

Toward a Global PhD?

FORCES AND FORMS
IN DOCTORAL EDUCATION WORLDWIDE

Edited by

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INTRODUCTION

During the last fifteen years doctoral education in the US has received sporadic, yet considerable, public attention. Since the early 1990s organizations and stakeholders—those with a direct interest in the quality of doctoral education and concern about the production and employment of the next generation of highly educated scholars and professionals in the US labor market—have voiced criticism.

The major criticisms include the under- and over-production of PhD recipients; a doctoral education that is mainly oriented to provide for the next generation of professors; the lack of training in professional skills needed for collaborations and working in organizations; the inadequate preparation for teaching in the different types of US higher education institutions; the long time-to-doctoral-degree in some fields, an overall low completion rate; and the lack of information about employment outside of the academy. These tumultuous years for doctoral education mirror previous eras in the evolution of doctoral education in the US, when graduate education had to respond to demands from national forces as well as to the internal demands and dynamics of their own universities.

Thus the purpose and structure of US doctoral education today faces numerous challenges. These challenges include: managing the intricate link between doctoral education and the institutional research missions of the university; undergraduate education; the labor market; funding; accountability and governance; and most recently, pressures from the global economic market. In this paper I will provide an overview of the history of graduate education in the United States, the current structure of gradua-

tion at most US universities, recent challenges and changes within doctoral education and national responses to those challenges and changes.

FORMS—DEVELOPMENT AND SCOPE OF US DOCTORAL EDUCATION

History: A little over a hundred years ago, in the late nineteenth century, leading US college educators turned to the German university as a model for inspiration to reform the inherited British undergraduate college into a place for advanced learning and training in original research. They borrowed selectively and reworked the German ideas to fit the needs and ideas of the time. The results became new creations with only little resemblance to the original inspiration. The advanced degree served, and still serves, almost exclusively as the gateway into the professoriate. Therefore, in US universities the PhD¹ from its inception entailed, in most cases, substantial research training. Most strikingly the US version concocted a novelty never imagined in Germany until recently: the distinction between undergraduate and graduate study.² At the individual discipline level, undergraduate and graduate education is housed under one roof, the “department.” As a way to coordinate the various graduate programs, US universities established the “graduate school,” a central administrative unit that oversees all masters and doctoral education, and more recently houses post-doctoral training in a campus setting.

Purpose and Goals: While different debates about doctoral education have accompanied its development in the US, the primary purpose and goal of doctoral education has been preparation of the next generation of university professors who will become productive researchers and innovators, and in turn become teachers of the following generation.

Infrastructure: In the United States over four hundred institutions award doctoral degrees and the number is steadily increasing. Between 1995 and 2003 the number of US universities conferring doctoral degrees climbed from 376 to 423.³ However, fifty of these institutions award about 50 percent of all doctoral degrees. As a result, doctoral education is primarily concentrated in a few institutions—the major research universities—of which the majority are members of the American Association of Universities.⁴

Funding: The US has public and private universities. Public institutions are part of the public higher education system and are under the sovereignty of the fifty US states. Initially, the states provided property, building, equipment, and instructional salaries for all of their public universities. Private institutions are funded by endowments, philanthropy, investments, and property holdings, and student fees. Once a student is

accepted into a doctoral program in a private institution his or her studies are funded similarly to a student in a public institution. In both the public and private institutions doctoral education is funded by various sources. Teaching and advising is funded by the state through salaries to academic instructional staff, the graduate professors. Research is largely funded by the US federal government⁵ through research grants and contracts including laboratory instrumentations to individual professors and campuses. Research is also funded by private foundations and internal university allocations. Doctoral students are funded through a few national government, private foundation, and individual campus graduate student fellowship programs. Many doctoral students are funded through teaching assistant (TA) positions within their departments that last for at least one year or up to four years, as in the humanities. These TAs are provided by the state. Practically all science, engineering and many social science students are funded as research assistants (RA) on professors' individual research grants or through traineeships from governmental grants. In addition, universities have additional financial support mechanisms such as fee and tuition fellowships or waivers. Students can also apply for federal support through the student loan program. According to the 2003 *Summary Report of the Survey of Earned Doctorates* (SED) graduating doctoral students reported that their primary financial support came from these areas: 20 percent from fellowships; 30 percent from research assistantships; 20 percent from teaching assistantships; and 30 percent from financing their studies on their own, by working various jobs on or off campus, including financial support from their employers, or from foreign governments.⁶

