AAU

COMMITTEE ON GRADUATE EDUCATION

REPORT AND RECOMMENDATIONS

October 1998

Graduate Education Committee

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Task Forces

Quantitative Dimensions of the Enterprise

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Institutional Policies Governing Graduate Education

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Financial Support for Graduate Education

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EXECUTIVE SUMMARY

Graduate education in the United States is widely recognized as the best in the world, yet it is far from perfect and will remain in a leadership position only by continual self-examination and improvement. Criticisms commonly heard today include overproduction of Ph.D.s; narrow training; emphasis on research over teaching; use of students to meet institutional needs at the expense of sound education; and insufficient mentoring, career advising, and job placement assistance.

Taking these criticisms seriously, the Association of American Universities (AAU) formed the Committee on Graduate Education to evaluate the conduct of graduate education on its member campuses. The Committee examined the institutional perspectives on graduate education, surveyed its institutions about their graduate programs, and developed guidelines on best practices for graduate education policies and programs. The Committee concentrated on Ph.D. or doctoral education, the focus of the national debate on graduate education.

THE NATIONAL PERSPECTIVE

Graduate education prepares the scientists and engineers needed by industry, government, and universities to conduct the nation's research and development; educates the scholars in the humanities, social sciences, and the arts who preserve and enlarge our understanding of human thought and the human condition; and develops the scholars in all disciplines who become the faculties of the nation's colleges and universities.

Following World War II through the early 1970s, graduate education experienced unprecedented growth. This growth leveled off during the late 1970s and the first half of the 1980s, but it has increased steadily for the last decade. In 1995, the number of Ph.D. recipients reached an all-time high of 41,610. The growth in Ph.D. recipients has been accompanied by increased participation of women, minorities, and foreign students.

Over the last decade, the number of Ph.D.s awarded by U.S. universities to foreign students has increased at more than twice the rate of Ph.D.s awarded to U.S. citizens, reaching 32 percent of all doctorate recipients in 1995. Concern has been expressed about the impact of foreign Ph.D.s on the domestic employment market, but several factors suggest that the impact is small. Moreover, those foreign students who remain in the U.S. enrich the nation's talent pool.

Employment data indicate that Ph.D. recipients have low unemployment rates upon completion of their graduate work and throughout their careers. However, an increasing number of Ph.D. recipients are still seeking postgraduate commitments upon completion of their doctoral programs, and a growing number of commitments that are secured at Ph.D. completion are for postdoctoral appointments. Understanding the implications of these trends will require additional information.

THE INSTITUTIONAL PERSPECTIVE

Although graduate education makes important contributions to the education and research missions of universities, its overriding purpose must be the education of graduate students. Apprenticeship teaching and research activities that, under faculty mentorship, provide progressively increasing levels of responsibility are effective ways to teach graduate students how to teach and conduct independent research. However, subsuming the interests of students to conflicting institutional or faculty interests can undermine the educational benefits of these apprenticeship arrangements.

Student interests should also be paramount in designing a graduate curriculum that prepares students for a broad array of careers, and in building a diverse student body that enriches the educational environment and that prepares students to work effectively in a global environment.

The policies governing federal support of research assistantships through the federal research project grant system run counter to sound educational policy. Graduate students involved in teaching and research are students, not employees; the principal purpose for their teaching and research activities is to learn how to teach and conduct research. But Office of Management and Budget (OMB) Circular A-21 stipulates that federal agencies can support graduate students as research assistants on federally funded research grants only to the extent that "a bona fide employer-employee relationship" exists between a graduate student and faculty investigator. Federal policy should be changed to eliminate the employer-employee stipulation and encourage the dual benefits to research and education of graduate students serving as research assistants.

Universities need to track the placement of their Ph.D. students at least to their first professional employment. Institutions also should maintain program performance and student evaluation information. Such information is needed for both internal evaluation of programs and external accountability for them.

Many universities have examined their graduate programs in light of concerns discussed in a number of national forums and have responded with a wide range of creative programs to meet evolving student and societal needs. Among other initiatives, universities and their academic departments have improved teacher preparation programs, reduced enrollments and improved student financial support, instituted interdisciplinary opportunities, and improved faculty mentoring and career advising.

RECOMMENDATIONS FOR BEST PRACTICES IN GRADUATE EDUCATION

The Committee encourages each university and each department within an institution to examine the size, scope, and performance of its graduate programs to determine whether these programs are meeting the interests of students in preparing them for the diversity of careers to which they may aspire, and to take appropriate actions where they do not. The Committee has sought to identify common elements in recent institutional changes and adaptations in developing the following recommendations or guidelines for best practices.

RECRUITMENT AND ADMISSIONS

Admissions decisions should be made with the goal of maintaining and improving the quality of programs.

Departmental recruitment and admissions policies should include provisions designed to increase the participation of talented students from groups underrepresented in their graduate programs. To make significant progress, universities will need to work with undergraduate institutions and K–12 schools to reach minority students as early as possible in their educational lives and encourage them to prepare for and pursue graduate study.

Universities should encourage enrollment of exceptional foreign students while continuing efforts to develop the U.S. domestic talent pool.

FINANCIAL SUPPORT

All admitted students should be given accurate information about the costs they will incur and realistic assessments of future prospects for financial support.

Financial support should be designed to assist students in their progress to a degree; financial support through work that draws students away from their graduate programs should be avoided.

GRADUATE CURRICULUM

Institutions should evaluate the graduate curriculum to assure that it equips students with the knowledge and skills needed for a broad array of postdoctoral careers that they might wish to pursue.

The graduate curriculum should balance breadth and depth with the need to minimize time-to-degree.

FACULTY MENTORING

Faculty mentors should confer with students frequently to assess students' progress, and should provide the department with periodic assessments on progress to the degree.

Institutions and departments should clearly affirm the importance of faculty mentoring through policy guidelines and incentives.

