2004-2005 AIR DISSERTATION GRANT PROPOSAL

Employment Sectors as Opportunity Structures: The Effects of Location on Male and Female Scientific Dissemination

Dataset of Interest: Scientists and Engineers Statistics Data System (1995; 2001)

Fellowship Amount Requested: $15,000

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2. PROJECT SUMMARY

Employment sectors are a fundamental dimension of the scientific career that influences work experiences, opportunities, prestige, and productivity outcomes. My previous research has shown that academic scientists experience a greater degree of gender disparity in involvement in patenting and publishing than industrial scientists, yet little is known about the sector-level factors responsible for this difference (Bunker Whittington 2004). In my dissertation I demonstrate the importance of organizational context in guiding dissemination by male and female scientists, and I propose that differences in organizational goals, supply side demands, and the social arrangements and reward incentives of academia and industry contribute to differences in gender disparity across sectors. Existing SESTAT data on the patent and publication counts of male and female scientists employed across sectors provides an empirical test of these factors. I supplement the statistical results with a series of in-depth interviews with scientists and administrators working in a variety of sectors and institutions to assess how sector-level mechanisms are interpreted and understood by both male and female scientists. In sum, I develop a theory of employment sectors as opportunity structures for increasing or decreasing dissemination activity (and disparities) among male and female scientists, and test this theory using both qualitative and quantitative analyses.

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4. PROJECT DESCRIPTION

Statement of the Problem

Information on the patenting and publishing activity of scientists and engineers has long been an interest among scholars of science and technology. Publishing transmits valuable knowledge and resources to other scientists, both in the academy and in industry, while patenting is thought to spur innovation through economic and proprietary incentives. Traditionally, scientists within academia have primarily published, shying away from pursuing economic ends through patenting or other marketable ventures, while industrial scientists have primarily pursued commercial goals. Over the past two decades, however, federal promotion of technology transfer by universities and the increased reliance of outside business firms on academic research have created a strong link between science and technology through the commercialization of university research (Rosenberg and Nelson 1993, Cohen, Florida, and Goe 1994, Owen-Smith 2000). At the same time, in some sectors there is much greater involvement in basic research by industry (Powell and Owen-Smith 1998).

Female scientists have traditionally published (Cole and Cole 1973, Fox 1983, Zuckerman 1987, Levin and Stephan 1998, Long 2001) and patented (Morgan et. al. 2001) less than their male counterparts in the sciences. Research on gender differences in dissemination, however, rarely includes measures sensitive to the organizational context of scientific work. Previous research on gendered productivity has concentrated primarily on the academic realm, and often only with regard to dissemination through publishing. But scientific careers outside the academy are becoming more common, and growth in university-industry relations has increased academic involvement in commercial ventures. While several studies have shown that scientific location

affects research activity, few have concentrated on how program and sector contexts may affect male and female scientists differentially, or focused on productivity outcomes beyond publications. Assessing the effects of organizational context on multiple forms of dissemination is of great importance as scholars begin to sort out the contemporary pushes, pulls, and constraints operating on the female scientist in an era where commercial and academic science are closely intertwined.

My dissertation aims to evaluate the influence of organizational context on productivity disparities between male and female scientists, and identify the mechanisms by which such influences operate. In my previous work using nationally representative data on scientists and engineers in the United States, I used log linear modeling of 1995 SESTAT data to analyze patterns of involvement in publishing and patenting behavior among male and female scientists who are working in four disciplines (life sciences, physical sciences, computer and mathematical sciences, and engineering) and three employment sectors (four-year colleges, government, and industry) (Bunker Whittington 2004). My empirical evidence indicates that the propensity to engage in publishing and patenting behavior varies with gender as well as discipline and employment sector. Findings also suggest that gender differentials in involvement in dissemination activities cannot be attributed solely to the structural positions and places where women are located, or the level of female representation in the field.

The results also show that dissemination disparities between male and female scientists are significantly different across university and industry sectors. Specifically, academic scientists experience a greater degree of gender disparity than industry scientists, other things being equal. Whereas industrial male and female scientists are equally likely to engage in publishing and/or patenting behavior, male scientists in the academy are more likely to engage in these activities

than academic females. Female scientists in academia have a decreased propensity to publish and patent as compared with female scientists in industry, independent of discipline. The fact that academic scientists experience a greater degree of gender disparity than industry scientists suggests the importance of sector contexts in guiding dissemination activities.

