Paths to the Professoriate

Strategies for Enriching the Preparation of Future Faculty

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Chapter Seven

"So You Want to Become a Professor!"

Lessons from the PhDs—Ten Years Later Study

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The U.S. Ph.D. is a much sought-after degree, both nationally and internationally. In fact, U.S. doctoral education serves as a model throughout much of the world. In the United States, however, the doctoral degree is not without its critics. During the past few years we have seen an increased focus on doctoral education, including the training of future faculty, researchers, and scholars. As this volume suggests, the attention has generated a number of studies and initiatives designed to improve doctoral education. We believe that both career path analysis of Ph.D. recipients and Ph.D. recipients' retrospective evaluations of their doctoral programs should inform recommendations for change. Guided by this belief, we undertook the PhDs—Ten Years Later Study described in this chapter as a way of bringing greater empirical understanding to Ph.D. education in the United States. In the information that follows, we begin by discussing our overall research and then highlight some of the key findings, implications, and recommendations that are most relevant to preparing future faculty.

Background and Purpose

PhDs—Ten Years Later is a national study of the career paths of doctorates and the feasibility of assessing doctoral programs based on the graduates' career outcomes. This survey contacted almost six thousand individuals in six selected disciplines. The study focused on individuals who completed their doctoral degrees at one of sixty-one doctoral granting institutions in the United States. The original interest in surveying Ph.D. outcomes on a national level arose out of ongoing research on current graduate students at the University of California, especially at Berkeley, and from the principal investigators' (PIs) participation on the 1993–1995 National Research Council (NRC) advisory board for the assessment of research doctorate programs in the United States. Research on recent Ph.D. recipients frequently lacks information on these individuals' career paths and on their perception of the usefulness of the education and training that they received for their subsequent professional careers and lives. The NRC debated the inclusion of educational outcomes, such as employment several years after degree completion and satisfaction with the Ph.D. experience. Because the NRC committee decided not to pursue this outcome analysis, however, the PhDs—Ten Years Later Study was in part piloted to evaluate the feasibility of assessing career outcomes several years after degree completion. In this chapter we address issues associated with preparing future faculty drawn from our study of the career paths of Ph.D. recipients in six disciplines and present their suggestions for current doctoral studies drawn from their years of employment and job satisfaction.

Methods

We focused our study on doctorates in six disciplines from five major fields of study: life sciences (biochemistry), engineering (computer science, electrical engineering), humanities (English), physical science (mathematics), and social science (political science). We studied doctorates in these fields at sixty-one universities selected on the basis of four major criteria. The first criterion was institutional participation in the 1982 National Research Council doctoral program assessment. The second criterion was their level of Ph.D. production; we only included programs that awarded a minimum of six

Ph.D.'s in three consecutive years. Third, we included only those institutions that had doctoral programs in at least three of the six disciplines. Finally, we sought balance in geographical and public-private distribution. Of the sixty-one participating institutions, thirty-two were members of the Association of American Universities (AAU). From these institutions we obtained the names of the doctoral graduates who ultimately participated in the study. Because we wanted to allow time for their careers to settle, we included only those doctoral recipients from the institutions who had received their Ph.D.'s ten to fourteen years prior to the study—that is, between July 1, 1982, and June 30, 1985. Once we selected an institution, we included all doctoral recipients of the relevant programs in the survey population. No subsampling occurred.

Using the selected disciplines, the institutional criteria, and the specified period for degree completion, we identified 5,859 Ph.D. recipients as the population for the study, including the international students, regardless of whether they remained in the United States after attaining their doctorates.[1] This survey population accounted for 57 percent of the total Ph.D.'s awarded in the United States in these six fields during the three years. Of the respondents in the survey population, 24 percent were women, and 23 percent were from other countries.

Once we had identified the population, we obtained our information primarily through a twenty-two-page survey that was mailed in late 1996 and early 1997. The questionnaire focused on the employment history of the participating doctoral recipients. It asked whether they took a postdoctoral position or positions, and if so, how many and for how long. It also inquired about their job-search process and the factors influencing their decisions to accept their first and current positions, asked for a retrospective evaluation of their doctoral programs and information on whether they had found the degree useful, and requested information on spouses and children. The survey also included five open-ended questions.