DATA FOR INSTITUTIONAL POLICYMAKING, PROGRAM EVALUATION, AND STUDENT ADVISING

Institutions should maintain data on completion rates, time-to-degree, and placement to the first professional employment, as well as conduct exit surveys for all Ph.D. recipients. Institutions should provide such program performance data to student applicants.

Institutions should provide job placement assistance for students who request it.

PROGRAM EVALUATION

Institutions should evaluate the quality of and justification for their doctoral programs through self-study, on-site evaluation by external reviewers, or both.

Institutions should terminate programs that cannot maintain the infrastructure and student financial support necessary for acceptable program quality.

Institutions should not begin new programs absent a regional or national need and sustainable support.

POLICY IMPLEMENTATION AND MAINTENANCE

Institutions should ask departments to provide descriptions of their goals and expectations for their graduate programs, and should periodically compare these against departmental program performance data.

The AAU should assist institutions in developing common definitions and reporting procedures that will permit cross-institutional comparisons of program performance.

EXTERNAL SUPPORT FOR GRADUATE EDUCATION

Support for graduate education from a number of external sectors plays a critical role in sustaining the quality of graduate education:

The federal government provides valuable support for graduate education through competitively funded fellowship and traineeship programs, research assistantships funded through the federal research project grant system, and student loans that augment and fill gaps in other sources of financial support. These forms of support meet important needs in graduate education; all should be continued.

Given the importance of federal support, recent cutbacks in federal fellowship programs and proposals to reduce or eliminate the subsidized components of federal student loans for graduate and professional students raise serious concerns. Financial support is critical for graduate students, who are young adults forgoing employment to pursue additional education. Moreover, graduate education benefits the nation, and federal support of graduate education advances the national interest.

- States support graduate education primarily through teaching and research assistantships at resident public universities. States also support graduate education indirectly through research and development investments and graduate fellowship programs, which may be available to students attending both public and private institutions.

Private foundations enable universities to embark on new and continuing initiatives that are otherwise difficult to sustain. Industry support provides financial assistance to students and graduate programs while fostering university-industry research connections and exposing students to industrial career opportunities.

INTRODUCTION

American graduate education is widely considered to be the world's best. Students from around the globe come here to prepare themselves for careers in academia, industry, and other sectors. Yet critics have asserted that the U.S. is producing too many Ph.D.s, that research is overemphasized at the expense of preparation for teaching, and that excessive specialization crowds out interdisciplinary breadth. They have argued that Ph.D. programs take too long and that too few students finish. They have charged that universities rely too much on graduate students to teach undergraduates, and that faculty use graduate students to benefit of their research projects rather than the students' research training. Universities have been accused of recruiting foreign graduate students to the exclusion of U.S. students.

The Association of American Universities (AAU) formed the Committee on Graduate Education to examine these concerns and to evaluate candidly the conduct of its campuses' graduate programs. The Committee—comprising university presidents, chief academic officers, and graduate deans—sought to examine current problems, identify evolving needs, and policy changes.

The AAU is an appropriate organization to examine the state of graduate education. It consists of sixty U.S. and two Canadian universities with strong programs of research and graduate and professional education. Although AAU universities constitute only 16 percent of the nation's Ph.D.-granting universities, they graduate more than 50 percent of the nation's Ph.D.s. The quality of their programs is high: of the 418 Ph.D. programs ranked in the top ten in their respective academic disciplines in a recent National Research Council assessment,[1] 93 percent were administered by AAU universities.

1 Research Doctorate Programs in the United States: Continuity and Change. National Academy Press, Washington, D.C., 1995.

Despite the strong standing of many AAU-university graduate programs, the Committee believed that all graduate programs would benefit from careful assessment. After initial discussions of the overall issues, the Committee divided into three task forces to examine the following specific areas:

- quantitative dimensions of the enterprise
- institutional policies governing graduate education
- financial support for graduate education.

The Committee asked AAU members if they had examined their graduate programs in light of the concerns that have been raised, and if such examinations had led to changes in policies and programs. Based on the results of these queries, the Committee developed recommendations for best practices that it believes respond to present challenges and will better serve students and the nation.

The Committee concentrated on Ph.D. education, the focus of the national debate on graduate education. Unless otherwise specified, graduate education refers to Ph.D. education in this report.

The Committee's report and its recommendations are intended primarily for university administrators and faculty, but we hope that all organizations and individuals with an interest in graduate education will find the report useful.

THE ROLE OF GRADUATE EDUCATION IN THE NATION

Graduate education prepares the scientists and engineers needed by industry, government, and universities to conduct the nation's research and development. Graduate programs also educate the scholars in the humanities, social sciences, and the arts who preserve and enlarge our understanding of the history and scope of human thought and the human condition, and transmit that knowledge to succeeding generations. Moreover, graduate education produces the scholars in all disciplines who become the faculties of the nation's more than three thousand colleges and universities.

The United States invested $171 billion in research and development (R&D) in 1995. The federal government and industry, the principal investors in the national R&D effort, recognize that R&D is a major engine driving economic growth and productivity. The graduate students who will become the next generation of the R&D workforce are also a key component of the research enterprise: they are active research performers, conducting a major portion of academic research, the source of more than 50 percent of the nation's basic research. In this country, graduate education and academic research are conducted in the same place by the same people, and both activities are enriched by their extensive interconnections.

Much of the nation's applied research and development is conducted in the industrial sector, and graduate education is a critical contributor to industrial R&D. Physical science and engineering Ph.D.s are particularly important to industry: of 1995 Ph.D. recipients, 44 percent of physical science Ph.D.s and 62 percent of engineering Ph.D.s had employment commitments in industry.[2]

The benefits of graduate education extend well beyond science and technology. Graduate education in the humanities, social sciences, and the arts produces the teachers and scholars who bring the intellectual history of human thought and creative expression to their students, expanding their capacity for critical thinking by applying the lessons of the past to current problems and future challenges. In the classroom and beyond, teaching and scholarship in the humanities, social sciences, and the arts inform the public discourse essential to the functioning of a democracy.