By looking cross-sector, this research gains insight into the settings in which science is conducted. Further work, however, is needed to sort out the specific employment sector conditions under which male and female scientists disseminate. This research investigates patterns of scientific *involvement* in dissemination activities, but the effect of sector and science on the *magnitude* of male and female dissemination is of great importance as well. My dissertation work will evaluate how sector-level characteristics influence the productivity of male and female scientists, and to what extent sector-level factors influence not only whether or not scientists engage in multiple forms of dissemination behavior, but also the extent to which they do. Additionally, while it is known that female scientists commercialize their research to a lesser degree than their male counterparts (Bunker Whittington 2003; Morgan et al. 2001), my dissertation seeks to address whether or not gender inequality in commercialization behavior has decreased over time. A recent 2001 wave of SESTAT data is now available for investigation, and my dissertation work will include a cross-time analysis of trends in male and female commercialization.

This project also seeks to understand the mechanisms by which scientists in the private sector are able to overcome the effects of gender, and conversely, factors that work to preclude academic female scientists from equal participation. Scholars have suggested that the normative incentive structures of academia and industry play a large role in characterizing the nature of scientific goals and outcomes (Dasgupta and David 1994, Merton 1942, Stephan 1996), yet little

empirical work investigates the differential effects these environments have on male and female scientists. In my dissertation I demonstrate the importance of sector-level factors in guiding dissemination by male and female scientists, and I propose that differences in age, funding structures, and human capital may play an important role. Organizational goals, supply side demands, and the social arrangements and reward incentives of academia and industry also contribute to variation in gender disparity across sectors. In sum, my dissertation will formulate a theory of employment sectors as opportunity structures, identifying sector-level characteristics that may help to explain the presence of an interaction effect between employment sector and gender.

Theoretical Framework

Organizational context is especially important in occupations dealing with science and technology, because these fields are social by nature. Scientists often work in teams to share in the costs of equipment, accommodate large research projects and maximize funding opportunities. Scientific advance is often highly competitive, with rival teams racing for priority. In a key respect, science has a winner-take-all, or winner-take-most, reward system. In fast developing fields, commercial firms may be an an advantage over university labs as they find it easier to reassign staff and reallocate funds to promising projects. From an organizational perspective, the achievements of male and female scientists can be thought of as a function of the characteristics and practices of their work and employment settings (Fox 1996).

Most work on gendered productivity has concentrated primarily on the academic realm, and often only on doctoral recipients. Although scholars have proposed many explanations for academic gender disparities, past research efforts have been largely unable to fully account for

variation in productivity (Long and Fox 1995, Zuckerman 1991, Ward and Grant 1995). Differences in measured ability and intelligence (Cole and Cole 1973), previous education and graduate school research experience do not explain disparities in performance (Fox 1996). Furthermore, interactions between gender and marriage or family are either weak or inconclusive (Long 1990, Fox 1994, Xie and Shaumann 1998). In light of these findings, the impact of organizational context becomes even more compelling, given that personal characteristics and other differentiating factors can be ruled out.

In a recent study, Xie and Shaumann (1998) find rank, research funding, and type of institution to be the strongest factors mediating interactions between gender and academic publishing. Little is known about the importance of these factors for gender differences in the private sector, however. Within the academy, women are more likely to be located in lower-ranked and non-tenure track positions (Xie and Shaumann 1998). Perhaps greater proportions of senior academic men lead to greater disparities among the sexes; alternatively, difficulties that female scientists experience in obtaining senior positions may account for productivity differentials. Recent work by Smith-Doerr (2004) shows that male and female scientists tend to hold comparable management positions in industrial biotechnology firms. Past research by Long, Allison and McGinnis (1993) shows a causal relationship between academic rank and productivity, with higher producing scientists receiving more returns to career advance. I expect that similar processes may be acting upon industrial scientists, and as such, industrial scientists experience decreased gender disparities as compared with their academic counterparts.

Comparisons between senior academic and industrial scientists are difficult, however. Unlike academia, industry does not have clear status distinctions that are uniform across disciplines. As such, comparisons between employment sectors must be able to rely on datasets

with adequate detail about the nature of industrial respondents' jobs. The 1995 and 2001 SESTAT data, with information on respondents' educational background, organizational experience, indicators of grant support, supervisory status, and salary, affords the opportunity to make realistic comparisons of industrial and academic experience.