To ensure the highest possible response rate, we obtained addresses for these doctorate recipients in the selected fields and institutions from multiple sources, including participating institutions, professional association membership directories, a variety of national directories, commercial locator agencies, and on-line search engines. The response rate was 66 percent from domestic Ph.D. recipients (U.S. citizens and permanent residents) and 52

percent from international recipients (temporary visa holders at the time of their doctorate completion). Because of the large size of doctoral programs at AAU universities, 84 percent of the Ph.D.'s who participated in the study received their degrees from AAU institutions.

In addition to the survey, we used two other major sources of information in the study. The first was in-depth interviews with fifty-six people—about eight to ten from each discipline—to provide the context in which individuals make career decisions. In addition, with the cooperation of the graduate deans at all sixty-one universities, we were able to include as part of our database the responses to the Survey of Earned Doctorates, a national survey sponsored by the National Science Foundation (NSF) that is completed by doctoral students at the time their dissertations are filed. This NSF survey provided complete demographic information on our survey populations, such as parents' education level, and financial information, such as major fellowships.

Although our research included doctorates in all careers for the six disciplines, in the next section we highlight key findings that are most relevant to preparing future faculty. We define "faculty" broadly to include tenured, tenure-track, and non-tenure-track individuals who teach and are employed at institutions of higher education. Our study found that ten-plus years after Ph.D. completion (varying by field), between 3 percent and 18 percent of faculty were working in non-tenure-track positions as visiting, affiliate, or research professors, or lecturers. Indications are that the number of Ph.D. recipients who teach in non-tenure-track positions is growing (Baldwin & Chronister, 2001; Martin, 1998). We therefore have included both tenure and nontenure tracks when presenting results for future faculty.

Key Findings

An important goal of our study was to ensure that present Ph.D. students make informed career decisions. In this chapter we have selected those findings from the study that provide students and faculty with empirical evidence about the proportion of students who wanted to become professors or who actually became professors. We also want students to be informed about actual professorial career paths, including the job-search process. The reality that

most Ph.D. recipients are married or live in committed relationships has consequences for their career paths. We therefore present findings associated with dual-career academic couples. We further present findings of the Ph.D. recipients' job satisfaction, with careers both inside academia and in the business, government, and nonprofit sectors. We believe that these research findings will allow current students to evaluate their career choices more realistically and accurately. Knowing what lies ahead will provide them with a clearer understanding of steps to take during graduate school in order to prepare for their chosen paths. The voices and recommendations of their peers of a few years back can help guide them in their preparation for the future.

As already noted, the key findings of our study presented here pertain specifically to preparing future faculty. The first set of key findings focuses on the career paths of the Ph.D. recipients in our study. The second set focuses on the retrospective evaluation of their Ph.D. education based on the career paths they have taken.[2]

Career Paths and Faculty Rank

This section focuses on the career paths of our study's respondents. Some key findings follow:

- About one-half (53 percent) of all respondents reported that they aspired to become professors at degree completion.
- Most English and political science Ph.D. recipients sought the professoriate (English, 81 percent, and political science, 72 percent).
- Less than one-third (28 percent) of *all* the surveyed Ph.D. recipients were employed in tenure-track positions as their *first jobs* after degree completion.
- Of the tenured faculty among the respondents, two-thirds began their paths to tenure in assistant professor positions immediately following degree completion. The remaining one-third began careers in various temporary positions, and on average, only after a period of four to five years moved into a tenure-track path.

