorded; on average, this number is five years.

Employment in a biotechnology firm is used as a variable in two ways. As a dependent variable, affiliation with a dedicated biotechnology firm measures who enters the new industry (Hypothesis 1). As an independent variable, biotech affiliation represents the effects of employment in a network form of organization (Hypothesis 3). In contrast, hierarchical organizations include university and other higher educational organizations, government agency and nonprofit research institutes, hospitals, and pharmaceutical and chemical corporations. The smaller proportion in biotech does not preclude comparing position level attained in biotech compared to other organizations in logistic regression models. Note that biotech employment is not used as an independent and dependent variable in the same models.

"Period" is a dichotomous dependent variable in which the early period measure is before 1989, whereas the 1990s are regarded as later in biotechnology industry history. One indicator that the biotech industry had reached viability is that after 1988 an independent press began recording and selling information on firm activity in a volume called *BioScan.* The time prior to this trade publication is considered the early years of the industry (ca. 1975–88).

"Level of position" integrates academic, industry, and government settings into one ordered scale developed in consultation with scientists in the public and private sectors. Because this is a relatively young sample, the main positional difference occurs between those scientists who supervise and direct projects and those who follow others' guidelines in working at the bench. Nonsupervisory jobs are distinguished from leadership positions in this dichotomous variable. In the natural sciences, when a PhD has completed one or several postdoctoral positions and has finally obtained "a lab of one's own," it is a significant career step. In academia this step is usually represented by the assistant professor position and in industry by the "senior scientist" or "research group leader" title. This measure of position fits nicely with the available data, as young scientists who have achieved leadership roles are usually not occupying positions at the very top. The distribution of people in jobs along the ladders in Table 2 from student in another discipline to CEO is such that most individuals in this sample are clustered right above and below the leadership line (i.e., postdocs and staff scientists or assistant professors and research team leaders). The dichotomous measurement for supervisory position thus indicates a significant boundary in the real world and in the available data. The majority of this young sample holds nonsupervisory (i.e., postdoctoral training) positions.

Methods

Because dichotomous dependent variables are specified, I use logistic regression models to test the hypotheses. For the analyses of gender effects on timing of entry into the biotechnology industry, the dependent variable is affiliation with a biotech firm. The explanatory variable is gender $\times$ period, to see whether the effects of gender differ in the early period of the biotech industry compared to

TABLE 2
PhD Positions and Supervisory Level

Academic Position	*Industry Position*	*Supervisory Level*
Student in another discipline, RA		0
	Assistant, technician	0
Postdoctoral fellow		0
	Scientist	0
	Team director	1
Assistant professor		1
Associate professor		1
	Department/section head	1
Full professor		1
	Upper research administration	1
Dean/administration		1
	Board of directors, CEO	1

the later period. The controls include the effects of gender, period, and education, as well as education × period, in case educational prestige is more important to young PhD careers in either period.

For the second set of models, the dichotomous dependent variable is supervisory position. Prestige of education and years since PhD are controlled for in these models. Hypothesis 2 states that male PhDs are more likely than female PhDs to obtain leadership positions, hence the explanatory variable is gender. Hypothesis 3 adds consideration of the organizational form in which scientists are employed. Employment in a network organization, compared to a hierarchy, will increase the likelihood of a female PhD obtaining a supervisory position. Thus the explanatory variable in the model for H3 is gender × biotech. In addition, this model controls for the effects of gender and biotech affiliation and education × biotech, in case having a prestigious education matters more for obtaining supervisory positions in biotech firms.

In-depth, qualitative interviews inform the quantitative results. I interviewed forty-one life scientists working in U.S. biotech firms, universities, a nonprofit institute, government agencies, and a pharmaceutical corporation between 1993 and 1998. Interview data that explore the relationship between gender and working in different organizational forms are presented below to amplify the statistical analyses.

RESULTS

Gendered Entry into the Biotechnology Industry

The sociology of science literature shows good evidence of a competitive queue for tenure-track academic positions. Men and PhDs from more prestigious programs head the line into academia as they disproportionately garner positions compared to other PhDs (Long and Fox 1995). But what is the effect of the emergence of the biotechnology industry on life science careers? Has there been a queue of life scientists into the biotechnology industry as there has been into tenure-track life science jobs? The question for the data presented here is whether who goes into biotech—a majority of male or female PhDs—differs by industry period.