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2 Summary Report, 1995: Doctorate Recipients from United States Universities. National Academy Press, Washington, D.C., 1997.

Graduate education across all academic disciplines is the principal source of the faculties of the country's colleges and universities. The United States has built the largest and most accessible system of higher education in the world. More than 65 percent of high school graduates enroll in higher education programs; in total, over 14 million new and continuing students attend U.S. colleges and universities. These institutions employ more than 900,000 faculty members, most of whom have been educated in our nation's graduate programs.

In addition to its external benefits, graduate education benefits the institutions in which it is carried out. University graduate programs are inextricably intermingled with the teaching and research missions of the institutions. These interconnections enrich both the education of graduate students and the university's research and education programs. Graduate students, closer in age and cultural experience to undergraduate students than faculty members, may be able to find the crucial connections that will make subjects come alive and spark a lifelong interest in a particular discipline. The vitality and creativity of bright, young students working in a research lab can invigorate a research program and launch new lines of inquiry. The presence of a strong cadre of graduate students is often one of the most effective recruiting tools for attracting high-quality faculty.

Graduate programs and graduate students enhance the capacity of universities to foster national and international intellectual discourse on major scientific and humanistic debates. Graduate students function as connecting links in the modern research university, bringing faculty together from across disciplinary units for student-initiated conferences and workshops, as well as on dissertation committees. Both the interests and abilities of graduate students make possible an expanded range of course offerings and broader disciplinary and cross-disciplinary perspectives on university campuses.

Graduate education accomplishes these functions through extended postbaccalaureate study to acquire greater understanding of some area or topic. Graduate education is not a simple extension of undergraduate coursework beyond the baccalaureate level, but involves new forms of learning and mastery of new capabilities.

- Master's education is generally a two-year program consisting primarily of coursework and seminars focused in specific fields of the arts and sciences as well as areas such as business, engineering, and social work. Colleges and universities, collaborating with business, industry, and government, have developed literally hundreds of different master's degree programs to meet specific needs in these sectors.
- Graduate professional education comprises well-defined postbaccalaureate programs in such areas as law, medicine, and dentistry, providing the rigorous training necessary for the practice of those professions.

- Ph.D. education differs from master's and professional education, as well as from undergraduate education. The Ph.D. is a research degree, signifying that the recipient has acquired the capacity to make independent contributions to knowledge through original research and scholarship.

  Ph.D. education is both long and rigorous. The initial years of a Ph.D. program typically involve advanced coursework, during which students begin to identify their areas of particular interest. Coursework gives way to more apprenticeship activities in research and teaching, working with one or more faculty mentors.

  Students in the sciences generally begin focused work in a laboratory as research assistants to a faculty investigator; students in the humanities immerse themselves in individual scholarship, working with a faculty advisor. During this initial work, students learn the methods of research and scholarship and identify the specific area for their dissertation research. Conducting the research and writing the Ph.D. dissertation typically takes two or more years.

  The entire process varies widely by student, by discipline, and by institution, but the duration of Ph.D. education is typically lengthy: the median registered time-to-degree—the time enrolled in educational programs between receipt of the baccalaureate and receipt of the Ph.D.—is about seven years.[3]

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3 Summary Report, 1995: Doctorate Recipients from United States Universities. National Academy Press, Washington, D.C., 1997. Registered time-to-degree varies significantly by discipline; in 1995, it ranged from a high of 8.4 years in the humanities to a low of 6.4 years in the physical sciences. It should be noted, however, that few Ph.D.s in the humanities engage in postdoctoral study before their first professional employment, while a preponderance of physical sciences Ph.D.s pursue postdoctoral study.

THE NATIONAL PERSPECTIVE: QUANTITATIVE DIMENSIONS OF PH.D. EDUCATION

Following World War II through the early 1970s, higher education in the United States experienced a period of unprecedented growth. The GI Bill expanded access to higher education for returning veterans. The Soviet Union launched Sputnik in 1957, and the Cold War fueled an intense technological competition between the U.S. and the Soviet Union. Both increased college enrollments and the race to regain U.S. scientific and technological leadership impelled abrupt increases in the production of Ph.D.s. The federal government used newly created agencies, including the National Science Foundation, the National Institutes of Health, and the Department of Defense, to provide the financial underpinnings of this growth in graduate education and research through the creation of several major fellowship and traineeship programs and sharp increases in academic research funding. Between 1958 and 1973, the number of Ph.D.s produced annually in the U.S. grew from 8,773 to 34,000, and federal funding of academic research increased from less than $400 million to just under $2 billion.

Throughout the remainder of the 1970s and the first half of the 1980s, Ph.D. production leveled off as supply began to exceed demand. Ph.D. production peaked just as the number of teaching positions began to decline. Beginning in 1967, the growth in federal R&D funding began to moderate as well.

For the last decade, Ph.D. production has increased again, rising from 31,297 in 1985 to 41,610 in 1995 (Table 1). The growth in degrees has been accompanied by a growth in the number of doctoral programs and the number of institutions offering the doctorate. In 1989, 458 institutions offered at least one doctoral program; by 1993, 650 institutions offered one or more doctoral programs. However, the 60 U.S. member universities of the AAU accounted for about 22,000, or just over half, of the 41,610 doctorates awarded in 1995. Between 1985 and 1995, the number of doctoral degrees given annually by AAU member institutions grew on average by 2.5 percent per year, compared to 2.9 percent per year among other universities. However, first-year and total enrollments have been declining in U.S. universities since 1994, presaging a leveling off or decline in Ph.D. production in coming years.

Table 1
An Overview of Doctorate Recipients at U.S. Universities

	Number of Doctorates Awarded			% of Total,
	1985	1990	1995	1995
Total	**31,297**	**36,067**	**41,610**	**100**
By discipline				
Physical sciences	4,531	5,859	6,806	16
Engineering	3,166	4,894	6,007	14
Life sciences	5,780	6,604	7,913	19
Social sciences	5,765	6,093	6,623	16
Humanities	3,429	3,822	5,061	12
Education	6,733	6,511	6,546	16
Professional & Other	1,893	2,284	2,654	6
By gender				
Men	20,553	22,962	25,277	61
Women	10,744	13,105	16,333	39
By ethnicity				
Minorities[4]	2,086	2,359	3,489	8
By nationality				
U. S. Citizens	23,370	24,905	27,603	66
Foreign	6,551	9,791	13,113	32

Source: Special data runs by National Research Council from the Survey of Earned Doctorates..