The common faculty assumption in the non-engineering disciplines was that Ph.D. students are interested in a professorial

career and follow a smooth career trajectory that starts with an assistant professorship, followed by promotion to a tenured faculty position. However, this assumption was not supported by our data. Ph.D. recipients in political science held the largest proportion (44 percent) of tenure-track faculty positions as their first job, followed by computer scientists (38 percent), English Ph.D. recipients (37 percent), and mathematicians (37 percent).[3] The proportion that joined the tenure-track and tenured ranks later varied by field. In biochemistry and mathematics, delayed entrance to tenure-track positions (32 percent in biochemistry and 27 percent in mathematics) was due to the convention of working as a postdoctoral fellow immediately after Ph.D. completion. In English and political science, the delayed entrance of Ph.D. recipients into faculty ranks (25 percent in English and 17 percent in political science) could be attributed to the limited academic job market in both fields. In English, increasing the number of publications while working in a non-tenure-track (or nonfaculty) job improved the academic job chances; however, the time spent in a non-tenure-track position translated into delayed job stability and earnings.

Ten to fourteen years after degree completion, 54 percent of our total survey respondents were working in faculty positions (42 percent were tenured, 7 percent were tenure-track, and 5 percent were non-tenure-track). (See Table 7.1.)

Looking only at the survey respondents who reported wanting to become a professor (53 percent), the percentages were somewhat higher: 67 percent were working in faculty positions (54 percent were tenured, 7 percent were tenure-track, and 6 percent were non-tenure-track). (See Table 7.2.)

In addition, the data suggested that:

- Mathematics had the highest percentage of tenured faculty (59 percent from the overall survey population and 64 percent from the subpopulation who wanted to be faculty).
- Biochemistry had the highest percentage of faculty still in assistant professor positions more than ten years after degree completion (14 percent from the overall survey respondents and 15 percent from the subpopulation who wanted to be faculty).
- English had the highest percentage of non-tenure-track faculty (10 percent from the overall respondents and 9 percent from the subgroup who wanted to be faculty).

Current Employment

Gender, by Field		*Tenured*		*TT*		*NTT*		*All Faculty*		*All Other*		*Total*	
Field of Education	*Gender*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*
Biochemistry	Men	18.6	78	14.3	60	5.7	24	38.6	162	61.4	258	100	420
	Women	19.8	32	14.8	24	13.6	22	48.1	78	51.9	84	100	162
	Total	18.9	110	14.4	84	7.9	46	41.2	240	58.8	342	100	582
Computer science	Men	30.6	88	4.2	12	1.7	5	36.5	105	63.5	183	100	288
	Women	37.5	12	—	—	—	—	37.5	12	62.5	20	100	32
	Total	31.3	100	3.8	12	1.6	5	36.6	117	63.4	203	100	320
Electrical engineering	Men	21.5	88	2.2	9	0.5	2	24.2	99	75.8	310	100	409
	Women	56.3	9	6.3	1	—	—	62.5	10	37.5	6	100	16
	Total	22.8	97	2.4	10	0.5	2	25.6	109	74.4	316	100	425
English	Men	63.5	209	3.0	10	6.7	22	73.3	241	26.7	88	100	329
	Women	52.2	188	6.4	23	12.8	46	71.4	257	28.6	103	100	360
	Total	57.6	397	4.8	33	9.9	68	72.3	498	27.7	191	100	689
Mathematics	Men	61.4	290	5.3	25	3.8	18	70.6	333	29.4	139	100	472
	Women	49.1	54	5.5	6	3.6	4	58.2	64	41.8	46	100	110
	Total	59.1	344	5.3	31	3.8	22	68.2	397	31.8	185	100	582
Political science	Men	57.0	179	5.7	18	2.5	8	65.3	205	34.7	109	100	314
	Women	50.5	55	7.3	8	5.5	6	63.3	69	36.7	40	100	109
	Total	55.3	234	6.1	26	3.3	14	64.8	274	35.2	149	100	423
Total	Men	41.8	932	6.0	134	3.5	79	51.3	1145	48.7	1,087	100	2,232
	Women	44.4	350	7.9	62	9.9	78	62.1	490	37.9	299	100	789
	Total	42.4	1,282	6.5	196	5.2	157	54.1	1635	45.9	1,386	100	3,021

Note: Tenured = tenured faculty; TT = tenure-track faculty; NTT = non-tenure-track faculty; all faculty = T + TT + NTT; all other = employment in all sectors except the listed three categories.

Source: PhDs—Ten Years Later Study.