Following the lead of Xie and Shaumann (1998), I also argue that the different funding regimes of academia and industry may also be an important factor guiding sector-level differences. Much scientific research rests on the use of expensive equipment, the availability of laboratory space, and monetary allocations for graduate student and post-doctoral assistance. Universities will often supplement funds for equipment and/or research assistance in the beginning years of a career, after which the achievement of external funding is a necessity for most academic scientists to sustain their research (Stephan 1996).

Whereas academic scientists compete against one another for limited external funds, industrial research funds are more plentiful, coming from both outside grants and internal sources. The availability of inside resources free from competition may allow for more equal opportunity among industrial men and women as compared with their academic counterparts. Previous research has documented the strength of both academic seniority and resources in mediating the gender effect on academic productivity through publications; using the nationally representative SESTAT data, my dissertation research addresses the extent to which these factors play a role in the industrial realm.

I have elaborated on the potential importance of position and resources in guiding productivity differentials, but sector-level structural differences in organizational goals, incentives, and norms also play an influential role. The structure of academic science resembles that of a tournament (Lazear and Rosen 1982, Freeman 2001); rewards and output are determined as the

result of "winner-take-all" contests in which participants compete for prestige and renown through a priority-based competition (Cole and Cole 1973). Such competition puts considerable pressure on academic scientists, as potentially large rewards are distributed to scientists with very small differences among them (Freeman 2001). Some research has suggested that scientific industrial settings are internally less competitive and more egalitarian (Rabinow 1996, Smith-Doerr 1999), but little attention has focused on the organization and labor market factors that produce these different settings and productivity outcomes. This issue is exceedingly difficult to tackle, as neither comparable quantitative data nor ideal matched samples are available. But the SESTAT data will allow me to explore how male and female scientists are distributed in the structure of academic and industrial science, and selective interviews will be able to speak to the relationship between this distribution and employment sector culture.

There is speculation that commercial firms pay more and offer more benefits in order to attract scientists (Stern 1999). Although historically industry has been seen as less prestigious than academia, it has also provided some women with favorable workplace incentives (such as greater work flexibility and higher mobility) not present in the academy (Long and Fox 1995, Aisenberg and Harrington 1988). Some scholars speculate that women scientists make a tradeoff in prestige for the slight advantages available in industry (Etzkowitz et al. 2000). Recently, however, careers outside the academy are growing in prestige, and influences on male and female labor market decisions are changing. To the extent that industrial firms allow publishing and offer secure employment, I expect to see movement towards industry. Through qualitative interviews, my dissertation seeks to address the supply side of sector activity by investigating the *new* opportunities driving the labor market productivity of male and female scientists.

Lastly, previous literature has left factors influencing *commercial* dissemination largely unaddressed. As academic involvement in technology transfer increases and industrial participation in basic research grows, noticeable changes have occurred in scientists' work practices and the standards by which success and rewards are determined. The increasing overlap between the reward systems of academia and industry allows for an accelerated advantage to the scientist who can succeed in both realms. If fewer women are taking advantage of these opportunities in commerce, why? What factors influence this disparity? This project will investigate the strength and influence of organizational context variables on male and female commercialization.

Research Questions

In sum, my dissertation addresses the following questions about gender differences in scientific productivity:

1) What is the association between gender, scientific location, and dissemination?
2) To the extent that rank, funding, and institutional factors play a role in academia, what effect do these characteristics have on gender equality in industry?
3) Are there additional factors that differentially affect male and female scientists within and/or across employment sectors?
4) How do these influences vary for commercial dissemination?
5) What is the nature of these trends over time?

My goal in this project is to assess the ways in which multiple measures of performance are tied to the environment of scientific work, and to identify location-level characteristics that contribute to gender disparities in productivity outcomes.

Research Methodology

I investigate the relationship between scientific location, gender and dissemination through two lenses of analysis: 1) from a large-scale aggregate level with quantitative data on university and industry dissemination counts across time, and 2) from an individual level through focused interviews with a select sample of university and industry scientists.

Quantitative Analysis

Data Source

Data on scientific patenting and publishing behavior is available from the 1995 and 2001 SESTAT data system, an integrated database of employment, educational, and demographic characteristics of scientists and engineers in the United States[1]. SESTAT is an integrated database of employment, educational, and demographic characteristics of scientists and engineers in the United States, which combines data obtained from three surveys, the National Survey of College Graduates (NSCG), the National Survey of Recent College Graduates (NSRCG), and the Survey of Doctorate Recipients (SDR). SESTAT data is collected every other year beginning in 1993, however 1995 and 2001 are the only years in which respondents were asked about their patenting and publishing behavior[2]. In addition, dissemination questions were not asked in the

[1] Up until now, data limitations may well be a reason for the lack of previous research on dissemination outcomes across employment sectors and disciplines. The National Science Foundation's SESTAT dataset is unique in that it is the only nationally representative survey, that I am aware of, which combines information about scientists' publishing *and* patenting behavior with necessary control variables for career history and demographic background.