The growth in Ph.D. recipients has been accompanied by increased participation of women, minorities, and foreign students in postbaccalaureate education. Among the class of 1995 at AAU universities, over 37 percent of graduates were women, 13 percent minorities, and 32 percent foreign nationals. Nationally, virtually all of the increase in the number of new doctorates seen in the past decade is accounted for by the increases in women and foreign students.

U.S. minorities earned a record number of Ph.D.s in 1995—3,489—accounting for 8 percent of total doctorates awarded by U.S. universities and nearly 13 percent of doctorates awarded to U.S. citizens in 1995. Asians, Blacks, Hispanics, and Native Americans all increased their percentages of earned doctorates over 1994. Blacks, Hispanics, and Native Americans earned their doctorates primarily in education, followed by the social sciences. Asians earned doctorates primarily in the life sciences and engineering. Women were most heavily represented in education, social sciences, and humanities and least well represented in physical sciences and engineering.

4 Percentage comprises U.S. citizens who disclosed their race. Minority groups include Asians, Blacks, Hispanics, and Native Americans; these groups make up 13 percent of the U.S. citizens receiving doctorates.

PLACEMENT AND EMPLOYMENT OF DOCTORATE RECIPIENTS

Unemployment among new doctorates consistently has been low. Two percent of 1991-94 AAU university Ph.D. recipients were unemployed in 1995; the rate of unemployment was highest for the humanities, at 3.3 percent in 1995. In comparison, 1.3 percent of the 1985-88 cohort was unemployed in 1989.

Doctorate recipients appear to maintain a high rate of employment throughout their careers. For example, 2.1 percent of those graduating between 1975 and 1978 were seeking employment in 1979, and only 1 percent of 1975-1978 graduates were seeking employment in 1995. Although these data do not indicate the nature of employment or whether that employment draws meaningfully on doctoral training, studies indicate that doctorate recipients are generally employed in positions that draw on abilities acquired in their doctoral training and that most doctorate recipients would not change their earlier decisions to earn Ph.D.s.

Table 2 provides evidence of the stability in the academic employment patterns of Ph.D.s. The table presents data for Ph.D. recipients from AAU universities in five-year blocks of time, showing employment in the fifth year for students who received their Ph.D. in one of the prior four years. The data indicate little change in the proportion of Ph.D.s who are employed in academe in the first few years after receiving their degrees. Although the proportion of new doctorates in tenure track positions declined from the late 1980s to the early 1990s, the proportion was even lower in the late 1970s.

Table 2
Academic Employment of Recent Ph.D.s
(Graduates of AAU Institutions)

Status of:	1975-78 Ph.D.s in 1979	1981-84 Ph.D.s in 1985	1985-88 Ph.D.s in 1989	1991-94 Ph.D.s in 1995
# Employed in Academe	31,056	28,132	29,541	32,317
All fields				
% employed in academe	58	56	58	57
% on tenure track	65	59	74	70
Sciences				
% employed in academe	55	55	57	57
% on tenure track	50	48	64	59
Engineering				
% employed in academe	34	36	40	32
% on tenure track	63	62	79	73
Social and Behavioral Sciences				
% employed in academe	64	58	56	60
% on tenure track	80	62	79	73
Humanities				
% employed in academe	70	70	77	78
% on tenure track	68	65	76	80

Source: Special data runs by National Research Council from the Survey of Doctoral Recipients.

However, a recent trend raises concerns: placement data indicate that new Ph.D. recipients are having more difficulty finding permanent employment. Nearly 40 percent of the class of 1995 from AAU institutions were still seeking definite postgraduate commitments––either employment or postdoctoral study—by the time they received their degrees, up from a third of the graduates ten years earlier; a similar change can be seen among the graduates of other research universities (Table 3). Moreover, among the students with definite plans, more are pursuing postgraduate study and correspondingly fewer are entering the job market directly.

Table 3
Increasing Career Uncertainty:
Career Plans of Doctoral Students at the Time of Graduation

	AAU			Other Universities		
	1985	**1990**	**1995**	**1985**	**1990**	**1995**
All graduates	17,289	19,454	22,032	14,008	16,613	19,578
Students with definite plans	11,605	12,785	13,444	9,347	10,628	11,410
(% of all graduates)	67 %	66 %	61 %	67 %	64 %	58 %
Among those with definite plans						
Postdoctoral study	3,000	3,887	4,603	1,649	2,272	2,765
(% of graduates with plans)	26 %	30 %	34 %	18 %	21 %	24 %
Employment	8,560	8,841	8,762	7,659	8,299	8,567
(% of graduates with plans)	74 %	69 %	65 %	82 %	78 %	75 %
Academic appointments	5,212	5,530	5,427	4,508	4,968	5,289
(% of those starting employment)	61 %	63 %	62 %	59 %	60 %	62 %

Source: Special data runs by National Research Council from the Survey of Earned Doctorates.

Clearly, there is much we do not know about Ph.D. placement and employment. National Research Council employment data indicate low rates of unemployment for Ph.D.s throughout their careers. If 40 percent of 1995 AAU-university Ph.D. recipients had no definite commitments at the point of Ph.D. completion, most of them must have secured commitments soon after, given the low rates of unemployment. Nonetheless, an increase in the proportion of Ph.D. recipients without definite commitments upon completion of their degree is troublesome. Moreover, there is much left out of these employment data about underemployment, the possible mismatch between expectations and outcomes, and other important components of the employment picture; a fuller understanding is needed to draw firm conclusions about the trends in Ph.D. placement and employment.