Demographics: Approximately 4 percent of all undergraduates in the US go on to obtain a doctorate. Presently about 40,000 PhDs are awarded annually in the U.S. The growth in PhD production began during the 1960s (when about 10,000 PhDs were awarded) with the onset of the Vietnam War. Many men deferred the draft by going to graduate school—and thus the early 1970s show a dramatic increase in doctorate awards (nearly 30,000 PhDs). This PhD increased production rate leveled off over the 1980s (the number remained about the same) and began to increase again in between 1990 and 1998 to nearly 43,000 PhDs. Fueling the increase in PhDs, particularly in humanities and arts, has been the widely publicized, but false prediction of a shortage of PhD recipients in the late 1980s to fill the positions of retiring faculty. This increase in the PhD production rate during the 1990s was further fueled by higher enrollments in the life sciences, physical sciences, and engineering largely due an increase in the influx of international students in these fields. Since 1970 the life sciences experienced

TABLE 13.1. Percent of Women PhD Recipients by Major Field

<i>Field/Year</i>	1973 <i>N</i> =33,755*	1983 <i>N</i> =31,281*	1993 <i>N</i> =39,505*	2003 <i>N</i> =40,590*
Physical Science	7%	14%	21%	27%
Engineering	1%	5%	9%	17%
Life Science	18%	31%	42%	48%
Social Science	21%	40%	50%	55%
Humanities	29%	44%	48%	51%
Education	25%	50%	59%	66%
Prof./Other	13%	29%	36%	50%
Total	18%	34%	38%	45%

* N equals all PhDs awarded.

SOURCE: CIRGE, UW Seattle, 25 August 2005. From "Doctorate Recipients from United States Universities: Summary Report 2003," p. 49.

the largest consistent increase, to over 8,000 PhDs awarded in 2003. Education experienced the most consistent decrease of doctorates awarded since the 1970s, by a drop of slightly over 8 percent, from about 7,200 to 6,600 doctorates, a field with relatively few international students. The rapid increase in the physical sciences and engineering fields experienced during those years was followed by a slow but steady decrease since the late 1990s.

Doctoral education in the US has seen a significant change in the demographics of doctoral students. Regardless of age and other employment status, all individuals enrolled in a graduate education program in the US have a student status within the university, regardless also of employment as a teaching or research assistant. Women's degree achievement in doctoral programs since WWII has steadily increased, and reached close to parity in 2003 (45 percent).⁷ The largest increase occurred during the last thirty-three years. In 1970 the proportion of women earning PhDs was 13 percent, and in 1983 and 1993, it increased to 38 percent. (See table 13.1.)

Women's PhD acquisition since the year 2000 surpassed men's in the fields of education, social sciences, and the professional fields, and is equal to that of men in the humanities and nearly equal to that of men in the life sciences.⁸

While the vast majority of doctorate recipients are racially identified as white, the year 2003 saw the largest percentage of doctorates being earned by individuals identified as racial/ethnic minorities who were historically underrepresented groups in higher education. Nineteen percent or 4,753

TABLE 13.2. Doctorates Awarded to Racial/Ethnic Minority U.S. Citizens for the Last Three Decades: 1973–2003

<i>Race/Year</i>	1973 <i>N</i> =22,956*	1983 <i>N</i> =25,020*	1993 <i>N</i> =28,408*	2003 <i>N</i> =26,931*
Black	3%	4%	4%	7%
American Indian	0%	0%	0%	1%
Asian	4%	4%	7%	8%
Hispanic	1%	2%	3%	5%

* *N* equals all PhDs who identified their race/ethnicity.

SOURCE: CIRGE, UW Seattle, 30 August 2005, NSF Web CASPAR; From "Survey of Earned Doctorates/Doctoral Record File," via Web CASPAR, <http://caspar.nsf.gov>.

of all recipients were minorities and included Blacks, Asians, Hispanics, Native American Indians, Hawaiians, and Pacific Islanders. (See table 13.2.)

International students are those students who come to the study in US institutions on a full-time basis. Officially they are called "non-US citizens on temporary visa." The proportion of international students rose from 10 percent in 1973 to 27 percent (10,585) in 2003. (See tables 13.3 and 13.4.)

Although the number of international applicants has dropped since 2002, there has been no reduction in doctorates awarded to international students because it takes on the average five to seven years from entrance to graduate school to doctoral degree completion (including master's degree). Until 2002 roughly 50 percent of the international PhD students remained in the US after degree completion.⁹ The five largest countries of origin are: the People's Republic of China, Korea, India, the Republic of China (Taiwan), and Canada.