Table 7.2. Professorial Career Goal Realization in Employment, Ten to Fourteen Years After Ph.D. Completion, by Field

Become Professors	*Current Employment*											
	Tenured		*TT*		*NTT*		*All Faculty*		*All Other*		*Total*	
Field of Education	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*
Biochemistry	24.4	40	15.2	25	7.3	12	47	77	53	87	100	164
Computer science	47.6	50	7.6	8	1.9	2	57.1	60	42.9	45	100	105
Electrical engineering	36.1	26	2.8	2	1.4	1	40.3	29	59.7	43	100	72
English	59.9	276	5	23	8.9	41	73.8	340	26.2	121	100	461
Mathematics	64.2	176	8.4	23	3.3	9	75.9	208	24.1	66	100	274
Political science	60.2	147	6.1	15	3.3	8	69.7	170	30.3	74	100	244
Total	54.2	715	7.3	96	5.5	73	67	884	33	436	100	1,320

Note: Tenured = tenured faculty; TT = tenure-track faculty; NTT = non-tenure-track faculty; all faculty = T + TT + NTT; all other = employment in all sectors except the listed three categories.

Source: PhDs—Ten Years Later Study.

- Political science, nationally the field with the highest proportion of African American and Latino faculty, had a proportionally low representation of African American and Latino faculty among their tenured faculty.
- Women in biochemistry, English, and political science made up a larger percentage of those in non-tenure-track faculty positions than men did.

Although the majority of Ph.D. recipients who had the goal of being a professor at the time of Ph.D. completion had indeed become professors, more than one-third had not yet realized this goal. The survey respondents who were tenure-track, as opposed to tenured, ten to fourteen years after degree completion, spent their first post-Ph.D. years in postdoctoral appointments rather than in tenure-track positions and therefore had a delayed tenure. There was also a gendered component to the postdoctoral years, particularly for dual-career academic couples. Given the difficulty in job searching for two tenure-track positions, women (more often than men) accepted postdoctoral appointments to remain in the same geographic locations as their partners. Our findings showed that although many postdoctoral appointments are followed by a tenure-track position, for the woman whose spouse is already in a tenure-track position, postdoctoral years can follow with a non-tenure-track position.

One of our women mathematicians, almost certainly married to a fellow mathematician, described the impact of postdocs on her career:

> My husband and I made the mistake that when I finished my Ph.D. we went to a temporary position for my husband—a great postdoc. This was a mistake. Our second move was much more difficult, and may have cost me any career. We should have moved to permanent positions when we could. The two-body problem is hard to solve. We did not get this advice. Academia is not responsive to the problems of women. In particular, there is little recognition of the problems of two careers, or of the conflicts of tenure and child-rearing. It is easier to find two assistant professor positions than two associate professor positions. Couples in two-body situations should solve their problem early. This does limit opportunities, and women are disproportionately affected.

After winning two extremely prestigious postdoctoral positions, this woman mathematician was working in a non-tenure-track position making $12,000 a year. Her husband earned more than $100,000 a year.[4]

Although our study showed a fairly small percentage of non-tenure-track faculty members, recent studies have pointed to a growing number of non-tenure-track positions (Baldwin & Chronister, 2001). And as previously suggested, gender differences for this population are notable. Comparing two fields with high representation of non-tenure-track positions (biochemistry and English), we found in biochemistry that 14 percent of the female faculty versus 6 percent of the male faculty were non-tenure-track. In English, 13 percent of the female faculty versus 7 percent of the male were non-tenure-track. These year-to-year, and even term-to-term, appointments constitute a secondary labor market in academia, which, according to our study, tends to be a feminized labor market.

Retrospective Job Placement Evaluations

Perhaps no information is more pertinent to current and future faculty and current students than the retrospective program evaluation that Ph.D. recipients provide a number of years after g raduating. They are in an ideal position to reflect on their doctoral education in the context of having worked for a number of years applying their education.