POSTDOCTORAL APPOINTMENTS

An increasing proportion of new Ph.D. recipients from AAU institutions are pursuing postdoctoral study instead of employment after graduation. Many observers have concluded that this increase is a response to a poor job market. However, this recent increase is the continuation of a trend that began over two decades ago.[5] The increase in postdoctoral appointments over an extended period suggests that the changes in postgraduate plans shown in Table 3 are not entirely a response to short-term changes in employment opportunities.

Discipline-specific expectations are clearly a powerful factor in students' postgraduate career plans. The AAU Committee on Postdoctoral Education recently surveyed AAU universities and selected academic departments and postdoctoral appointees as part of an examination of postdoctoral education. The Committee found that over 80 percent of the biochemistry and physics departments surveyed would not even consider hiring someone without postdoctoral experience for a tenure track faculty position.

Most of the postdoctoral appointees surveyed identified "necessary step to achieve desired employment in my field" or "acquire additional research experience or learn new research techniques" as the primary reason for pursuing a postdoctoral appointment; few departments or their postdocs identified "employment holding pattern" as a significant reason. The data collected by the Postdoctoral Education Committee also indicate that the vast majority of recent doctoral recipients are working in positions related to their field of study, and that postdoctoral fellows go on primarily to academic and research positions.

Nonetheless, the increased number of Ph.D.s accepting postdoctoral appointments, whatever the reasons for that increase, means that a larger portion of students who have already foregone earned income from full-time employment to pursue doctoral study are now forestalling full-time employment yet again to acquire what appears to be in some disciplines the new de facto terminal degree.

FOREIGN STUDENTS

Between 1985 and 1995, the total number of Ph.D.s awarded by U.S. universities increased by about 3 percent per year, while the number of Ph.D.s awarded to foreign students increased by about 7 percent per year, reaching 32 percent of all doctorate recipients by 1995 (Table 1). The majority of these students were in the United States on temporary visas, but the number of students who were permanent residents also rose rapidly during the decade (Table 4). The majority of the growth in foreign doctoral recipients has come from four countries: China, India, Taiwan, and Korea.[6]

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5 The Committee on Science, Engineering, and Public Policy (COSEPUP) of the National Research Council reported that 8 percent of 1969-1972 Ph.D. recipients had postdoctoral appointments in 1973, whereas 19 percent of the 1985-1988 Ph.D. cohort had postdocs in 1989. Reshaping the Graduate Education of Scientists and Engineers. National Academy Press, Washington, D.C., 1995.

6 Summary Report, 1995: Doctorate Recipients from United States Universities. National Academy Press, Washington, D.C., 1997.

Table 4

Selected Statistics on Foreign Students Receiving Doctorates in the U.S.: Trends in the Number of Recipients and their Postgraduate Plans

	1985	1990	1995
Doctorates awarded to non-U.S. citizens			
Permanent residents	1,324	1,698	4,307[7]
Temporary visas	5,227	8,093	8,806
Total	***6,551***	***9,791***	***13,113***
Postgraduate plans (% of total)			
Postdoctoral study	18	22	23
Employment	50	40	34
Still seeking (study or employment)	32	37	43
Postgraduate location			
% of permanent visa holders staying	89	85	92
% of temporary visa holders staying	46	51	52

Source: Special data runs by National Research Council from the Survey of Earned Doctorates.

Observers from a number of sectors have expressed concern that foreign students are crowding domestic employment markets for Ph.D.s. Although foreign students who remain in this country clearly compete with U.S. citizens for jobs, several factors suggest that the impact of foreign students on domestic employment markets is small and is more than offset by strong countervailing benefits to the nation and to American graduate education. First, employment statistics for all doctorate recipients remain very strong. Second, approximately half of the foreign students on temporary visas leave the U.S. after receiving their doctorate; moreover, enrollments of foreign graduate students in science and engineering have been declining since 1994, and immigration of scientists and engineers dropped significantly in 1994.[8] Third, U.S. graduate programs attract some of the strongest students from an international talent pool: the foreign students who enroll in U.S. graduate programs enhance the intellectual and cultural environments of these programs. Those foreign students who remain in this country enrich the human resources the nation has to draw on. Those who return to their home countries strengthen those nations to the benefit of the U.S. as well: a successful nation will be a stronger trading partner with the United States and better able to join the U.S. in protecting the global environment, and the mutual understanding fostered by international exchanges will facilitate international cooperation.

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7 The comparatively large increase in the number of permanent residents between 1990 and 1995 likely reflects changes in immigration law enacted in 1990 which facilitated in some cases the acquisition of permanent resident status, as well as a change in the status of Chinese students following Tiananmen Square.

8 Data Briefs. National Science Foundation, 96-312 and 97-311.

THE INSTITUTIONAL PERSPECTIVE: INSTITUTIONAL RESPONSIBILITIES FOR GRADUATE EDUCATION

PREEMINENCE OF STUDENT INTERESTS

The overriding purpose of graduate education is and must always be the education of graduate students. In designing graduate programs and advising graduate students, university administrators and faculty members must hold the interests of students paramount.

Graduate students learn to teach and to conduct research by performing these activities under faculty mentorship. Apprenticeship teaching experiences at progressively more advanced levels, augmented by workshops and other pedagogical training programs, are extremely effective ways to teach prospective teachers how to teach. Similarly, graduate students learn how to conduct original research through apprenticeship activities that progress from assisting faculty investigators in their research projects to conducting independent dissertation research under faculty guidance. As graduate students become skilled in these apprenticeships, they contribute increasingly to the education and research missions of universities.

However, if student interests become subsidiary to conflicting institutional or faculty interests, the educational benefits of these apprenticeship arrangements can be undermined. Asking graduate students to teach courses without adequate preparation is inappropriate for both teacher and students. Having graduate students serve as teaching assistants for extended periods without advancing in pedagogical development is unfair to graduate students and can prolong their time-to-degree. Student needs and interests, and not departmental teaching responsibilities, should be the primary basis for determining when and how much graduate students teach.