Despite the increase in PhD production, the ratio of PhDs to bachelors degrees has stayed fairly stable between 3.5–4.3 percent during the last twenty years, at 3 percent when we count only degrees awarded to US citizens and permanent residents. About 25 percent of the US population holds a bachelor's degree and 1.5 percent holds a doctoral degree, including MDs and JDs.

Although the number of faculty at US colleges and universities has steadily increased during the last thirty years, the number of tenure-track faculty has not increased in relation to the increase in the undergraduate and graduate student population.¹⁰ The number of "other faculty," referring to the non-tenure track group of annually appointed lecturers, instructors, and affiliates (who are often part-time) is steadily increasing.¹¹

TABLE 13.3. Percent of International PhDs by the Last Three Decades

1973	10% (<i>N</i> =3,209*)
1983	15% (<i>N</i> =4,540*)
1993	25% (<i>N</i> =9,973*)
2003	26% (<i>N</i> =10,585*)

* *N* equals total international PhDs awarded.

SOURCE: "Doctorate Recipients from United States Universities: Summary Report 2003," p. 54.

TABLE 13.4. International PhDs by Major Field for the Last Three Decades

<i>Field/Year</i>	1973 <i>N</i> =3,209*	1983 <i>N</i> =4,540*	1993 <i>N</i> =9,973*	2003 <i>N</i> =10,585*
Physical Science	21%	20%	24%	21%
Engineering	20%	26%	28%	27%
Life Science	20%	17%	20%	21%
Social Science	16%	13%	11%	11%
Humanities	8%	8%	6%	7%
Education	9%	12%	6%	6%
Prof./Other	5%	5%	6%	6%

* *N* equals total international PhDs awarded.

SOURCE: "Doctorate Recipients from United States Universities: Summary Report 2003," p. 54.

Overall, the median age of doctoral recipients in the US is in the early 30s. In 2003 the median age was 33.3 years. Individuals receiving their doctorates in science and engineering fields are generally the youngest, with a mean age of 31.8 years, while for those in the humanities the median age is closer to the mid 30s (34.5). Education doctorates are generally the oldest with a mean age of early 40s.¹²

*Program Structure*¹³: After completing an undergraduate degree, which is generally a four-year course of study, an individual is qualified to apply

for further education at the graduate level. Masters and doctoral education (also called graduate education) takes place in highly decentralized and semi-autonomous units, mainly in departments of doctoral-granting universities and colleges. If a person chooses to go on for a doctorate degree, he or she has various program options. For some programs the procedure is to obtain a master's degree and then apply to continue on for the doctorate. Other programs allow the applicant to apply directly to a doctoral degree program. While great variety exists among doctoral programs, two basic structures are common. One pertains primarily to social science and humanities fields, the other to science and engineering. Both general types of programs have a highly selective admissions process. In general, a quarter of all applicants are admitted.

Admission criteria are based on the undergraduate grade point average; the scores on a national graduate entrance exam—which includes a verbal, analytical, and quantitative component; letters of recommendation from undergraduate professors; and a “Statement of Purpose” essay. For the social science and humanities the typical program involves up to three years of course work—mainly seminars. Many doctoral programs require a certain number of fixed core courses along with a fairly large number of electives. The end of this period is marked by taking general exams and writing a major publishable article, which together serve to demonstrate the knowledge of the field acquired during the coursework years. Usually after passing the exam and completing the article, students embark upon developing their dissertation proposals. These proposals are formally reviewed. Thereafter students are engaged in their original research. This period of time does not necessarily need to take place at the home university, and often it is spent in the field—for example in archives, museums, or libraries—anywhere in the world. The completion of the dissertation is in most instances a formal presentation by the student to the dissertation committee, which consists of between three to five faculty members, with one person who must be from outside the program. The dissertation manuscript must be signed by the dissertation committee signaling its approval. At present the average time-to-degree in the social sciences and humanities ranges between five to eight years for social sciences and five to nine years in the humanities.

Science and engineering doctorates follow a similar sequence of course studies, dissertation development, and research. However, an essential preliminary step is an examination at the end of the first year of doctoral study in which the students have to demonstrate basic advanced knowledge of the field. In many programs this exam functions as a way to ensure that

only qualified students continue. At the end of year two, or in some cases year three, students take a general exam that includes the presentation of dissertation research and at least a publishable research paper. During the entire period of doctoral study, the students work in their main dissertation advisor's laboratory, usually paid as research assistants. Given that in these laboratories major research is taking place, doctoral students work side by side with their advisors, the advisor's post-docs, and undergraduate students, on research that is likely to shape their dissertation. Completion of the dissertation culminates in a defense, usually at the end of year five and up to year seven. One significant distinction between the fields of study is the nature of their financial support. Social science and humanities students rarely have the opportunity to be paid to work on their dissertation. Instead they are often employed as teaching assistants. However, this employment is, in most cases, not directly related to their dissertation. In many science fields a post-doc position (usually between two and four years) has become a requirement or a preferred option to enter a professorial career path.