So what did the Ph.D. respondents—half of them now faculty—tell us? Table 7.3 presents the top three most cited topics by discipline and by question.[5]

The top suggestions for doctoral programs relate to the need for greater educational relevance to the changing world inside and outside academia and better labor market preparation, such as teaching and hands-on practice. In short, these survey respondents called for a curriculum of breadth that is interdisciplinary and that remains current so that students will have marketable skills. Comments such as this one were typical: "Keep curricula and program state of the art . . . constantly updating the programs to reflect changes, new needs, and demands in the workforce."

Table 7.3. Recommendations for Doctoral Programs, Per Open-Ended Questions, Top Three Rankings

	Biochemistry	*Computer Science*	*Electrical Engineering*	*English*	*Mathematics*	*Political Science*
Provide breadth/interdisciplinary	—	2	3	3	1	1
Stay current/marketable	2	1	1	—	2	3
Teach how to teach	—	—	—	1	3	2
Downsize	1	—	—	2	—	—
Provide hands-on experience	—	3	2	—	—	—
Provide information on BGN	3	—	—	—	—	—

Note: BGN = business, industry, government, and nonprofit organizations.

Source: PhDs—Ten Years Later Study.

Respondents from fields with the highest proportion of doctorates in academia recommended that Ph.D. programs teach students how to teach. In addition, in both biochemistry and English, disciplines in which Ph.D. recipients faced the toughest academic job markets, respondents recommended "downsizing."[6] Biochemists said: "Take only as many students as can be realistically trained for the few [academic] jobs that are available. Also try to expose students to a multidisciplinary education to make them more well rounded and therefore more attractive hires." Biochemists suggested repeatedly that doctoral programs should provide information about employment in the business, government, and nonprofit sectors. Both engineering programs recommended offering hands-on, practical experience during graduate school through internships or exposure to people with professional industrial experience.

Their suggestions for current students' educational focus included the following points:

- Focus on interdisciplinarity; go for breadth.
- Get a broad acquaintance with the field before becoming entirely specialized.
- Define goals early on in graduate school.
- Love the field or leave it.

When it came to the job search, the many responses can be summed up as follows:

- Better assistance is needed with the practical aspects of the academic job search from the faculty.
- Better understanding of and guidance for jobs outside academia are needed.

Phrased in myriad ways, eighty-nine respondents mentioned the need for "practical advice on the mechanics of the job search, especially the packaging of oneself in a CV, letters, and interview techniques." Their responses suggest that they saw this kind of help as intimately connected to having supportive and positive relationships with their mentors. For example, a typical response asked for "more support from faculty and preparation for interviews once dossier requests came in. I received good prep for my oral and written qualifying exams, but little prep for what came after writing a vita in the job search."

In general, this cohort complained about the overall quality of relationships they had with their faculty. Even after more than a decade, resentments toward their advisors during the job search provoked strong comments, such as this one: "It would have helped if one of my referees had taken the time to write more than a four-line letter of recommendation!" Another suggested, "It would have been helpful if I received some support from my department and advisor. I had none—my advisor was a 'star' who had no interest in mundane matters like jobs."

Another expressed a desire for better, more compassionate guidance. This person said: "I can now see that the letters of recommendation I got were from lame people. Real mentoring from more savvy folks would have helped; but overall professors in my department saw graduate students as aliens—not as potential junior colleagues whose struggles they could relate to." In the midst of these voices, however, there were also some that acknowledged that they received "truly caring and skillful guidance."

Many respondents commented that they had only a dim understanding of the highly restricted and competitive academic job market they were entering. They expected their advisors and departmental faculty to provide them with better information. Some expressed the opinion that their advisors understood the nature of the academic job market but simply did not care enough to provide them with good information, whereas others perceived their advisors to be themselves ill-informed about the academic job-market situation. All in these groups felt that they would have been well-served by better information on the academic market in general, the expectations of potential employers, and a candid assessment of their own prospects in particular. For example, one respondent desired "a clear idea of the jobs people in the previous classes had obtained—we all naïvely thought [that] jobs at outstanding schools would just open up."

Regardless of discipline, respondents often felt that they graduated without having a good understanding of the "big picture" of employment possibilities. There was often a tendency for faculty to expect their students to become faculty also, or at least the students believed and acted as if this were the case. (See Table 7.4.)