Before presenting the model testing the hypothesis of female entry early into the open industry, I report a basic model (1) without interacting the independent variables with the industry period. This model allows for the assessment of the main effects of the variables, and the results are found in Table 3 below. The log odds resulting from the model are transformed into percent change in odds in the third column of the table. Table 3 demonstrates the results of the logistic regression model of the effects of gender and period in biotechnology industry history, controlling for PhD granting department, on the probability of a PhD's entrance into a biotech firm. This table shows that entry into the biotechnology industry is

TABLE 3

Effects of Gender on Entry into the Biotechnology Industry by Period: Results of Logistic Regression Analyses

	(1)			*(2)*		
Variable	*Logistic Coeff. (S.E.)*	*Sig. Level*	*Percent Change in Odds*	*Logistic Coeff. (S.E.)*	*Sig. Level*	*Percent Change in Odds*
Constant	−2.2312 (.2103)			−2.4052 (.3257)		
Education rank 11–50[a]	−.3819 (.1741)	.0282	32 decrease	−.4607 (.3053)	.1313	n.s.
Education rank below 50[a]	−.8652 (.2136)	.0001	58 decrease	−.9655 (.3737)	.0098	62 decrease
Gender (F)	.0182 (.1726)	.9161	n.s.	.2880 (.3264)	.3777	n.s.
Period (later)	.2497 (.1673)	.1356	n.s.	.5008 (.3839)	.1920	n.s.
Educ rank 11–50[a] × period				.1088 (.3717)	.7697	n.s.
Educ rank <50[a] × period				.1409 (.4554)	.7570	n.s.
Gender (F) × period				−.3860 (.3854)	.3165	n.s.
−2 Log-likelihood	1232.134			1231.379		
Chi-square	20.606	.0004		21.360	.0033	
Degrees of freedom	4			7		

N = 2,211

[a] The relevant comparison is to education in PhD program ranked in the top ten.

affected by educational background. Holding the effects of period constant, those with a middle-ranked education, in comparison to the elite educated, have their odds of entering the biotechnology industry decrease by 32 percent. PhDs from the least prestigious departments, compared to those from top-ranked schools, have their odds of entering the biotechnology industry decrease by 58 percent. Gender is not a significant predictor of entering the biotech industry arena.

The key concern for Hypothesis 1, however, is whether the effects of gender differ by time period. Thus the model of interest (2) includes interaction terms for gender by period (and education by period). Table 3 also presents the results of this interaction term model. Percent change in odds due to each coefficient is also shown for the hypothesized model.

The results of model 2 in Table 3 show that the noninteractive independent variables have nearly the same effects as in model 1. In comparison to those educated in a top ten department, PhDs with degrees from departments ranked lower than 50 have their odds of going into the biotech industry decrease by 62 percent. PhDs with middle-ranked educations have only a marginally significant chance of decreased odds of ending up in biotech, compared to the elite educated, in model 2. There is no significant difference between the middle and top departments for industry entry here, but that may be due to the loss of degrees of freedom to nonsignificant coefficients, in comparison to the first model. PhDs from elite institutions are more likely to enter biotechnology than are other scientists—but this does not vary by industry period. The lack of significant difference between periods indicates that where a scientist received his or her PhD continues to matter across the industry timeline. All things considered, the main effects of education are very similar in both models.

Neither gender nor period is a significant predictor of taking a biotechnology job, in both analyses. The lack of significance for the interaction between gender and time period does not bode well for Hypothesis 1. Based on the queuing literature and information on the early legitimacy of biotech, I hypothesized that gender would significantly predict entry into biotechnology differently by time period so that men would step into the new industry first. The results indicate that, instead, men and women seem equally likely to enter the biotechnology industry, in both time periods. No gender queuing appears to be taking place. An alternative to the gendered "female to male" or "male to female" diffusion of job entry is that there is no difference in who enters a new arena by gender. Although a negative hypothesis cannot be definitively tested, it appears that there is provisional evidence that gender does not predict when PhDs are likely to enter the biotechnology industry.[4] This lack of support for Hypothesis 1 (or for its converse, that women enter first) suggests that standard queuing theory does not easily explain entry into this industry.

Gender Stratification among Life Scientists

Hypothesis 2 predicts that gender stratification will occur in scientific careers across sectors, as has been found repeatedly among academics. The first model in

TABLE 4

Effects of Gender on Mobility into Leadership Positions by Form of Economic Organization: Results of Logistic Regression Analyses

	(1)			(2)		
Variable	*Logistic Coeff. (S.E.)*	*Sig. Level*	*Percent Change in Odds*	*Logistic Coeff. (S.E.)*	*Sig. Level*	*Percent Change in Odds*
Constant	−2.1387 (.1447)			−2.7914 (.4879)		
Education rank 11–50[a]	−.2988 (.1296)	.0212	26 decrease	.3991 (.5048)	.4292	n.s.
Education rank below 50[a]	−.1064 (.1370)	.4375	n.s.	.6624 (.5740)	.2485	n.s.
Gender (F)	−.3837 (.1225)	.0017	32 decrease	−.9178 (.4506)	.0417	60 decrease
Years since PhD	.2340 (.0159)	.0001	26 increase	.2504 (.0165)	.0001	28 increase
Biotech affiliation				.6600 (.4999)	.1867	n.s.
Educ rank 11–50[a] × biotech				−.7912 (.5221)	.1297	n.s.
Educ rank <50[a] × biotech				−.9134 (.5902)	.1217	n.s.
Gender (F) × biotech				1.4087 (.4688)	.0027	Significant increase[b]
−2 Log-likelihood	2194.104			2151.987		
Chi-square	299.864	.0001		341.982	.0001	
Degrees of freedom	4			8		

$N = 2{,}062$

[a] The relevant comparison is to education in PhD program ranked in the top ten.