The Department—Home of the Graduate Program: The graduate faculty members are those professors who are likely to teach both undergraduate and graduate classes. For graduate education (both masters and doctoral) a faculty member serves as advisor to a doctoral student most often from entrance to exit. In the humanities, social sciences, and education, students often choose their main advisor and dissertation committee at the time they begin working on their dissertations. Graduate professors oversee the many issues facing graduate students, such as admission decisions, allocation of fellowships and assistantships, awards for exceptional graduate students' teaching, initiation of program revisions, and the overall monitoring of student progress. Every department has one administrative assistant dedicated to graduate student matters. Often this person holds a permanent staff position so that he or she is able to offer continuity to the graduate students and to the program as a whole.

Program Quality Assessment: Departments are subject to periodic review, generally every seven to ten years. This review covers both undergraduate and graduate programs and its procedure varies among universities. The graduate component of these department reviews, which are undertaken by neighboring departments within the same university and faculty from the same discipline from other universities, consists of a qualitative and a quantitative assessment of the masters and doctoral programs. Usually the departmental review is part of the responsibility of the graduate school, undertaken by the “graduate council”—an academic senate

sub-committee. In addition, the department chair annually reviews faculty members for the purpose of promotion. This promotion review includes an assessment of publications, teaching evaluations, and in many cases the level of doctoral students' satisfaction with advising provided by the faculty member. It also includes doctoral students' academic achievement and honors, assistance to graduate students in their professional development (such as publishing, teaching, and grant writing), and the students' presentation skills at national and international conferences.

National Assessment of Doctoral Education Programs: The national assessment of doctoral programs in the US began over seventy-five years ago (in 1925). A number of national associations began conducting reputational studies by asking raters, who were usually professors in various fields, about the esteem in which they held doctoral programs. The results were then ranked. Since 1982 the National Research Council, a "think tank" of the National Academies, has undertaken such assessments. While the last assessment, in 1995, expanded the quantitative research methods, nevertheless it spurred widespread criticism of creating a "horse race" mentality through the ranking of programs.¹⁴ NRC therefore appointed an advisory committee to examine past methodology used. In 2003 the committee published its recommendations. It pointed out five major weaknesses of previous assessments: (1) a flawed measure of educational quality, derived from unclear questions posed to faculty respondents that resulted in "research reputation" and "program quality" being interchanged; (2) the obsolescence of data because of the ten-year cycle; (3) a poor dissemination of results; (4) the use of outdated or inappropriate taxonomy of fields; (5) the inadequate validation of data accuracy. NRC is currently undertaking a new and widely improved research doctorate assessment to be completed in 2007–08.

Although the NRC assessment was widely criticized, institutions and individual doctoral programs have taken the results very seriously because the assessment stood as a proxy of program quality. High quality programs attract high quality students, more research money, and are less likely to lose faculty or funding, and/or to be abolished altogether. In response, institutions are refining their quality measures. Institutional data collection has become a primary concern. Many graduate schools have introduced exit questionnaires that are completed by doctoral recipients. These questionnaires ask recipients to assess their satisfaction with their degree programs. In addition, various professional accreditation organizations produce their own department and doctoral program assessments in order to maintain a high quality of doctoral education. In all, these various means

of quality assessment are a guarantor of ongoing systemic renewal and improvement.

Graduate School and Graduate Dean: The graduate school is closely linked to the research agenda of the university. Universities vary in how they ensure that policies and procedures that govern the research activities of the university are directly responsive to the needs of the graduate programs. In some instances the positions of vice-president for research and graduate dean are shared by the same person. In other cases, particularly where large medical schools exist, these two positions are filled by two different people. Regardless, the graduate dean and the vice-president for research are in the inner circle of the president of the university.¹⁵

The graduate school monitors student progress, grants degrees, collects dissertations, and approves new degree programs. The graduate school plays additional important roles on campus, from establishing policy and procedures to determining financial support, to developing mechanisms for quality assurance. It supports intellectual development and advocates for the academic staff in their roles as advisors, as well as for the graduate students, with a focus on student retention, time-to-degree, career development, and doctoral job placement.