Table 7.4. Ph.D. Respondents' Views of Faculty Members' Career Expectations for Their Students

Major Field	*Academic Careers (%)*	*Both Academic and BGN (%)*	*BGN Careers (%)*	*No Specific*
Biochemistry	55	20	(3)	24
Computer Science	21	52	(4)	26
Electrical Engineering	8	53	5	34
English	73	8	(3)	19
Mathematics	54	24	(1)	22
Political Science	61	19	(1)	20

Note: BGN = business, industry, government, and nonprofit organizations. When the number of respondents in a category was less than five, that number, rather than a percentage, is shown in parentheses.

Source: PhDs—Ten Years Later Study.

A relatively narrow understanding of the ideal job often worked against graduates, as they reflected later. Many felt that more information was needed about the different types of academic institutions and jobs in business, industry, government, and nonprofit organizations. One mathematician recommended more advice and encouragement:

> Advice and encouragement about the different types of academic jobs—that is, university (research-oriented) versus small college (teaching-oriented). The nearly exclusive expectation of members of the department where I received my Ph.D. was that students would go to (hopefully good) research universities. It was felt that students who were interested in teaching at small colleges should keep quiet about it, lest the department lose interest in their progress. A few students were discouraged from continuing by their advisors when they made it known that they aspired to teaching at a small college instead of doing research at a university. Fortunately, I think this attitude has changed a lot in the last ten to twelve years, in my field generally, and in that graduate program in particular.[7]

A biochemist suggested, "My advisors could have spent more time with me to discuss the job market and to prepare applications.

Their honest view on the general direction of the science (what's hot and what's not) and how my training and my accomplishments would fit in would have been very helpful." Another went so far as to say, "I never wanted an academic job, particularly, but it was all I knew about. I ended up as a tenured professor, but I probably would have been happier in industry."

We found that although Ph.D. students felt well educated in their particular fields, they did not feel particularly well educated in what being a faculty member actually entails. Most knew that they would teach, although not all of them gained teaching experience as graduate students. The majority, however, felt unprepared for the broader tasks of being a faculty member, such as being an advisor, being a good mentor, serving on committees, acquiring outside funding, managing a research group, organizing conferences, learning how to manage their time, or knowing about the ethics of their field. As one electrical engineering Ph.D. recipient in our study stated, "I would let engineering Ph.D. students who are planning an academic career know that they will spend much (or all) of their time trying to obtain research funding, and little (if any) time actually doing research." Thus, devoting attention to the multifaceted aspects of being a faculty member, indeed defining what it is to work in a faculty position, is key to preparing future faculty.

Implications

One implication of this study is that career path analysis and retrospective analysis can be employed effectively to benefit current and future student education. The better that graduate deans, faculty, and students understand career paths of Ph.D. recipients and the retrospective evaluations of their doctoral programs, the better prepared future faculty will be to assist their students in comprehensive and meaningful ways. For example, knowing that one-third of the tenured faculty in our study did not move directly from Ph.D. completion to assistant professor positions tells us that the first job after receiving the Ph.D. does not necessarily determine the career path. Having empirical information on career paths of tenured faculty can help faculty mentor and encourage their students.

The study also demonstrates that understanding discipline-based differences in career paths as tied to the job market can be useful. For example, some respondents in English and biochemistry called for downsizing Ph.D. programs on the basis of the difficulty in finding tenure-track faculty positions. Although such individual labor market–driven responses are understandable, adopting a pure short-term labor market outlook is vulnerable to constant labor-market fluctuations.[8] Any policy recommendation needs to address long-term labor-market trends in order to avoid being obsolete when doctoral students complete their studies. In the case of English, the academic market has been limited for thirty years and has not improved lately. Therefore, attention to the reality of a persistent limited academic labor market is well placed. The situation in biochemistry is more complicated. The rapid advancement in the area of molecular research and life sciences in general created more academic positions. However, the accumulated postdoctoral population waiting for academic jobs and the increase in Ph.D. recipients in the life sciences since 1995 has exceeded the available academic positions.[9]

The study also reinforces the notion that the doctoral degree itself is put to many different uses in a variety of employment sectors. Traditionally, faculty and students in fields such as English and political science have operated under the assumption that no employer outside the academy will hire Ph.D. recipients.[10] Also in these fields, there exists a general assumption—particularly by the faculty—that the successful Ph.D. student should become a professor. Numerous comments in the open-ended section of our survey reported the risk of appearing to be a less serious doctoral student if one does not aspire to the professoriate.