[b] See text for discussion of percent change in odds in this interaction coefficient.

Table 4 analyzes the effects of gender on position. Controlling for the number of years since the PhD was granted, who is more likely to achieve supervisory positions in science-intensive organizations? Gender is related to leadership position, so that men are more likely to become leaders. Being female is associated with a 32 percent decrease in one's odds of attaining a leadership position. Years since PhD, not surprisingly, is positively related to attaining a leadership position. The results presented in Table 4 show that men are more likely than women to attain supervisory roles (controlling for years since PhD). These results do not mean that female PhDs have less prestigious degrees; the rank of university programs in molecular biology is controlled for in the model. The first model is consistent with other studies of stratification in academic science; men are generally more likely than women to have leadership positions. The next question that arises is whether these results for leadership will differ by employment in different organizational forms. Will gender still have the same effects when comparing network to hierarchical organizations?

For Hypothesis 3, model 2 in Table 4 presents the results of a logistic regression analyzing the effects of gender and whether the job is in a biotech firm on the level of position achieved. Years since PhD, the control variable, is positively related to attaining a supervisory position. Prestige of PhD education (in organizations other than biotech firms, because of the interaction term) is not related to position here. Educational rank does not significantly affect supervising when it is interacted with being in a biotech firm or not; having a top-ranked education does not matter more for supervising in biotech firms than for other types of organizations. Again in the second model, gender is related to leadership position. Being female results in a 60 percent decrease in odds of occupying a leadership position in a nonbiotech organization. The significant interaction of gender with biotech affiliation, however, indicates that the difference between the effect of gender in network and hierarchical forms is significant. Women are more likely to supervise others' science when employed in biotech firms. Let us examine this interesting finding more closely.

That women attain more success in network organizations is not a result simply of the fact that there are more women or more leadership positions in the biotechnology industry. Although the logistic regression model protects against this by controlling for the marginals on biotech and gender, the percentages are illustrative. Those in the network organizations have gender and leader distributions similar to those in other organizations. In this sample, the percent female for PhDs in the biotechnology industry is 28.7, nearly the same as percent female in all other organizations at 28.3. The percentage of PhDs who are leaders in the biotech industry is 18.4, compared to 29.4 in supervisory roles at other employing organizations. Biotech firms, if anything, have proportionally fewer people in leadership roles because they tend to have flatter job ladders than do hierarchical organizations.

If you are a woman, is it more advantageous to be in a network organization rather than a hierarchy? To address the question of the benefit of the network form for female PhDs, we can add the biotech and gender interaction coefficients. This reveals the magnitude of the effect for women of being in a network form: 2.0687. Female PhDs in biotech firms are nearly *eight times* as likely to be in leadership positions than are female PhDs in more hierarchical organizations. The clear result is that women who are employed in a network form are much more likely to attain leadership roles. In contrast, there is no significant difference in leadership chances for male PhDs, as demonstrated by the nonsignificant biotech coefficient in Table 4, model 2. Men are neither more nor less likely to attain leadership positions in the biotechnology industry.

DISCUSSION: WHY IS THERE EQUITY IN THE NETWORK FORM OF ORGANIZATION?

The quantitative data show that employment in a biotechnology firm benefits the careers of female PhDs, but they do not tell us why that might be the case. First, I look at some common explanations at the organizational and individual levels. I then describe the explanation that emerged from my interview data—flexibility—an aspect of the network form that operates across organizational and individual levels. In examining qualitative data, however, there is not the same certainty for ruling out alternative explanations as there is with quantitative controls.