WEAKNESSES AND CRITICISMS OF US DOCTORAL PROGRAMS

In the late 1980s, articles in major publications such as the *New York Times* and the *Wall Street Journal* heralded a forthcoming shortage of PhD recipients by the 1990s due to massive faculty retirements and an anticipated increase in the college-bound population. These articles were based on a 1989 book by the president of the Andrew Mellon Foundation and the 1990 publication of a presidential address of the American Association for the Advancement of Science.¹⁶ In response many universities planned expansions to their graduate education programs in rapid succession. However by 1995, the end of the Cold War, a worldwide recession, and a federal government forced to reduce a budget deficit called a halt to plans of expansion. Universities soon began curtailing PhD production in those fields with a limited academic job market. For many universities, working to realign their PhD production in terms of national and international forces represented the beginning of a major re-thinking of PhD education in general.

This major re-thinking gained additional momentum with the 1995 publication of an influential and widely quoted report by a committee of the National Academies, *Reshaping Graduate Education of Scientists and Engineers*.¹⁷ This publication was highly critical of the current state of doctoral education. From 1995 on, a number of forces for change began to

come together: The National Academies Report, increasing criticism from doctoral students (through the establishment of graduate student unions), and the demand for greater accountability by state governments concerning doctoral education outcomes generated national attention and resulted in a national convening of major doctoral education stakeholders in Washington, DC in the summer of 1995. For the next five years invigorating and necessary attention was paid to doctoral education, culminating in a major national conference in 2000. This conference, organized by *Re-Envisioning the PhD* under the leadership of Jody Nyquist and funded by the Pew Charitable Trusts, articulated a call to reevaluate doctoral education, to determine whether this education is indeed appropriate to prepare scholars and researchers to meet the demands of society and the global world, to better understand the criticisms of doctoral education in the United States, and to develop strategies to address the criticisms. The major criticisms of US doctoral education that have arisen over the past fifteen years can be summarized in the following list regarding doctoral student training. Briefly, doctoral students are believed to be:¹⁸

- educated and trained too narrowly;
- lacking key professional skills, such as collaborating effectively and working in teams, and lacking organizational and managerial skills;
- ill-prepared to teach;
- taking too long to complete their doctoral studies and in some fields many are not completing their degrees at all;
- ill-informed about employment outside academia; and
- having too-long a transition period from PhD completion to stable employment.

FORCES AND STIMULI OF CHANGE

Changes in higher education's wider social, political, and economic contexts shape the content and operation of doctoral education. Powerful forces converge at the intersection of doctoral education and university research in particular.¹⁹ The labor market, state higher education governing boards, federal and state research funding and student aid policies, and the public have demanded that the university be increasingly accountable for the use of public tax dollars. Graduate students, within their national organization (NAGPS) and within their disciplines' national professional associations such as the MLA, have played a more dominant external role in shaping institutional policy and program structure. The internal forces

that have shaped graduate education include advancement in knowledge; individual departments, which differ widely from each other in size, wealth, program structure, and outlook regarding the purpose of doctoral education; a student body that in recent years has become increasingly diverse in gender, ethnicity, citizenship, and age and has formed graduate student unions; and the increasing intra-institutional competitive pressure to improve or maintain programs that are regarded highly in academic quality by their peers.

Since 2001, due to a change in the leadership of the US government, followed by changed national priorities after the terrorist attack on September 11 of 2001, graduate education again had to cope with external forces and a further reduction in funding by state and federal governments. Exceptions are areas of national priorities, such as biotechnology, and areas of military and national security. Most recently, the reduction of international students coming to study in the US is of concern to universities and national organizations that focus on the production of the country's highly trained labor force. As US science and engineering has become increasingly more dependent on international students and scholars, the United States needs to compete more strenuously for international talents to come to US programs. Also, US students need to be prepared to work in a global arena and be able to address global scientific challenges in a time of increasing global tension.

Recently, Ronald Ehrenberg, Director of the Cornell Higher Education Research Institute, succinctly stated what the nature of the connection of federal funding is in regards to graduate education, the economy and international students:

1. Research and development lead to innovation and economic growth.
2. Graduate students in general and foreign graduate students in particular, play a major role in the production of research and innovation
3. Attempts to make statements about shortages of PhD-level scientists and engineers are almost certainly doomed to fail and miss the point that what is optimal from the perspective of different actors in the market (individuals contemplating graduate study, individual professors, academic departments, and employers), is not necessarily optimal for the nation as a whole.
4. Financial stresses faced by American higher education institutions have serious implications for the future flow of US graduates into PhD programs.
5. The mobility of college graduates in general, and PhDs in particular, will cause states to under-invest in their public higher education sys-

tems and provides a strong argument for an increased federal role in graduate education.²⁰