The fourth implication concerns gender and combination of family and career. The rise of dual-career academic couples puts specific burdens on a couple as they negotiate job searching, career advancement, and family. Marriage patterns of women Ph.D. holders have a significant impact on their career paths. Of the women in our survey, 61 percent were married to a spouse having a Ph.D., a J.D., or an M.D., but only 27 percent of the men in our survey had a spouse with such a degree. One consequence of this marriage pattern is that in order for couples to live in the same geographic area, one of them must often accept non-tenure-track employment. Although the pattern is not new, the percentages are increasing. Historically, women Ph.D. recipients either were barred from employment at the same institution as their husbands because of antinepotism laws or took administrative rather than research and teaching positions to remain in academia (Shoben, 1997; Stephan & Kassis, 1997). However, given the growing number of women earning Ph.D.'s, coupled with the changing economic structure of colleges and universities, the issue of an academic secondary labor market is especially acute. In fields where the postdoc is common, women are bridging the transition from Ph.D. education to post-Ph.D. work with more and longer stints in postdoctoral positions than men.[11]

There is a strong indication that after completing their Ph.D., women combine a committed relationship, family creation, and career with working in postdoctoral appointments that allow them to be in the same location as their partners. Our study found that women Ph.D. recipients in mathematics were especially affected by the dual-career academic couple phenomenon. In mathematics, prestigious postdoctoral fellowships are a key stepping-stone toward a faculty career in a research university. However, the kinds of postdoctoral appointments that married women in mathematics held appeared not to have that stepping-stone character. Among women mathematics Ph.D. recipients who wanted to become professors, their postdocs (sometimes organized around their husbands' postdocs) served to shunt them away from a tenure-track trajectory.

A particularly notable implication of this study concerns the feasibility of conducting a large survey of this sort, in terms of contacting people and interesting them in taking the time to fill out the survey. The success of this survey is a clear indication that former students can be located, and more importantly, are willing to participate. The study demonstrates that Ph.D. recipients value their education and recognize that their retrospective analysis of doctoral education and experiences can be utilized to benefit current and future students.

Recommendations

Our research findings lead to several recommendations:

- *Future faculty and those preparing them need to familiarize themselves with the general trends in Ph.D. production in the United States and particularly in their own fields, as well as the initial career plans of recent graduates.* They can do so by consulting the annual *Summary Report of Doctorate Recipients from U.S. Universities* or the *Survey of Earned Doctorates* (SED), published by the National Opinion Research Center (see National Opinion Research Center, 2001) and sponsored by five national agencies. However, as our findings indicate, Ph.D. advisors, department chairs, and graduate deans need to look beyond initial career plans as reported in the SED in order to give relevant placement information to their students. We therefore recommend that departments collect and make available placement information on their graduates at least up to five years after degree completion. Indeed, tracking Ph.D. recipients for ten years would be ideal because of the long entry period for a significant number of individuals.
- *Future faculty members need to receive broad career information so they are better informed that challenging and intellectually satisfying positions exist outside academia.* They also need institutional support to collaborate with other units (both inside and outside academia) to pass employment information on to their students. Finally, they need to work to create an environment that allows for career goals beyond the tenure track.
- *In preparing future faculty, departmental administrators and faculty need to have long-term (lifelong) educational goals and values in mind with a broad understanding of the various career paths open to their Ph.D. graduates.* They need to equip their doctoral students with the knowledge and skills required to meet changing academic and nonacademic employment conditions.

We end with specific recommendations for those who have the power to implement them in light of our key findings: the university central administration, graduate deans, department chairs, and faculty.