Similarly, the purpose of research training should not be diverted to meet faculty research objectives in conflict with student interests and career objectives. Within the constraints of their sources of financial support and their own developing competencies, students should be given the flexibility to pursue their evolving research interests, leading to the identification and conduct of their dissertation research.

The interests of students must also be paramount in designing the graduate curriculum and advising students on the sequence of courses, seminars, and other educational and training activities that they will pursue. Student career objectives should shape the graduate curriculum and the course of students through it, not the career preferences or teaching interests of faculty advisors and mentors.

Universities should seek to build diverse student bodies in their graduate programs. Bringing together talented students from diverse backgrounds serves the interests of students by building a community of scholars judged for the quality of their ideas and preparing them to work in a global environment that draws on talent spanning race, gender, ethnicity, and nationality. Although recent progress has been made, universities need to continue their efforts to increase the participation of students underrepresented in their graduate programs. Universities should continue to encourage the participation of talented foreign students but should attend to the balance between U.S. and foreign students.

FEDERAL POLICIES GOVERNING RESEARCH ASSISTANTSHIPS

Current federal regulations governing graduate student research assistantships run counter to sound educational policy. Graduate students involved in teaching and research are primarily students, not employees; the principal purpose for their teaching and research activities is to learn how to teach and conduct research. Yet federal regulations (Office of Management and Budget Circular A-21) stipulate that federal agencies can support students as research assistants on federally funded research grants, "provided that there is a bona fide employer-employee relationship between the student and the institution for the work performed. . . ."

It is true that certain aspects of both teaching and research assistantships have characteristics of an employer-employee relationship; indeed, in some public institutions, teaching assistants and some research assistants may be classified as state employees. However, graduate teaching and research assistants are fundamentally students, learning by doing in the apprenticeship relationship that is the hallmark of American doctoral education. To require an employer-employee relationship as a condition of federal support for research assistants miscasts the nature of research assistantships. Moreover, such a requirement can work against the interests of the federal government, since it may narrow the conditions under which research and graduate education are conducted simultaneously, benefiting both activities.

Federal policy should be changed to foster the critical interconnections between academic research and graduate education by eliminating the employer-employee stipulation and encouraging the dual benefits to research and graduate education that derive from graduate students serving as research assistants.

TRACKING PROGRAM PERFORMANCE AND STUDENT PLACEMENT

The Committee believes that universities have a responsibility to collect and evaluate information about the placement of their doctoral students, but AAU universities do not appear to be systematically evaluating the placement of their doctoral students. The Committee surveyed AAU graduate deans to determine whether member universities maintain placement records that would support the tracking of students' success in finding suitable employment; the finding of an almost universal lack of centralized institutional data on the employment status of recent graduates is extremely disappointing.

Individual faculty members typically know where their students go after graduation, and many academic departments keep quite good records at least to their students' next placement. But very few universities keep anything more than rudimentary data about former students' career activities, especially for students who are more than one or two years beyond receiving their Ph.D. This lack of information about Ph.D. student placement should not continue.

In addition to placement data, universities should maintain comprehensive data on time-to-degree and completion rates. Exit surveys of both Ph.D. recipients and students who leave before program completion provide valuable information on doctoral programs.

Such information is necessary for internal evaluation as well as for external accountability. Internally, placement data are essential for evaluating graduate programs. Externally, universities will and should be held accountable by the public and by funding agencies to be able to demonstrate that Ph.D. recipients have acquired skills and abilities valued by subsequent employers. Institutions that keep track of graduates' job placements and their satisfaction with their doctoral education will be in a better position to respond to questions from the public, government agencies, and other supporters of graduate education. In addition, information on program performance and student placement should be available to all students who are considering applying to graduate programs.

National data bearing on Ph.D. placement are being collected systematically, as has been reported here. However, almost all placement and employment data are drawn from two national surveys administered until recently by the National Research Council.[9] These data are invaluable for national policy analysis, but they have significant limitations. The annual survey of doctorate recipients asks doctoral students at the point of graduation what their postdoctoral plans are, breaking that question down into "definite" or "seeking" commitments for postdoctoral study or for employment in educational institutions, industry/business, government, nonprofit organizations, or other areas. The second survey samples doctorate recipients every two years on their employment status and provides valuable information on the nature of their work and sector of employment. But, as important as these surveys are, they do not contain the information needed by individual institutions to assess their own graduate programs and track the postgraduate experiences of their own doctoral students.

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9 Until this year, the National Research Council has administered the annual Survey of Doctorate Recipients and the Survey of Earned Doctorates. The surveys are now being administered by the National Opinion Research Council.

UNIVERSITY RESPONSES TO PROBLEMS AND CHALLENGES

The highly publicized criticisms of graduate education have a longer vintage within the academic community, and they have not been ignored. The Association of Graduate Schools (AGS)—the graduate deans of AAU universities—published a report in 1990, *Institutional Policies to Improve Doctoral Education*, and the AGS has discussed that report and related topics at its annual meetings since then. The Council of Graduate Schools has published a series of reports and papers over the last decade concerning policies and good practice in both doctoral and master's education. In 1995, the National Research Council's Committee on Science, Engineering, and Public Policy (COSEPUP) issued a comprehensive report on graduate education which examined the state of the enterprise and issued recommendations to respond to concerns it believed were valid.[10] COSEPUP followed its report with a national convocation a year later to discuss responses to the report. The Association of American Medical Colleges and a number of scholarly and professional societies also have recently examined various aspects of graduate education. In addition, a number of universities have conducted thorough examinations of the purposes and performance of their own graduate programs.

The view emerging from these national and institutional examinations of graduate education is that the balance between institutional and departmental benefits from and responsibilities for graduate education has in many cases shifted too far in the direction of institutional and departmental benefits, to the detriment of graduate students and programs. Concerted efforts should be and have been made to right this balance.