INITIATIVES AND INNOVATIONS

These criticisms gave impetus to a flurry of national and local initiatives in doctoral education by the National Science Foundation, the Alfred Sloan Foundation, the Ford Foundation, the Council of Graduate Schools, the Pew Foundation, the Woodrow Wilson Foundation, the Carnegie Foundation for the Advancement of Teaching, and a number of individual university programs. Private foundations, reflecting the particular US higher education system, fund all but one of the national initiatives, and a number of single-institution ones as well. These initiatives include:

1. National Science Foundation: The Integrative Graduate Education Research and Traineeship program (IGERT), and Alliances for Graduate Education and the Professoriate (AGEP)
2. Council of Graduate Schools: Professional Master's Program, Professional Science Master's Program; Responsible Conduct of Research Project; the Doctoral Completion Project; Preparing Future Faculty/Preparing Future Professionals
3. The Carnegie Foundation for the Advancement of Teaching: Carnegie Initiative on the Doctorate
4. Pew Foundation Charitable Trust: Re-envisioning the PhD
5. The Woodrow Wilson National Fellowship Foundation: The Responsive PhD, including the Humanities at work program
6. CIRGE/Ford Foundation national PhD career path and educational outcome surveys

The National Science Foundation's "Integrated Graduate Education and Research Traineeship" (IGERT) initiative proposes the creation of doctoral programs that are centered on theme-based research. The goals are:

- a. To provide funding for doctoral students that is more independent of the faculty advisor by tying the funding to the doctoral program and not the faculty advisor;
- b. To build doctoral programs that are interdisciplinary;
- c. To educate and train doctoral students in problem-oriented and theme-based research programs;
- d. To provide access for doctoral students to professionals in their field who work outside of academia;

- e. To organize the structure of the program so students learn the maximum range of professional skills, from learning how to teach, to working in teams, publishing, developing presentation skills, and learning organizational skills; and
- f. To bring diversity to doctoral programs.

This initiative provides funding primarily for students rather than faculty. With the shifting of funding away from faculty to students the emphasis is placed on the learning environment. With this shift NSF hopes to reduce time to doctoral degree and to create a future generation of scholars who are better prepared to address the large-scale problems of industrialized societies that cannot be solved by a single disciplinary focus or by a single researcher. This program is intended to catalyze a cultural change in graduate education, for students, faculty, and institutions, by establishing innovative new models for graduate education and training in a fertile environment for collaborative research that transcends traditional disciplinary boundaries. It is also intended to facilitate diversity in student participation and preparation, and to contribute to the development of a diverse, globally-engaged science and engineering workforce. Since 2003 it has included an international perspective. At present 125 programs at sixty-five universities are or were funded for five years, with a possibility to apply for renewal. Each program was granted \$2.9 million, largely for student stipends, evaluations, and curriculum development.

The National Science Foundation's "Alliances for Graduate Education and the Professoriate" (AGEP) initiative is designed to increase the number of US citizens and permanent residents entering the science, engineering, technology, and math fields. AGEP has the specific goal to increase the number of under-represented minority graduate students in these fields and consequently the number of underrepresented minorities in faculty positions.

The Council of Graduate Schools (CGS) has a number of initiatives and programs that are designed to respond to changes in graduate education. The "Professional Master's Program" initiative helps institutions develop and provide a master's degree for people who are interested in pursuing careers in the business, government, and non-profit (BGN) employment sectors and who will start work at the entry level. This initiative responds to employer needs for an entry-level work force that has stronger skill sets than workers with bachelors degrees, as well as student needs for a degree that helps them compete successfully for jobs in the BGN sector. The professional master's is particularly well-suited for the liberal

arts undergraduate major who is not pursuing either a PhD or professional degree (law, social work, engineering, etc.).

A similar initiative, but geared more explicitly for the sciences, is the "Professional Science Master's Program," funded by the Sloan Foundation, Council of Graduate Schools, and the Ford Foundation. It is an initiative that proposes a better match between the career options and the career opportunities of graduate students in the sciences and social sciences. This program responds to the criticisms of doctoral education time-to-degree, high attrition rates, the limited academic job market, and students' desire for non-faculty positions, by providing an alternative route to a terminal science master's degree. This initiative funds institutions to develop a new type of science master's degree that equips people to work outside of academia. It targets major research universities as well as masters-focused institutions to develop two-year masters programs that are heavily oriented toward interdisciplinary course work and strong interaction with employers.