Organizational Age and Size

One explanation for biotech gender equity might be that the relatively younger firms have not had the time to accrete taller authority structures like older companies. In observations of biotechnology firms ranging from two to twenty years old, I did not detect differences by organizational age in the use of the network form or female leadership. Another age-based argument might be that young organizations find it difficult to compete with older ones for candidates and thus are forced to hire less desirable scientists (which females may be stereotyped as) for positions of responsibility. But young firms do hire desirable candidates. PhDs with top-ranked educations enter biotech firms and top universities; biotech firms have an easier time hiring good candidates than many other older industrial organizations.[5]

Unfortunately, quantitative data are not readily available at the organizational level to compare characteristics such as size and age. Organizational-level data of any type are often not available in studies of individual mobility; broad occupational code is often the only recorded employment context. Even when very good organizational-level data are examined for effects on individual careers (e.g., Baron, Mittman, and Newman 1991; Haveman and Cohen 1994), the studies focus on careers in organizations in only one population. My examination of jobs in organizations in different populations (i.e., the biotechnology industry, the pharmaceutical industry, academia) within one field (life sciences) means that the data on the organizational level are less detailed to fit within the confines of one project. By missing information on size, I cannot estimate how size might operate through other variables (Osterman 1995) or how aspects of hierarchy might affect women differently in smaller organizations (MacDermid and Williams 1997). Anecdotally, I observed similar patterns among scientists working at biotech firms of 30 to 3,000 employees, but compared to pharmaceutical corporations such as Glaxo that employ more than 100,000, it is difficult to say how much of the equity effect is due to the relatively small size of biotech firms.

Individual Socialization and Productivity

A possible explanation for the gender equity in the biotechnology industry at the individual level is that differences in gender socialization contribute to women preferring to work in a network form rather than a hierarchical organization, making a larger pool of women receptive to leading research in biotech. This idea would lead to the prediction that network organizations may especially appeal to scientists who have been socialized to prefer cooperative rather than individually competitive work (i.e., women). Although there was less evidence in my data for the gender socialization perspective, at least one scientist believed that the collaborative nature of biotech work appeals to female PhDs and that women are better at teamwork science. In Henry's words: "Collaboration is fundamental in biotech. Women are team players and generally get along better, so they have an easier time moving into biotech firms."[6] This explanation seemed less plausible, especially since none of the women scientists I spoke with offered this explanation.

Unfortunately, at the individual level, quantitative data were not readily available on publication records. Possibly, counter to my argument, female scientists simply do not publish a sufficient number of articles and the higher quality of their publications (Cole and Zuckerman 1984) matters less for promotion, and thus they fail in academia. Then perhaps many women enter biotech by default and are smarter on average than male PhDs in biotech, because smarter men can be productive and stay in university positions. So these smarter, less often published women are promoted in biotech because they are better scientists than their male counterparts. In contrast to this scenario, I assume that there are *not* gender differences in abilities of scientists entering the biotechnology industry. The educational ranking variable provides data that may be related to this scientific productivity issue. There is no difference among scientists who enter biotech firms—male and female—by the ranking of their PhD program, which may indicate that those entering biotech are not necessarily failed academics. But it is probably a stretch to assume similar average productivity for those from the same schools, particularly since women often do not receive the same mentoring that men do in the same departments (Etzkowitz, Kemelgor, and Uzzi 2000). From the qualitative interviews, an admittedly nonrepresentative sample, there is some indication that women in biotech publish just as frequently as those in academia and that highly sought candidates—male and female—choose biotech firms as a place to do science and publish without the "distraction" of constantly writing grants and teaching. However, systematic publication data are needed to rule out the counterargument.

Flexibility

Qualitative observations among life scientists have led to my conceptualization of how the network form produces less inequity than hierarchy.[7] Of the different explanations of relative gender equity, the one that kept appearing in my qualitative evidence had to do with the flexibility of the network form.[8] In talking to scientists about the working environment of biotech firms, I discovered a shared perception of more open opportunities for groups of people traditionally disadvantaged in science, especially women. Miles, a white male academic who had experience working in a biotech firm, commented that he thought the flexibility would especially help women and people of color to move up job ladders: "I think there are more opportunities in biotechnology. There, titles are fluid, and if the person is gung-ho and has the skills they can move more quickly into positions of responsibility." Miles then compared biotech flexibility to the rigidity of academia and the pharmaceutical industry:

> Academia is limited, there tends to be this tunnel vision. The idea is that you go the way your mentor did, and that's the only measure of success. There are good opportunities in industry—especially in biotechnology. At [a multinational pharmaceutical corporation with which he had experience], industry is closer to academic roles—more rigidly defined. If you start as a technician, there's a stigma for moving up to more senior positions.

Flexibility of work roles in a network form contributes to gender equity by allowing the old molds to be broken. Dorothy, a PhD who had been one of the first postdoctoral students in biotechnology, noted that the flexibility of her biotech firm was responsible for her being able to shift her career focus substantially in taking on an extrascientific leadership role: "At [a biotech firm] they were quickly developing research and the board wanted a patent expert in-house. I was interested even though I was a scientist. They knew I was bright, and so they paid me to become a patent agent." Both Miles and Dorothy said that the biotech industry offers less standardized roles than are found in other life science organizations. The flatter structure of biotech firms seems to permit more varied opportunities for all scientists to take positions of responsibility.