10 Reshaping the Graduate Education of Scientists and Engineers. National Academy Press, Washington, D.C., 1995.

The AGS surveyed its member graduate deans, initially in 1995 and in more detail in 1996, about whether their institutions had taken steps to modify their graduate programs. Of the 39 institutions and 235 academic departments responding to the 1996 survey, nearly 90 percent of the institutions and 80 percent of the departments were addressing such issues as time-to-degree, size of graduate programs, interdisciplinary programs, and career advising and placement.[11]

This committee sent an informal inquiry to the AAU graduate deans concerning examples of changes, adaptations, and innovations in graduate education that are responsive to the challenges and opportunities that are confronting the enterprise. The inquiry identified a wide range of creative programs that respond to the changing conditions of graduate education and evolving societal needs. A number of universities have reduced enrollments and improved the financial support of students who do enroll; these actions have improved the quality of enrolled students, reduced time-to-degree, and increased rates of retention. Institutions have instituted interdisciplinary programs, particularly in the biological sciences. Several institutions reported systematic efforts to improve faculty mentoring throughout students' graduate programs; one institution has developed a program that draws on enhanced student-faculty communication as a means of improving retention. Institutions have improved their career advising and placement efforts and expanded student understanding of and preparation for nonacademic research careers—not as "alternative" careers but as fully appropriate Ph.D. pursuits. Joint university-industry initiatives are aiding graduate program recruitment, placing students in industrial internships, informing students of industrial career opportunities, and drawing on industrial advisory boards for advice and financial support. A number of universities have developed creative, new, practical and applied tracks within master's programs for students who do not wish to pursue research careers but are interested in technical or managerial careers in business and industry. Many graduate programs are developing certification programs that augment and complement core Ph.D. education. Other institutions are developing new forms of financial assistance to provide students with extended support that is both more reliable and more flexible than current forms of support.

One of the most systematic efforts to increase graduate student preparation for teaching is the "Preparing Future Faculty" (PFF) program cosponsored by the Council of Graduate Schools and the Association of American Colleges and Universities and funded by the Pew Charitable Trusts. The program links research universities with nearby liberal arts colleges, community colleges, Historically Black Colleges and Universities, and other comprehensive institutions to provide participating graduate students with teaching and other professional experiences at the partner institutions. PFF universities and other institutions adopting similar programs often incorporate these initiatives into additional teacher preparation activities that may include teaching assistant orientation and continuing support programs, teaching certification programs, and advanced teaching activities.

Among the many impressive examples of institutional change, one university has adopted an institutionwide set of guidelines for faculty mentoring and career counseling of graduate students, coupled with an assessment of graduate student outcomes based on reports from and continuing discussions with departments. As part of this effort, the university has encouraged departments to assess the relationship between their admissions policies and program size and their expectations and placement performance.

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11 The results of these surveys have been placed on the AGS website: http://www.ags.ucsd.edu/ags.html.

Another university conducted a year-and-a-half-long review of graduate education based on inquiries to all departments on admission and departmental requirements, mentoring, curriculum structure and earlier exposure to research, breadth of training, significant shifts within disciplines, pedagogical training, and career counseling and placement activities. The results of this review are being incorporated into department-based changes in graduate education policies.

A number of institutions are building interdisciplinary programs that provide new combinations of education and training to meet emerging challenges. For example, one institution has created an interdisciplinary program in tropical conservation and development with support from the Ford and MacArthur Foundations, marshalling the educational and research talent from a range of disciplines to address pressing global problems. Students in the social and biological sciences develop knowledge and research skills needed by conservation and development professionals for creating strategies, establishing policies, and building institutions to improve the lives of rural people, promote biodiversity conservation, and enhance national resource management. Students draw on theory and methods courses offered by faculty in 15 academic departments, the Museum of Natural History, and the College of Law.

These examples can only suggest the range and diversity of program change and adaptation. The Committee suggests that the AGS continue the clearinghouse function it carried out in conjunction with its earlier surveys, to identify new programs and policies that others may wish to learn more about.

These program changes are occurring where they should, at the institutional and departmental level, accommodating institutional and disciplinary differences that could never be captured in any attempt at a single, prescriptive national policy. Moreover, these programmatic changes improve, extend, and complement, but do not fundamentally alter, the characteristics of American graduate education that have made it emulated worldwide—a commitment to quality, the intermingling of teaching and learning with research and scholarship, and a continuing focus on the Ph.D. degree as a research degree that imparts to its graduates the capacity to advance the frontiers of knowledge and disseminate that knowledge through teaching, publishing, and other forms of communication.

RECOMMENDATIONS FOR BEST PRACTICES IN GRADUATE EDUCATION

The Committee encourages each university and each department within an institution to examine the size, scope, and performance of its graduate programs to determine whether these programs are meeting the interests of students in preparing them effectively for the diversity of careers to which they may aspire, and to take appropriate actions where they are not. The nature and extent of institutional and departmental responses will vary, as they should, according to local circumstances. Even more, the need for and types of changes will vary widely by discipline. However, the Committee has sought to capture some of the common elements of institutional changes and adaptations, as well as continuing core practices, in a series of recommendations or guidelines for best practices in the various aspects of Ph.D. education.

RECRUITMENT AND ADMISSIONS

- Admissions decisions should be made with the goal of maintaining and improving the quality of programs and advancing the interests of students. Therefore, such decisions should include consideration of the availability of financial support, the involvement of students in departmental teaching and research activities as part of their educational programs, and the prospective job market.
- Departmental recruitment and admissions policies should include provisions designed to increase the participation of talented students from groups underrepresented in their graduate programs. To make significant progress in this area will require universities to work with undergraduate institutions and K-12 schools to encourage talented minority students to prepare for and pursue graduate programs leading to careers in teaching and research; universities should consider both individual and consortial strategies to reach minority students as early as possible in their educational lives.
- Universities should encourage enrollment of exceptional foreign students while continuing efforts to develop the U.S. domestic talent pool.