[2] NSF currently restricts the dependent variable and several independent variables in the sample for use by the general public. I have applied for and obtained the restricted 1995 data and have used it in the beginning analysis mentioned above. I am currently in the process of extending my licensing agreement to include the 2001 SESTAT data. I expect the extension process to proceed without difficulty, and to acquire the data very shortly.

NSRCG. Therefore, the sample used in this analysis is limited to the respondents of the NSCG and the SDR.

SESTAT survey data are acquired through a complex survey design that stratifies respondents by scientific discipline, employment sector, receipt of a doctoral degree, and demographic variables. When weighted, the 1995 and 2001 SESTAT data characterize a nationally representative population of individuals trained and/or working as scientists or engineers between 1990-1995 and 1995-2001. Because this analysis relies heavily on factors that are disproportionately sampled in the SESTAT surveys, and also because patenting and publishing activity varies greatly among those variables, all my analyses have been and will continue to be run with a *weighted* sample.

Scientists in the sample are classified by what SESTAT terms "major employment sector", that is, two-year colleges, four-year colleges, government, or business/industry. Institutions designated as four-year colleges include baccalaureate and masters institutions, and Research I and II universities. The industrial sector includes private, for-profit companies, as well as scientists who are self-employed. Most scientists within the government sector are federal workers; however, state and local government scientists are included as well.

In addition, scientists are placed in one of six disciplines according to the type of science they perform in their current job. These categories are computer and mathematical sciences, life sciences, physical sciences, social sciences, engineering, and non-scientific occupations. For this analysis, I will exclude scientists who worked at two-year colleges, as well as those located in the social sciences or in non-science or non–engineering disciplines. Theoretically, I am mainly concerned with scientific occupations that produce research that is potentially patentable as well as publishable. Non-scientific occupations and the social sciences are not oriented towards

commercialization in the same way other sciences are. Lastly, only scientists who are working full time are included in the sample. Part time scientists may not have an equal opportunity to publish and patent to the same degree as compared to their full-time counterparts, and are, thus, excluded from this analysis.

Research Variables

The dependent variable is publishing and/or patenting counts during the preceding five years from the survey date (1990-1995; 1995-2001). Those who listed research, design, or development as a primary work activity were asked whether or not they had been named as an inventor on a US patent application and as an author or co-author on a peer-reviewed published paper since 1990, and if so, how many articles or patents they had received.

Respondents were also asked about their educational background, organizational experience, work environment, supervisory status, job history, rank (if applicable) and other personal characteristics (such as marital status, number of children, etc.). These career history and demographic variables will be included in the analysis as explanatory and control variables (along with scientific discipline and employment sector controls). Table 1 in the Appendix provides a list of variables from the 1995 and 2001 SESTAT data that will be used as dependent, explanatory or control variables in the analysis.

After all variables and constraints are taken into account, the final sample for the 1995 data consists of 17,036 scientists (868,549 when weighted), 17.6% (14.6% when weighted) of whom are female. There are no missing data. A similar sample size is expected from the 2001 data.

Statistical Analysis

Since beginning work on my dissertation, I have used the 1995 SESTAT data on the quantity of scientists' publishing and patenting to produce descriptive statistics and a graphical analysis of gendered scientific productivity differentials across discipline and sector. Upon receipt of the 2001 data, graphical and descriptive trends across time will be incorporated into the existing tables. This work will ultimately comprise a beginning chapter of the dissertation that serves to situate and motivate the subsequent multivariate analysis.

A two-stage Heckman sample selection model for count data (of negative binomial distribution) will be used for the multivariate analysis. Models will be run with both publishing and patenting as dependent variables, and will be a focal component of my dissertation analysis. This analysis is unique in its use of a selection model to predict publishing and patenting outcomes, as traditional models have not taken into account the potential of selection bias in scientists' research dissemination. Modeling the dependent variable as such not only allows me to correctly estimate and account for any selection bias inherent in the dissemination process, but also to understand the extent to which each factor influences 1) the *decision* or *opportunity* to disseminate, as well as 2) the *amount* of dissemination once decided.