Martin, a department head in a small biotech startup firm, argued that having a more diverse group of scientists goes hand in hand with the flexibility and speed required in that industry: "In biotech, the speed of change is very fast, project management flexibility is incredibly important, so what I look for when hiring is good people; and as far as hiring women—diversity is good. Good comes from mixed backgrounds." The idea that rapidly changing science is best researched by a diverse workforce is more than just rhetoric in most biotech firms. Many firms have instituted "family-friendly" practices (Eaton 1999; Eaton and Bailyn 1999; Rayman 2001), which tend to benefit women PhDs especially.

Transparency

Why would the network form of organization be expected to produce *in*equality? I am arguing against the notion that because network organizations have fewer formal rules, they disadvantage less privileged members of society (women, minorities) who need rules to ensure their hiring and promotion. To understand why formal rules are less necessary for equity in network organizations, first we must understand what rules do. Rules create accountability in employers and enforce direct disincentives for discrimination. The network form of organization, however, produces the same functions through transparency. Transparency means that those who hire and promote are accountable to many others outside their office—including, in biotech, venture capitalists and outside scientific advisers. Also, the power difference between management and knowledge-producing employees is not as great as in more hierarchical organizations such as traditional pharmaceutical corporations with finely graded job ladders. Thus a scope condition of this increased gender equity in network organizations may be that it is limited to knowledge-expanding sectors. Perhaps network firms that mainly produce goods rather than create knowledge would be less likely to include individuals of different ethnicities or gender in the trusted circle. My argument applies to

PhDs in biotech—those who have achieved education credentials of the highest level. To achieve true equality in the life sciences, there needs to be greater opportunity for training working-class and minority students in doctoral programs.

Given the lack of socialization narratives, a likelier individual-level explanation is that there are different structural hurdles and opportunities for women in different types of organizations. The biotech industry presents an opportunity to work on exciting basic science—without many of the hurdles to be faced in academia. Opportunities to do challenging research with fewer hurdles (i.e., the tenure clock) for nontraditional scientists appeals to women, thus increasing the pool of well-qualified female PhDs available to biotech firms. Put colloquially, the combined carrot (biotech as good science opportunity) and stick (gendered academic politics) attracts women with leadership potential to biotech firms, compared to other organizations. Sara, a PhD currently leading research in a biotech firm, described an experience with discrimination in a university and compared it to the firm at which she works:

> [In academia] it's hard for women. If you're a man it's not the same way. I had an interview at [a research university] with the chair of [a] department, in his office. One of his colleagues walked by the open door and stopped in to say hello. When I was sitting right there, he told this other fellow, "I have a little girl here from England" [she quotes in a mocking tone]. He thought he was being nice, but he wouldn't have said if I were a man, "I have a little boy here from England."

Like the proverbial workhorse with the carrot and stick, biotech firms present the carrot of the opportunity to do basic science to highly trained women like Sara, who had prestigious postdoctoral training. At the same time, university hierarchies may be, however subtly, applying discriminatory sticks to women who could be potential leaders in academia. George's perception of academia and biotechnology, after spending substantial time in both settings, echoes that of Sara: "In biotechnology, there's more flexibility in terms of hours; it's more difficult to accommodate a family in academia, especially with the tenure clock." Likewise, Amanda's experience of not being able to gain tenure in academia but going on to accomplish much and make a name for herself in biotechnology supports Sara (a younger scientist's) wariness of academia. Amanda claims: "In biotech the 'rules' are clearer, in the university there are more political decisions, you have to 'do things right' as well as do good research." Amanda's emphasis on *rules* indicated that the informal expectations in biotech were actually clearer to her than how to play the game of getting around the formal rules in the university. The idea that there are fewer hurdles for female scientists in biotech firms than in academic settings apparently rings true.

Dorothy, a member of the baby boom generation, felt that the flexibility and visibility of scientific work in the biotech firm facilitated her career success rather than the women's movement alone:

> I feel like I was misled by the women's movement for years. There was no support for us in the academic workplace. Biotech is different in that it supports

> exciting science and encourages publication. You are allowed to see something and try it. That view, I feel, respects me as a scientist. Also, everybody knows everybody, it's important to know people in other companies. It's easier here to go out and do your thing, there's room for it. It's not altruistic, the function is to learn more about being competitive. The company gains by you doing "the next thing," by encouraging publications and presentations.

In contrast to her expectations of an egalitarian academic setting, Dorothy experienced discrimination as a female scientist in the university. Not that she thought being a biotech scientist was easy for women; she told me pithily, "Being a woman and a scientist is like trying to climb a tree with your hands tied behind your back." Her view, which represented the pattern I found in the qualitative data, was that biotech firms were more friendly to women scientists relative to other science-based organizations.