CGS also sponsors a project aimed at educating scientists and their students about the professional norms and ethical standards for responsible conduct of research. This project helps to ensure that all scientists are informed about the ethical requirements of research. It is underwritten by the US Department of Health and Human Services' Office of Research Integrity and by a grant from the National Science Foundation.

Another important project spearheaded by CGS and funded by Pfizer Inc. and the Ford Foundation is the "PhD Completion Project." This project is designed to help institutions develop strategies to address doctoral completion rates and attrition. It further supports evaluation of the strategies so that institutions can determine what strategies work and why. Participating institutions will have their graduate deans present results of the project and share information nationally.

"Preparing the Future Faculty" (PFF) initiative was originally initiated and funded in 1993 by the Pew Charitable Trusts Foundation and coordinated by the Association of American Colleges and Universities and Council of Graduate Schools. Currently the Council of Graduate Schools coordinates this program as a core part of its mission. The initiative's goals are to prepare current doctoral students for their role as future faculty and to prepare students, in a few cases, for their roles as professionals in their fields outside of academia. Today about 295 institutions participate. The majority are masters and bachelors institutions, with forty-three doctoral granting universities also participating. The initiative sponsors seminars and workshops to introduce doctoral students to the different types of institutions of higher education, to their responsibilities as teachers, researchers,

and to providing a service to the academic community. It places students into internships at these various institutions, where they teach under the mentorship of an established professor. Thus doctoral students have multiple mentors. It also offers pedagogical workshops. Since 1998, the PFF works together with disciplinary associations. These associations select the participating doctoral programs.

Another initiative is the "Carnegie Initiative on the Doctorate," sponsored by the Carnegie Foundation for the Advancement of Teaching. It is designed to support departmental efforts in structuring their doctoral programs. This initiative addresses the disciplinary communities of six fields: chemistry, education, English, history, mathematics, and neurosciences. It fosters discipline-based conceptual work. Departments that apply for and are selected to participate in this initiative receive advice and funding for two of their members to attend meetings with their counterparts in other participating programs, where they share experiences and information about restructuring their programs. They do this work in collaboration with their professional associations. In short, this initiative tries to stimulate a debate about the structure of doctoral programs by engaging the national association of a discipline in such a conversation.²¹

The "Responsive PhD," coordinated and funded by the Woodrow Wilson National Fellowship Foundation, is an initiative that focuses not directly on students or departments. Rather, it intends to support the initiators of change at a university, that is, department deans, divisional deans, and department chairs. It provides information on best practices in graduate education by bringing participating members together to share their experiences with their own best practices, particularly on the implementation process. The foundation funds the information-sharing meetings and provides some financial support to institutions that wish to implement one of the best practices. The Responsive PhD has identified four issues for a national agenda. The first one is to improve the diversity in graduate education and the professoriate. The second is to ensure that academic knowledge is used for social challenges and to promote "public scholarship." The third is to understand the impact of globalization on doctoral education. And the fourth is to prepare doctoral students for a range of careers.

The Woodrow Wilson Foundation also created the "Humanities at Work" project that consists of a two-year postdoctoral fellowship program, practicum grants of \$1,500 for graduate students, and a public scholarship grant for faculty. The primary goal of this project is to increase society's awareness of the value of humanities education.²²

The Ford Foundation has funded the University of Washington's Center

for Innovation and Research in Graduate Education to undertake national surveys on graduate education outcomes, including the career paths of PhD recipients (Social Science PhDs—Five + Years Out) and the evaluation of graduate education of these PhD holders. The intersection of family and career in the life of PhDs is a major topic in the analyses of the career path both for men and women. Increasingly the PhD leads to multiple career possibilities inside and outside of academia that are very satisfying to PhDs.

These initiatives and research activities address various forces that impact doctoral education. They represent different approaches and strategies in the effort to bring about desired changes and by so doing, they target different constituent groups: students, departments, deans, and universities. These initiatives furthermore vary significantly in scope and impact. They all acknowledge the major criticisms of the doctoral program and provide a platform for dialogue on innovation and change. Except for the NSF-funded initiatives they offer minimal financial incentives for implementing these best practices. Mostly they appeal to a moral imperative that there is a need for change and to the goodwill of campus administrators. They all provide advice and the promise of national visibility, thus raising the status of participating departments.

CONCLUSION: WHAT INFORMATION IS NEEDED?