Qualitative Analysis

In addition to my quantitative analyses, I plan on conducting focused interviews with university and industrial scientists in order to gather information on location-level tensions and relations as understood by scientists and administrators in the field. While my quantitative analyses address the *sorting* of scientists across sectors, my qualitative evidence speaks to the labor market and productivity *incentives* of scientific work. Interviews help elucidate how factors

scientists and administrators feel are important determinants of dissemination compare with the results of the empirical findings. The qualitative interviews also shed light on how relevant sector-level influences compare for male and female scientists.

Interviews will be held with a matched sample of both male and female scientists across the academy and industry. By doing so I can separate out general trends that are applicable to *all* members of an employment sector, as well as those factors that are *specific* to women and men exclusively. The sample includes scientists of all ranks (post-doctoral students, assistant, associate and full professors) and all levels of experience, enabling me to gauge possible generational effects that may be present.

Dissemination Plan

The results of this study will be disseminated through national conferences as well as through publications. If accepted, the results will be presented at the AIR Annual Forum in June of 2005. A final project report will be submitted to the AIR office in June 2005. Other aspects of the dissertation may be presented at the annual meeting of the American Sociological Association, and at other professional conferences. My dissertation project stems from a beginning body of work I completed for my admittance to doctoral candidacy. It was presented at the annual meeting of the American Sociological Association in 2002, and I submitted it as a sole-authored publication to *American Sociological Review*. I have since received a revise and resubmit on the article, in which the reviewers pose not only helpful, but also very feasible modifications and suggestions. I am currently working on the revision and expect to resubmit it shortly. The findings of the proposed work will be disseminated in a similar manner. I expect to continue publishing chapters of this dissertation in articles that highlight both the quantitative results and the theoretical discussion in relevant journals.

Policy Relevance, Significance of Research, and Target Audience

My dissertation attempts to explain how transformations in the nature and locus of technological innovation influence careers and work in the sciences. As patenting and commercially motivated technology transfer on university campuses increases, noticeable changes have occurred in faculty work practices and the standards by which success and rewards are determined. As such, the traditional view of the scientist as a disinterested and communal searcher of "knowledge for knowledge's sake" (Merton 1942) is being replaced by a new model of the scientist-entrepreneur, balancing corporate development as well as university activities for both academia and industry. Recently, scholars have suggested that the modifications brought on by commercialization have had large implications for not only university organization, but also the personal work practices of scientists, their individual scientific identities, and the broader occupational consensus of what constitutes "appropriate academic behavior" (Owen-Smith and Powell 2001, Etkowitz 1993, Packer and Webster 1996). While previous work provides a starting point to understand how increases in academic commercialization shapes faculty careers and identity, these studies have left the actions and rationale of *female* scientists largely unaddressed. First and foremost, the goal of this research is to address this gap.

Past research on scientific workers has documented the considerable disparities among male and female scientists. Women are less likely to participate in science and have lower rates of dissemination once there. Most studies of stratification and productivity in science focus solely on publishing in the academy, but the current climate of science suggests the importance of broadening this scope. This research addresses the impact of increasingly blurry boundaries between academia and industry on the productivity disparities between male and female scientists across sectors. Unlike prior analyses of scientific productivity, this dissertation seeks to answer

the under-researched question, "Is commercialization a new arena for gender disparity in scientific productivity?" Understanding the causes of inequality in dissemination is an important first step in sorting out systematic gender differences in rank, recognition and achievement.

This study also addresses the organizational context in which male and female scientists disseminate. Few studies compare the importance of sector-level factors in guiding the relationship between male and female scientists, yet employment sectors are a fundamental dimension of the scientific career that influence work experiences, opportunities, prestige and productivity outcomes. My preliminary findings of an "academy effect" have important implications for our current knowledge of the pushes, pulls, and constraints on female scientists. With academic participation in both basic science and commercial endeavors on the rise, the fact that female scientists in the academy lag behind their male counterparts, for whatever reason, and are more comparable to their industrial counterparts may have important repercussions for the future labor market choices of female scientists. In addition, findings of an "industrial advantage" speak to the importance of including non-academics in future studies of stratification in science. Failure to do so neglects the importance of organizational context on dissemination. In this research, the broader policy issue of the labor market consequences of differential rates of recruitment to the academy and industry is significant.

In conclusion, this research addresses multiple under-researched issues with uniquely appropriate datasets using an innovative statistical method that will be able to provide the most accurate information to date. Given the applicability of this topic to current issues around gender and labor market concerns, and the direct implication of it for social and economic theory, I expect the results of this dissertation to speak to policy makers and academics alike.