Collaborative Choice

Another equitable feature of the network form is that the project-based nature of work allows women greater choice in selecting research collaborators. Amanda, who has worked in both academic and biotech leadership roles during her career, contrasted the two settings in terms of choosing fellow scientists with a story: "A friend of mine left a tenured position at [an elite university] to go to [a biotech firm]. This person said the university department under [Professor X] was an autocracy. They just wanted to do science, didn't care about the prestige, and could do science there [at the firm]—working with who they wanted to rather than dealing with [X]." This relative choice in colleagues, especially collaborators on one's projects, may particularly benefit female scientists. For example, if a female PhD in a biotech firm is working with a male chauvinist from another organization on one project, she can avoid working with him in the future. In a hierarchy, she would be more likely to be stuck working with the chauvinist in her organization—or spending a great deal of time and energy having him removed. On the other hand, if biotech leaders find smart colleagues through collaboration who treat them with respect, they can often form a long-term relationship that goes beyond a single contract. Network organizations have projects that more routinely span organizational boundaries, heightening variability in working relationships and allowing for multiple modes of organizing work.

A downside of flexibility, however, is that it may exacerbate inequalities at the boundary between PhDs and other scientists. In my research with PhDs in biotech firms, from the scientist in his first week on the job to the chief scientific officer, not one person had to ask permission to talk with me or let me follow them around in the lab and to meetings. The technicians were a different story, however. I felt somewhat chastised in the lab one day while having an extended conversation with three technicians. Their supervisor poked his head in the door and commented sarcastically, "Are you still talking? How is the experiment going?" PhDs have collaborative relationships with outsiders for various projects, so an unknown person conversing with them at length is not unusual, but the direct monitoring of technicians as they work at the bench indicates they are not free to enjoy the flexible organizational boundaries of the firm.

Is the flexibility in biotech firms merely hype, or do they have a collaborative element that truly differs from academic collaboration? Academics in the life sciences certainly do write papers together across laboratories and universities. But this kind of collaboration differs from what I observed in biotech firms in at least two ways. First, there seems to be a greater obsession with who gets credit (understandably so, given the tenure system) than in companies where every scientist has stock options and will benefit from advances in knowledge. Second, who has flexibility—who is able to choose collaborators—differs for biologists in academia and industry. The natural sciences differ from the social sciences in the amount of capital required to maintain a laboratory and its equipment and staff. This resource limitation restricts initiation of collaboration by PhDs who do not have their own labs. In biotech firms, all PhD-level scientists seem to have considerable discretion in which projects they lead and in which projects they have a supporting role. That level of discretion is also true for established principal investigators in universities, especially famous ones with many resources, but less true for other PhD-level scientists—and certainly *not* true for most postdoctoral researchers. Individual discretion in collaboration reflects organizational-level behavior. Biotech firms engage in interorganizational collaboration in all aspects of organizational life, which means greater influence for PhD scientists spanning organizational boundaries in their work.

Collective Rewards

Interorganizational collaboration, the hallmark of the network form, may especially benefit women PhDs in biotech firms. In contrast to personal networking for individual rewards in bureaucratic organizations, which has been shown to increase gender stratification, connections made by those in a network form are perceived to add to the general good. Antonia, a senior scientist at a well-known biotechnology firm, notes that support for collaboration contrasts with her academic experience:

> From my experience at [an academic setting] I could tell you many a true story about political infighting—especially over funding. It was very stressful and *not* a pleasant experience. Now I think there is more camaraderie here because of the secure funding, among other things. I was excited to work at [the firm]; it's a great environment. No one is miserable. We are not compartmentalized—and get to work with many good scientists both here and outside the firm. And we choose who to work with based on nonfinancial considerations, like how good they are in their field.

Male and female PhDs alike receive support in the biotechnology industry for building their interorganizational networks, because the health of the firm is reliant on scientific collaboration. This networking support tends to help women in biotech, in comparison to their female colleagues in more hierarchical settings.

To summarize, there are three main reasons why flexibility in organizational form translates to gender equity: (1) increased transparency in organizations, (2) greater choice in forming collegial relationships, and (3) collective rather than individualized rewards. I am not arguing that members of network organizations are less self-interested than anyone else but rather that the organizational context places constraints on discriminatory behavior. When other organizations are involved in some of the core competencies of your organization (such as a research project in a biotech firm) it is much more difficult to hide discrimination and sexual harassment. In a network organization, when problems arise professionals have the flexibility to either exercise voice or exit a particular project while remaining with the same company. A scientist can voice her concerns and form a long-term relationship of trust with a collaborator in another organization or leave a project led by a discriminatory collaborator. Also, the emphasis on collective rather than individual rewards and the greater visibility of everyone's contributions may make it less likely that a female scientist's work will be suppressed or stolen, as it might by an immediate superior in a hierarchy. A caveat of this project is that more research is needed to gauge how generalizable the argument is. Data are needed to see if other fields with comparable network and hierarchical organizations exist, and whether stratification is mitigated by interorganizational networks. More evidence is also needed to assess whether the equalizing effects of network organizations remain constant when organizational age and size vary more than they do in the biotechnology industry.