Graduate deans and the central administration should do the following:

- *Spend more time, money, and effort on career planning and placement activities for doctoral students.* This means establishing collaborations between career planning and placement centers and academic departments for career planning workshop activities to be offered starting in the third year of the doctoral program; working with faculty to broaden the acceptance of business, industry, government, and nonprofit (BGN) organization careers as legitimate and desirable Ph.D. outcomes; making student placement a collective departmental responsibility; providing incentives to ensure that key faculty participate in placement; looking for funding scenarios that create powerful incentives for turning the culture around; and recognizing departments that place a very high percentage of their Ph.D. recipients into meaningful first jobs, regardless of sector.
- *Develop creative solutions for dual-career couples in the university.* Also, heighten awareness to offer more spousal accommodation during the faculty hiring process and support the establishment of a more family-friendly university, especially for women in science and engineering.

Faculty and department chairs should do the following:

- *Broaden program emphasis to prepare students for jobs in academia and BGNs.* Enhance training in teamwork and collaboration, interdisciplinarity, managerial, and organizational skills. Provide internship opportunities (academia, administration, BGNs). Encourage contact with the BGN sector. Articulate skills that are applicable in a variety of situations.
- *Prepare students who aspire to the professoriate for a life of teaching, research, and service in different types of higher education institutions.* Offer workshops, seminars, and internships that allow students to familiarize themselves with other than research institutions. Reward mentoring by faculty, especially mentoring of students of color.

All groups should do the following:

- *Develop a process for program evaluations by current and former graduate students.* Conduct surveys at regular intervals during the doctoral program. Require a Ph.D. exit survey under the graduate dean's purview. And finally, survey Ph.D. graduates five (and ten) years after degree completion.

Conclusion

As our study demonstrates, understanding the road to the professoriate and faculty career paths is immeasurably enhanced by retrospective studies such as the PhDs—Ten Years Later survey.[12] These studies provide graduate deans, program heads, graduate faculty advisors, researchers, and students with a wealth of data from which to make informed decisions about doctoral education. In this conclusion we would like to emphasize the importance of the data provided by the "write ins." Although we were advised against including open-ended questions—because of the study's size and the coding and analysis work—we felt strongly that a survey that posits former Ph.D. student voices as integral to doctoral education assessment must give respondents an opportunity to use their own words. As researchers, we were richly rewarded. Not surprisingly, Ph.D. recipients are both thoughtful and articulate about their education and careers. They constitute an invaluable resource for those of us who seek to advise students wisely and continue to improve and advance doctoral education.

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Notes

1. International Ph.D. students are concentrated in science and engineering fields. Roughly 50 percent of all international Ph.D. recipients remain in the United States.
2. Findings reported here are restricted to U.S. employment only.

3. Biochemistry was at only 1 percent because most took a postdoctoral appointment.
4. This case is a classic example of a more general finding: "For academic women, moves that advantaged their husbands' careers have certainly disadvantaged their own" (Miller-Loessi & Henderson, 1997, p. 37; see also Ferber & Huber, 1979; Marwell, Rosenfeld, & Spilerman, 1979; McElrath, 1992; Brooker-Gross & Maraffa, 1989).
5. The coding variables for the answers were established after reading over the majority of the responses. We then ranked the coded responses.
6. We assume the biochemists based this recommendation on their situation in 1985 *before* the increase of Ph.D.'s in biochemistry-molecular biology that occurred in 1987.
7. According to the Golde-Dore (2001) study conducted in 1999, this attitude had not changed.
8. See Zumeta and Raveling (2002), "Wither the Best and the Brightest?: Is There a Policy Problem Here?"
9. See National Research Council (1998), *Trends in the Early Careers of Life Scientists.*
10. See Nerad and Cerny (2000), "From Rumors to Facts: Career Outcomes of English Ph.D.'s."
11. See Nerad and Cerny (1999), "Postdoctoral Patterns, Career Advancement, and Problems."
12. See also Sadrozinski, R., Nerad, M., Cerny, J., with La, S. (March 2003), "PhDs in Art History—Over a Decade Later"; www.educ.washington.edu/COEWebSite/CIRGE/HTML/Getty.html.

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