Appendix 1.

Table 1. Variables to be used from Scientists and Engineers Statistics Data System: 1995, 2001

Variables	SESTAT Label
Dependent Variables	
Number of articles (April 1990-1995, April 1995-2001)	ARTICLE
Number of patent applications (April 1990-1995, April 1995-2001)	USPAPP
Educational Background	
Highest degree attained (Bachelors, Masters, Doctorate, Professional)	DGRDG
Year attained highest degree	DGRYR
Carnegie classification - school of highest degree	HDCARN
Time elapsed between doctorate and career path job (in months)	PATHMOS
Post-doctoral appointment indicator	PDIX
Job Related Data	
Salary	SALARY
Discipline (Computer and Mathematical Sciences, Life Sciences, Physical Sciences, Engineering)	OCPRMG
Current research supported by government grants	GOVSUP
Year principal job started	STRTYR
Employment sector (Industry, Academia, Government)	EMSEC
If Industry:	
Size of place of employment	EMSIZE
Supervisory status	SUPWK
Number supervised directly	SUPDIR
Number supervised indirectly	SUPIND
Management indicator	MGRIND
If Academia:	
Faculty tenure status	FACRANK
Carnegie class of employer	CARNEG
Demographic Variables	
Age	AGE
Marital status (Married, Divorced, Widowed)	MARSTA
Number of children	CHTOTPB
Race of respondent (White, Black, Asian/Pacific Islander/Native Amer.)	RACE
US citizenship status	CTZN
Respondent regional location	REPLOC
SESTAT Weight Variable	WEIGHT

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6. BIOGRAPHICAL SKETCHES

Kjersten Bunker Whittington

I received my bachelor's degree is physics from North Carolina State University in Raleigh, NC. While an undergraduate, I focused heavily on conducting independent research, completing two summer NSF Research Experiences for Undergraduates and an honors thesis that won the NCSU McCormick Award for Undergraduate Research in Physics in 1999. Realizing I would like to pursue a graduate degree in sociology, I joined the graduate program in the Department of Sociology at Harvard University as a Special Student/Visiting Scholar from 1999-2000, and was admitted as a doctoral student in the Department of Sociology at Stanford University in September 2000.

I am currently in my fourth year of the doctoral program. I have completed all required coursework, have been advanced to candidacy, and hope to complete my dissertation within the next year and a half. I am interested in issues pertaining to science and technology, work and gender, and quantitative methodology. Due to my mathematics background, I have strong quantitative and analytical skills, and have knowledge of a wide array of statistical methods and software. I have taken several statistics courses while a graduate student, and am comfortable with regression analysis (continuous, dichotomous, and polytomous outcomes), log-linear analysis, event history analysis, and social network analysis. I was selected and fully funded to attend the Inter-university Consortium for Political and Social Research (ICPSR) Summer Program in Quantitative Methods in Summer 2003, where I learned advanced topics in maximum likelihood, structural equation modeling, and agent based modeling techniques. In addition to my doctoral work, I have been employed as a statistical software consultant for the Social Sciences Data and Software group in the Stanford University Libraries since September 2001.

My work in the group involves one-on-one consultations with members of the Stanford community, developing user guides and web-based assistance with statistical software, and providing workshops for faculty and students.

I have extensive experience working with large datasets of complex design. I have conducted independent research using data from the National Longitudinal Study of Adolescent Health, and have been working with the public and restricted SESTAT data system since September 2001. I am comfortable implementing procedures that take complex survey design into account. I also have experience developing and managing large datasets. Since coming to Stanford I have worked closely with Professor Powell to update and help maintain a global database of biotechnology firms. I have also combined this data with patenting information from the United States Patent and Trademark Office and developed an algorithm to name-match and gender-code inventors by name, thus creating a patent database of male and female scientists in biotechnology. In addition to my dissertation work, I plan to continue working with these datasets in the future.

Selected sections from my vita are listed below:

STATISTICAL AND QUALITATIVE SOFTWARE

Stata and SPSS for Unix and PC platforms, UCINET, Pajek (Social Network Visualization Software), ATLAS.ti, Nudist/Nvivo, AMOS, Remark Web Survey, Microsoft Excel, Access, and Powerpoint, Visual Basic and Fortran.

HONORS

2003 Dissertation Fellowship, National Bureau for Economic Research, Science and Engineering Workforce Project, for "Employment Sectors as Opportunity Structures: The Effects of Location on Male and Female Scientific Dissemination."