FINANCIAL SUPPORT

- All admitted students should be given accurate information about the costs they will incur and realistic assessments of future prospects for financial support; to the extent possible, these students should be assured of multiyear financial support.
- Financial support should be designed to assist students in their progress to a degree. To the extent possible, this support should not involve work that draws students away from their graduate programs. In particular, students should not be supported as teaching and research assistants without progressing to greater levels of responsibility and independence; students supported primarily to meet the teaching needs of departments or institutions, or the research needs of faculty research projects, should be reclassified and compensated appropriately.

GRADUATE CURRICULUM

- Institutions should evaluate the graduate curriculum to assure that it equips students with the knowledge and skills needed for a broad array of postdoctoral careers that they might wish to pursue. Students need to acquire the capacity to make independent contributions to knowledge in a given discipline, to acquire an understanding of the interconnections between that discipline and its research methodologies and related areas, and to understand the application of this knowledge and experience to postdoctoral careers.
- The graduate curriculum should strive for balancing breadth and depth with the need to minimize time-to-degree.

FACULTY MENTORING

- Faculty mentors should confer with students on a frequent basis to assess the students' progress, and should provide the department with periodic assessments on progress to the degree.
- Institutions and departments should clearly affirm the importance of faculty mentoring through policy guidelines and incentives.

DATA FOR INSTITUTIONAL POLICYMAKING, PROGRAM EVALUATION, AND STUDENT ADVISING

- Institutions should maintain comprehensive data on completion rates, time-to-degree, and placement at least to the first professional employment (beyond postdoctoral appointments) for all Ph.D. recipients. Institutions should conduct exit surveys of graduating Ph.D. recipients and, to the extent possible, of students who leave programs before graduation. These data should be used to assess the performance of doctoral programs and modify them as warranted.
- Student applicants should be advised on the performance of programs to which they are applying in terms of completion rates, time-to-degree, and job placement.
- Institutions should provide job placement assistance to all students who request it.

PROGRAM EVALUATION

- Institutions should evaluate carefully the quality of and justification for their doctoral programs. They should carry out periodic assessments providing a broad perspective and balanced judgment, involving self-study, on-site evaluation by external reviewers, or both. Senior administrators, augmented by distinguished faculty, should oversee the evaluation processes and the department's or program's responses to assessment recommendations.
- Institutions should terminate programs that cannot maintain the infrastructure and student financial support necessary for acceptable program quality. Programs that are too small cannot sustain the programmatic breadth and student-faculty interactions necessary for a high-quality education; programs that have too many students cannot sustain the mentoring and apprenticeship that are essential components of graduate education.
- Institutions should not start new programs without first identifying a regional or national need and assuring provision of requisite and sustainable support. Interinstitutional collaboration in establishing joint programs may help prevent the unnecessary proliferation of Ph.D. programs.

POLICY IMPLEMENTATION AND MAINTENANCE

- Institutions should ask departments to provide descriptions of their goals and expectations for their graduate programs. These descriptions should be periodically compared against departmental data on admissions and financial support, exit surveys, data on completion rates and time-to-degree, and student placement data.
- The AAU should assist its member institutions to develop common definitions and reporting procedures to permit cross-institutional comparisons of program performance. Meaningful interinstitutional comparisons are particularly important for students seeking to make enrollment decisions that entail a commitment of several years. The AAU/AGS Project for Research in Doctoral Education may be able to assist in the development of common definitions and reporting procedures.

EXTERNAL SUPPORT FOR GRADUATE EDUCATION

The success of American graduate education rests on a partnership of universities and their patrons. The patrons provide essential financial support; the universities conduct high-quality programs that respond to the broad societal needs in which the patrons are investing. The Committee's report has focused on the responsibility of universities for doctoral education, but both the quality and quantity of doctoral programs are critically dependent on external support. Without generous funding from federal, state, and private sources, American graduate education would not have the preeminence it holds in the world today.

We wish to affirm the importance of federal support of graduate education and the sound grounding of that support in the national interest. The federal government provides extremely valuable support for graduate education through competitively funded fellowship and traineeship programs, research assistantships funded through the federal research project grant system, and student loans that augment and fill gaps in other sources of financial support. Although some adjustments may be warranted in the balance among these support mechanisms, all these forms of support meet important needs in graduate education and should be continued.

Because of the critical role of federal support of graduate education, the Committee is concerned with recent cutbacks in fellowship programs in several federal agencies and proposals to reduce or eliminate the subsidized components of federal student loans for graduate and professional students. Our concerns are two-fold: first, financial support is critical for graduate students, who are young adults forgoing employment to pursue additional education that yields considerable national benefits; and second, the expressed rationale for some recent cutbacks questions the federal role in the support of graduate education. Federal investment in graduate education serves the national interest. In turn, the continuing commitment of universities to the quality of their graduate programs will assure the benefits to the nation of that investment.

- States support graduate education primarily through funding teaching and research assistantships at resident public universities. Such funds are generally allocated as part of state general-fund appropriations for public universities. A number of states also support graduate education indirectly through state research and development investments; such graduate support may reach private as well as public universities. A few states fund graduate fellowship programs that are available to students attending both public and private institutions.

  Private foundations provide support that often enables universities to embark on new initiatives that are otherwise difficult to fund; foundations can also provide valuable assistance through support for ongoing activities that would otherwise not be funded.

  Industry support provides financial assistance to students and graduate programs while fostering university-industry research connections and exposing students to industrial career opportunities.

We acknowledge with deep gratitude the support of the patrons of graduate education. Continued cooperation between these external patrons and the university community, coupled with institutional adaptations of their own internal policies, will effectively prepare our national graduate education enterprise to meet the challenges of the twenty-first century.

POSTSCRIPT

The graduate programs administered by U.S. universities continue to serve as a model of creativity and productivity that is emulated worldwide. As national needs for graduate education have evolved, so have university graduate programs. The changes occurring within the nation's graduate programs will allow them to meet evolving needs and maintain the leadership position of the American graduate education enterprise. The Committee's recommendations for institutional policies governing graduate education are intended to facilitate this adaptation to new challenges.