CONCLUSION

Summary of Results

Rather than find evidence of gender queuing into the valued new arena of the biotechnology industry, entrance into the new field appears to be proportional to the number of male and female life science PhDs overall. Male and female scientists are equally likely to enter biotech across the entire industry time frame. While female scientists are often treated as peripheral, the early entry of women into biotech alongside men marks the industry as an interesting case. Instead of a subsequent feminization (or masculinization) of the arena as hypothesized, the analyses show that male and female scientists are at all times equally likely to work in biotech firms.

Although there do not appear to be gender differences in entry into biotech, the question arises as to whether gender stratification of PhDs might occur within life science organizations. Given the consistent finding of gender inequality in the academy, it might be expected that women would be less likely to supervise scientific research across other sectors as well. Such stratification in science careers was indeed found: leadership position is dependent on gender. And the result apparently is not due to gender differences in doctoral training, as prestige of education is controlled for in the models.

I have also addressed the question of whether the form of organization affects the likelihood of gender equity among scientists. In this analysis, the organizational field (life sciences) is constant, but there is variation in organizational form: the biotechnology industry represents the network form, and other life science organizations are hierarchical. The hypothesis that stratification by gender would be less pronounced in network organizations was supported. Women are more likely to be in supervisory positions in a network form of organization, such as a biotech firm. In studying why relative gender equity might occur in biotech firms, qualitative analyses provided plausible explanations. The flexibility of biotech firms and the opportunities women have in them to do visible science without jumping many of the hurdles of academia are common themes in the interviews.

Caveats

The limitations of not having data on organizational age, size, or individual productivity have already been discussed above. A limitation of the results regarding the gender queuing hypothesis is that the negative finding is difficult to interpret. Recall the result that there appears to be no gender queue, that men and women entered the biotechnology industry proportionately in both the earlier and the recent industry history. This finding may mean that opposite effects are occurring at the same time—that men entered early because of information from well-connected scientists about the exciting science going on in biotech and that women entered because they were marginalized in the university setting and had to turn to industry out of necessity. I do not think that opposite gendered effects are happening, however, based on the educational prestige data. Men are no more likely than women to attend highly ranked PhD programs, and new PhDs from the same schools are likely to have similar information about the job market. In my field notes of conversations with graduate students, I did not see a gender difference in how the biotech industry was regarded (generally, much better than pharmaceutical corporations). Future research surveying job candidates on their individual network ties and preference for different positions could more directly address the question of who enters a new field, and when and why. What does seem clear from these results is that the organizational context of queuing is an important issue. The lack of gendered entry into the biotechnology industry indicates that we need to think more about when and where gender queuing might *not* be found. Wright and Jacobs (1994) argue that computer work also did not exhibit gender queuing; increasing feminization was not associated with men leaving computer jobs. Perhaps the high skill requirements, relative autonomy, and intrinsic interest of working in the biotech and computer industries make them less likely to be devalued as "women's work" even when more women enter these fields. The main point is that gender and job queuing do not appear to be universal; more theorizing about the conditions of segregation of work by gender is needed.

Another caveat of this project is that the data are drawn from young scientists. I am not comparing male and female scientists at their career peaks. Cohen, Broschak, and Haveman (1998) found that among financial professionals, having a good proportion of women at the top of organizations was a predictor of more gender equality throughout job levels. Some women do have lead positions in biotech firms. The Massachusetts Biotechnology Council counted fifteen female presidents and CEOs of biotech firms in the Boston area in 2002 (*Boston Globe* 2002), more than all the female CEOs in the Fortune 1000 but only about 6 percent of all Massachusetts biotech presidents. More systematic study is needed for comparing male and female scientists on promotion, pay, and productivity throughout their careers in different organizational contexts.

Implications

Generally, research on the stratification of scientists needs to look beyond the academy. Among life scientists, more than a third are employed outside of academia (AAPS 1996; NSF 1998). To understand concepts such as the Matthew effect (Merton 1968), one must have good information on the organizational contexts in which scientists are employed. Recall that when organizational form was not included in the model assessing the effects of individual characteristics on supervisory positions, the results looked like those of many other studies of gender stratification in science. Of course, the important effect of organizational form would not have been seen if scientists in only one organizational setting (i.e., academia) constituted the sample.