2003 La Piere Second Year Paper Award, Department of Sociology, Stanford University for "Patterns of Dissemination in Public and Private Science: The Effects of Gender and Discipline."

2003 William and Leila Cilker Award for Excellence in Teaching, Department of Sociology, Stanford University

2003 Matt Goldstein Graduate Student Paper Award for "Exploring the Breakup of Violent Adolescent Relationships", Stanford University

2002 Hacker-Mullins Graduate Student Paper Award. American Sociology Association Science, Knowledge and Technology Section for "Patterns of Dissemination in Public and Private Science: The Effects of Gender and Discipline."

2001 Honorable Mention, National Science Foundation Graduate Research Fellowship

2000 Graduate Award Fellowship, Department of Sociology, Stanford University

WORK EXPERIENCE

2003 - Research Assistant, "Co-evolution of States and Markets". Principal Investigators: Walter Powell, Stanford University and John Padgett, University of Chicago. January-March, June-present

2002 Research Assistant, "Patenting in the Life Sciences: The Evolving Roles of Universities, Science-Based Companies, and Entrepreneurial Faculty." Principal Investigator: Walter Powell, Stanford University.

2001 Research Assistant, "Patenting in the Life Sciences: The Evolving Roles of Universities, Science-Based Companies, and Entrepreneurial Faculty." Principal Investigator: Walter Powell, Stanford University.

2001 - Statistical Consultant, Social Sciences Research Group, Stanford University Libraries. I provide assistance to Stanford faculty, staff, and students in statistical methodology and the use of quantitative and qualitative software.

2001 Research Consultant, Survey Design and Methodology. "Internet Usage and Attitudes." Telocity, Incorporated.

2000 Research Assistant, "Commitment At Work: The New World of the Knowledge Nomads." Principal Investigator: Todd Pittinsky, Harvard University

TEACHING

2004 Instructor, "Teaching Development Workshop." Expected Spring 2004.

2002 Teaching Assistant, "Data Analysis for Social Scientists." Instructor: Stefanie Mollborn, Stanford University.

2002 Teaching Assistant, "Introduction to Sociology." Instructor: Rebecca Sandefur, Stanford University

2002 Teaching Assistant, "Sociology of Gender." Instructor: Cecilia Ridgeway, Stanford University

2001 Teaching Assistant, "Computer Assisted Data Analysis." Instructor: Coye Cheshire, Stanford University

PAPERS AND PRESENTATIONS

Bunker Whittington, Kjersten C. 2003. "Patterns of Dissemination in Public and Private Science: The Effects of Gender and Discipline." Presented at the American Sociological Association Annual Meeting, Section on Gender and Science, Chicago, IL. Received Revise and Resubmit at *American Sociological Review*.

Smith-Doerr, Laurel and Kjersten C. Bunker Whittington. 2003 "A *New* Productivity Puzzle? The Effects of Blurred Boundaries between Academic and Commercial Science on Gender Stratification in Life Science Careers." Presented at the Society for Social Studies of Science Annual Conference, Atlanta, GA.

Bunker Whittington, Kjersten C. 2003. "Employment Sectors as Opportunity Structures: The Role of Collaboration Structures on Gender Differences in Patenting across Industry and Academia." Presented at the Santa Fe Institute, Workshop on the Network Construction of Markets.

Bunker Whittington, Kjersten C. 2003. "Exploring the Breakup of Violent Adolescent Relationships." Presented at the American Sociological Association Annual Conference, Session on Childhood and Youth, Atlanta, GA.

Research in Progress

(with Powell, Walter W. and Jason Owen-Smith) "The Role of Networks and Organizational Diversity in Regional Economies: Research Communities in Biotechnology."

(with Smith-Doerr, Laurel) "A *New* Productivity Puzzle? The Effects of Blurred Boundaries Between Academic and Commercial Science on Gender Stratification in Life Science Careers".