Over the last decade, a robust body of research on doctoral education has grown to inform practices in doctoral education. It has begun to move forward a rationale for an incentive structure to bring about change in a system where there are competing pressures and structures that tend to perpetuate the status quo. But more work in this domain is essential to ensure continued improvement. The innovations in doctoral education that address the changing population of students, new methods of learning, and emerging new disciplines do produce best practices, but additional studies are needed to discern the outcomes and the mechanisms for institutionalizing change. We continue to need improved understanding of what works and what does not. Many innovations are still largely local, and changes in practices are not broadly understood. The development of interdisciplinary curricula is largely done by trial and error. Different models for learning that preserve disciplinary depth and go beyond the traditional disciplinary boundaries while allowing students to prepare for a variety of careers in a changing global context warrant systematic investigation. The definition of what is a successful outcome for a PhD's education needs to be rethought. As new types of programs emerge that try to meet the demands of the labor market, it is important to define what

the unique contribution of the PhD education is, and how success should be measured both for society and the individual. Changing doctoral education is difficult in a decentralized system with the absence of an incentive structure. Innovation and institutional reform most likely will be achieved in the US when linked to the competitive races for scientific priorities, resources, and reputation.²³

NOTES

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1. In the following PhD (Doctor of Philosophy) and doctoral degree are used. There are a number of professional doctorates that are not PhDs, but are included in the numbers cited, for example the doctor of education (EdD), the doctor of social work (DSW), the doctor of public health (DPH), but *not* the doctor of jurisprudence (JD), nor the medical doctor (MD).
2. James Turner and Paul Bernard, "The German Model and the Graduate School: The University of Michigan and the Origin Myth of the American University," in *The American College in the 19th Century*, ed. Roger Geiger (Nashville: Vanderbilt University Press, 2000).
3. NORC, *Doctorate Recipients from United States Universities: Summary Report 1995*, 3, and 2003, highlights, and NORC, *Summary Report 2003*.
4. Currently sixty US universities and two Canadian universities are members.
5. The National Science Foundation (NSF), the National Institutes of Health (NIH), the Department of Energy (DOE), United State Department of Agriculture (USDA), and National Aeronautic and Space Administration (NASA).
6. NORC, *Summary Report of the Survey of Earned Doctorates, 2003*.
7. The 45 percent figure includes all women; when we look at just US citizens and permanent residents, we see that 51 percent of doctoral degrees went to women.
8. NORC, *Summary Report of the Survey of Earned Doctorates Degrees, 2003*.
9. D. Gupta, M. Nerad, and J. Cerny, "The Road Home: Exploring the Choice to Stay or Return of International PhDs," *International Higher Education*, Spring 2003.
10. The tenure system in the US is a promotion system in which professors progress to a permanent position. In order to achieve the permanent position a faculty member must be in a tenure-track position.
11. *Chronicle of Higher Education Almanac*, Issue 2005–6, 25; see also Baldwin and Chronister 2001; Gappa and Leslie 1996; Sommer 1994.
12. NORC, *Summary Report, Survey of Doctorates, 2003*.
13. See addendum.
14. *Assessing Research-Doctorate Programs: A Methodology Study*, 5.
15. See Organizational Charts.

16. Both predicted a serious shortfall of PhDs in the arts and traditional science, as well as the natural sciences and engineering for several decades to come. William G. Bowen and Julie Ann Sosa, *Prospects for Faculty in the Arts and Sciences* (Princeton, NJ: Princeton University Press, 1989); 8 Richard Atkinson, "Supply and Demand for Scientists and Engineers: A National Crisis in the Making," *Science*, 27 April 1990: 425-32.
17. COSEPUP 1995.
18. M. Nerad, "The PhD in the U.S.: Criticisms, Facts and Remedies," *Higher Education Policy*, Vol.17, No. 2.; Jody Nyquist and Bettina Woodford, "Re-envisioning the Ph.D.: What Concerns Do We Have?" Seattle, Washington, CIDR web site, <http://depts.washington.edu/cidrweb/>.
19. Patricia Gumpert, "Graduate Education and Research: Interdependence and Strain," in *American Higher Education in the Twenty-First Century*, ed. Philip Altbach et. al. (Baltimore: Johns Hopkins University Press, 2005).
20. Ron G. Ehrenberg, "Graduate Education, Innovation and Federal Responsibility," *Communicator*, CGS Vol. XXXVIII, No 6, July 2005, 1ff.
21. Chris Golde and George Walker, 2006.
22. The Woodrow Wilson National Fellowship Foundation, *Diversity and the Ph.D. A Review of Efforts to Broaden Race and Ethnicity in U.S. Doctoral Education*. Princeton, NJ: Woodrow Wilson National Fellowship Foundation, May 2005.
23. Irwin Feller, "Interdisciplinarity As a Component of the Reform of American Graduate Education," presentation to the NSF workshop on the future of graduate education, 19-20 March 2003.

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