Notwithstanding scope conditions, this study has implications for policies to increase gender equity among professionals. Studies of gender stratification tend to focus on the stability of gender inequality rather than investigate social changes toward gender equity (Chafetz 1990). By examining relative equality of opportunity, we might forge policy for change. The idea that nonhierarchical organizations might lead to less patriarchal outcomes in the workplace has been around at least since the 1960s women's movement (Ferree and Martin 1995; Rothschild-Whitt 1979), yet these organizations are normally viewed as experimental or "alternative." Not only are network organizations the standard in the biotechnology industry, but central location in interorganizational networks typify the most successful firms. Across the globe, the number of network firms is increasing and hierarchies are arguably in decline (Gibbons et al. 1994). Thus greater gender equity in biotech firms is not incompatible with economic performance. Small independent firms collaborating for economic productivity may be one route to greater equality in society as a whole (Perrow 1993), and perhaps to greater equity in the careers of men and women.[9]

In the academic realm, universities seem more aware of the consistent inequalities faced by female scientists. The widely publicized 1999 MIT study of tenured faculty women has helped to bring the issue to the table. The results of my study indicate that those like the MIT administration interested in greater gender equality need to consider changes at the organizational rather than individual level. The broad policy implication for greater gender equality among scientific professionals is that organizational forms designed to move away from rigid hierarchical structures, such as those currently found in academia and large pharmaceutical corporations, may allow for a more level playing field.

Acknowledgments: This project was funded in part by grants from the Social and Behavioral Sciences Research Institute and the Department of Sociology at the University of Arizona. Additional support came from NSF grant #97-10729, W. W. Powell and K. W. Koput, Co-Principal Investigators. I am grateful for helpful comments from Woody Powell, Paula England, Lis Clemens, Ken Koput, Cal Morrill, Pat Roos, Heather Haveman, Jason Owen-Smith, Jen Croissant, Julie Kmec, participants in the Social Organization Seminar at the University of Arizona, and the anonymous reviewers for *Sociological Perspectives*. Any remaining errors are mine alone. An earlier version of this article was presented at the 1998 meeting of the American Sociological Association, San Francisco.

NOTES

1. Thus agricultural, veterinary, and environmental biotechnology companies are excluded from the biotech category.
2. Missing data lead to different values of *N* by variable. The most common missing variable is gender, because certain faculty (and even an entire application in one case) list only initials rather than first names. In diagnostic analyses, comparable proportions for other variables were found among those with gender data and those missing gender data (i.e., the same proportion in ranking of PhD program categories). I assume that missing gender data is not significantly biased (i.e., those missing are the same gender). Seven individuals who were listed as deceased also appear as missing on career variables.
3. Ties in ranking do occur. The 1993 scores are attributed to university programs at all time points in the analysis because the 1982 NRC ranking did not include molecular biology programs, another indication of the relative novelty of this scientific area. Because department rankings are stable over time, with 80 percent and above reliability, using the available year's ranking seems judicious.
4. It is also possible that the problem of lower power due to smaller numbers of PhDs entering biotech, or other factors not included in the model, might explain the lack of significant results as expected.
5. One other explanation for gender equality related to organizational age might be that the biotech industry developed personnel systems in the 1970s, when gender equality was more salient due to affirmative action policies, and did not have the inertia of established male-centered organization to overcome. This interesting idea cannot be addressed by data available here. Comparisons to other industries formed at the same time as biotech or later, preferably also involving new technology (such as wireless telecommunications), are needed.
6. All names and some organizational details have been changed to ensure respondent confidentiality.
7. Note that my argument differs from others in focusing on the network form of organization. Scholars who have heeded Baron and Bielby's (1980) call to look at how the organizational context affects individuals' career success have generally focused on the social networks of individuals within one organization. The results of this study, however, demonstrate the importance of examining the interorganizational network context, not just the personal networks of individuals, for understanding career outcomes. For example, Kanter's (1977) classic study of intraorganizational power revealed that "old

boy" networks in a large corporation disadvantaged women's mobility. In contrast, this study finds that the proliferation of interorganizational networks in the biotechnology industry is associated with greater opportunities for women to move into positions of authority.

8. "Flexibility" in the workplace flexibility literature (for a review, see Glass and Estes 1997) more often refers to flex time policies that allow mothers to meet family responsibilities. Perin (1997) finds that project management is *not* designed to provide schedule flexibility in biotech firms and further that firms do not pay attention to gender differences in project management. I focus on how the interorganizational flexibility for scientists working on collaborative projects particularly benefits female PhDs, rather than on workplace policies.
9. Since 2001 biotech firms have not had the same failure rate as dotcoms but still have been adversely affected as stockholders became wary of the market in general and technology investments in particular. Unlike information technology's very short product cycles whereby software can be obsolete in a year or two, biotech is on a much longer product cycle whereby drug development takes at least a decade (Robbins-Roth 2000). Whether gender equity will continue as the biotech industry and venture capital hit harder times remains to be seen. The last big downturn, in the early 1990s, did not seem to affect women's entry and promotion in biotech any more than men's, however.

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