SERVICE

2003 - 2004	Student Member, Faculty Recruitment Committee, Stanford University, AY 2003-2004
2002 - 2003	Co-chair, Association of Sociology Graduate Students, Stanford University, AY 2002-2003
2001 - 2002	Student Member, Graduate Studies Committee, Stanford University, AY 2001-2002
2001 -	Community Associate for Graduate Residence, Escondido Village Graduate Housing, Stanford University

BIOGRAPHICAL SKETCH

Walter W. Powell

Walter W. Powell is Professor of Education and (by courtesy) Professor of Organizational Behavior, Sociology, and Communication at Stanford University. He is also an external faculty member at the Santa Fe Institute. At Stanford, he is Director of the Scandinavian Consortium on Organizational Research. He joined the Stanford faculty in July 1999, after previously teaching at the University of Arizona, MIT, and Yale. He has been a fellow at the Center for Advanced Study in the Behavioral Sciences and been a visiting faculty member several times at the Institute for Advanced Studies in Vienna and the Santa Fe Institute. Professor Powell works in the areas of organization theory and economic sociology. He is co-author of Books: The Culture and Commerce of Publishing (1983), an analysis of the transformation of book publishing from a family-run, craft-based field into a multinational media industry, and author of Getting Into Print (1985), an ethnographic study of decision-making processes in scholarly publishing houses. He has been involved in a number of studies of nonprofit organizations, ranging from public television to university presses to art museums to higher education. He edited The Nonprofit Sector (1987, referred to by reviewers as "the Bible of scholarship on the nonprofit sector"), and is currently working with Richard Steinberg on a second edition of the handbook. Powell is also co-editor with Elisabeth Clemens of Private Action and the Public Good (1998).

Professor Powell is most widely known for his contributions to institutional analysis, beginning with his article, with Paul DiMaggio, "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields" (1983, also translated into French, German, Italian, Japanese, and Spanish) and their subsequent edited book, The New Institutionalism in

Organizational Analysis (1991, translated into Spanish and Italian). This line of work continues in a forthcoming edited book, How Institutions Change.

Powell is currently engaged in research on the origins and development of the commercial field of the life sciences. With his collaborator Ken Koput, he has authored a series of papers on the evolving network structure of the biotechnology industry. This line of work continues his interests in networks as a form of governance of economic exchange, first developed in his 1990 article, "Neither Market Nor Hierarchy: Network Forms of Organization," which won the American Sociological Association's Max Weber Prize and has been translated into German and Italian. Powell and his research collaborators have developed a longitudinal data base that tracks the development of biotechnology worldwide from the 1980s to the present. With Jason Owen-Smith and a number of Stanford students, Powell is studying the role of universities in transferring basic science into commercial development by science-based companies, and the consequences for universities of their growing involvement in commercial enterprises. In support of this work, he has received three National Science Foundation grants, and research funding from both the Hewlett and Merck Foundations. His former student, Jason Owen-Smith (now on the faculty at the University of Michigan) received an AIR grant in 1998.

Powell is a member of the Board of Directors of the Social Science Research Council. At Stanford, he is a member of the Editorial Board of the University Press, a faculty affiliate of the Center for Social Innovation at the Graduate School of Business, and serves on the governing board of the France-Stanford program.

7. PROPOSED BUDGET

TITLE OF RESEARCH: Employment Sectors as Opportunity Structures: The Effects of Location on Male and Female Scientific Dissemination

Category	Requested Funds
Personnel Salaries	
Kjersten Bunker Whittington – 12 months @ $1,100 month	$13,200
Travel	
Domestic (AIR Annual Forum, Annual Meeting of the American Sociological Association)	$1,200
Other Direct Costs	
Materials and Supplies (Printing, Photocopies, Research Related Books, Dissertation Dissemination)	$600
Total Amount of Award	$15,000

8. CURRENT AND PENDING SUPPORT

I currently receive a research stipend (but no tuition support) through a dissertation fellowship sponsored by the National Bureau of Economic Research (NBER). The fellowship provides a monthly stipend; my tuition is funded by the Department of Sociology. This support will terminate at the end of the 2003-2004 academic year. At this point, no support for the 2004-2005 academic year has been guaranteed. (Note: This proposal is being re-submitted to NBER to be considered for a continuation of funding, though I have been notified by NBER that renewal applications will be funded only in the event there is a dearth of new applications.)

9. FACILITIES, EQUIPMENT, AND OTHER RESOURCES

I, along with my faculty advisor, have obtained a restricted data license for the 1995 SESTAT data files. We are in the process of completing the necessary steps to extend this license to include the 2001 SESTAT data files, which we anticipate proceeding without difficulty. In my office in the Department of Sociology, I have a personal computer that holds all necessary statistical software and complies with the security guidelines outlined in the SESTAT Restricted Use Data License. All of the resources available to graduate students in the Department of Sociology at Stanford University will be available for use in conducting the proposed study. These resources include laser printers, photocopy machines, a research library, statistical support, and computer clusters with the latest software and capabilities.

10. SPECIAL INFORMATION AND SUPPLEMENTARY DOCUMENTATION

None.