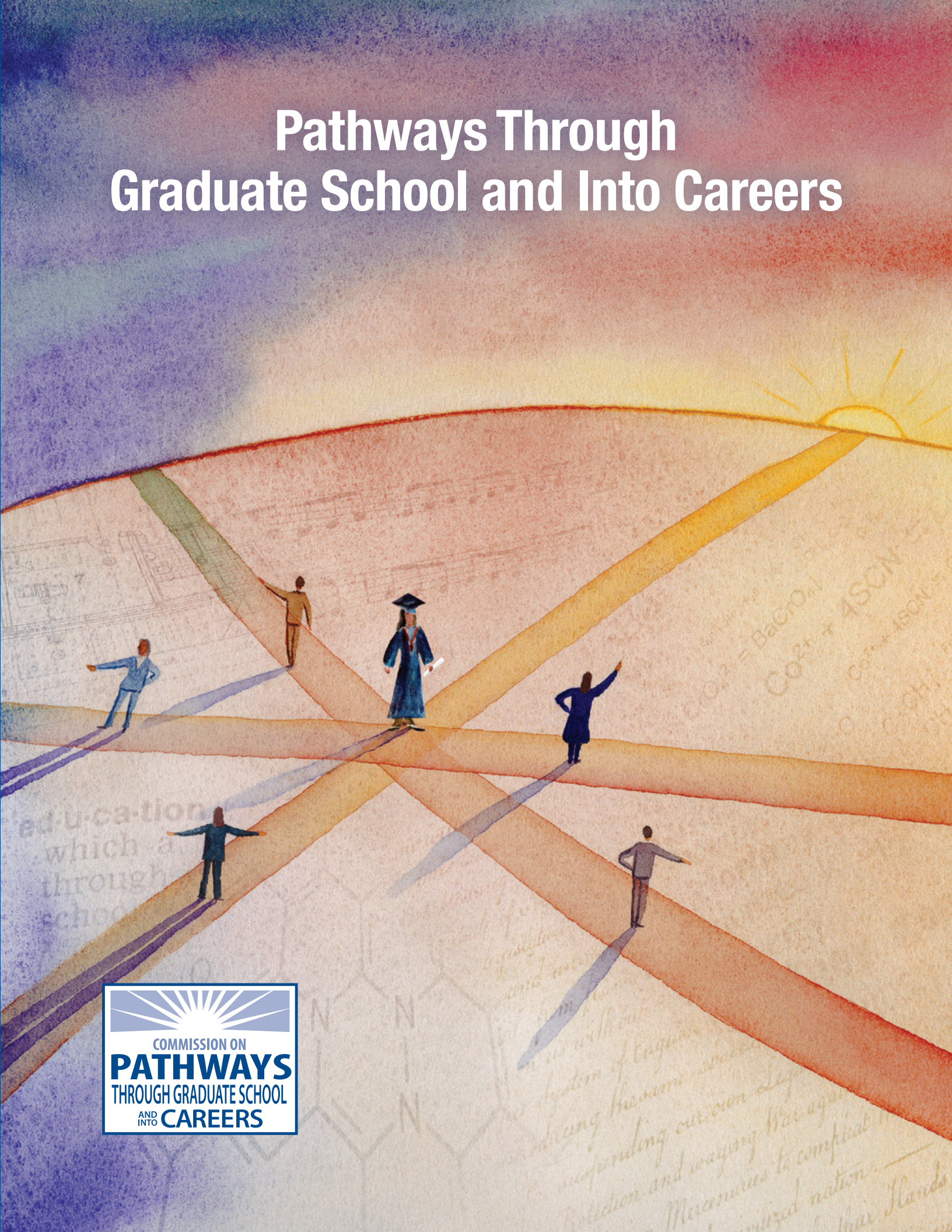
Pathways Through Graduate School and Into Careers



COMMISSION ON
PATHWAYS
THROUGH GRADUATE SCHOOL
AND INTO CAREERS

Pathways Through Graduate School and Into Careers

Listening. Learning. Leading.®

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Dear Colleague:

The United States' system of graduate education has produced many of the knowledge creators, leaders, and experts in a variety of fields that have fueled our success as a nation. In order for the United States to maintain its leadership role in global innovation and discovery, our country must continue to develop highly skilled human talent. However, as was noted in the 2010 report by the Council of Graduate Schools (CGS) and Educational Testing Service (ETS), *The Path Forward: The Future of Graduate Education in the United States*, the pathways for students through graduate school and into 21st century careers are not always evident.

The current report provides a thorough examination of this important issue. The lack of transparency about career pathways may affect students' plans about higher education, graduate education, and jobs. Ultimately, it could influence the availability of highly skilled talent in our labor force.

We contend that it is critical to illuminate the pathways from graduate school into careers given the U.S. economy's growing need for workers with advanced skills and knowledge. Between now and 2020, an estimated 2.6 million new and replacement jobs will require an advanced degree. We must ensure that graduate students complete graduate school with the preparation to meet the demand. This work is particularly important in the global context as other countries and regions of the world are investing in graduate education as part of their economic and workforce development strategies.

Research conducted for this report, including data gathered directly from students, graduate deans, and employers, indicates that graduate students lack access to clear, useful career information about the full range of career options available to them, both inside and outside the academy. This shortfall not only affects students during and after their graduate school enrollment, it also discourages undergraduate students from pursuing graduate education. While these results are of concern, they also provide an opportunity for future action. In this report, we make the case for the importance of clarifying career pathways for graduate students and guiding them toward career paths that are appropriate to their degree programs. We also outline the roles of key stakeholders — universities, employers, and policymakers — and provide recommendations to each of these three groups.

Two years ago, CGS and ETS affirmed that the United States' system of graduate education is a strategic national asset. The message of our new report has not changed, but our charge is different. We invite you to join us in recognizing our need as a nation to support this asset by illuminating career pathways for graduate students and providing support for them on their journey.

Sincerely,

Debra W. Stewart
President
Council of Graduate Schools

Kurt M. Landgraf
President and CEO
Educational Testing Service

Commission on Pathways Through Graduate School and Into Careers

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Eva Pell, John Kress, and Rob Leopold, *Smithsonian Institution*; Marty Shelton and Gary Gerber, *CSC*; Ronald Townsend and Tom Snowberger, *Battelle Memorial Institute*; Steve Ashby, *Pacific Northwest National Laboratory*; Thomas Zacharia, *Oak Ridge National Laboratory*; Jill Smart, *Accenture*; representatives from *TIAA/CREF®*; Maisha Gray-Diggs, *Procter & Gamble®*; Stanley Litow, *IBM*; and Susan Dumais and Rich Draves, *Microsoft®*.

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Introduction

Historically, graduate education in the United States has played a critical role in the success of the U.S. workforce and economy, attracting and producing many of the world's most influential researchers, innovators, and leaders. As demonstrated in the landmark 2010 report, *The Path Forward: The Future of Graduate Education in the United States*, the link between graduate education and American prosperity has never been stronger than it is today.[1] The current White House recently affirmed the central idea behind this conclusion, asserting that the economic future of the U.S. depends upon educational opportunity and excellence. In the words of President Barack Obama, "A world-class education is the single most important factor in determining not just whether our kids can compete for the best jobs but whether America can out-compete countries around the world."[2]

U.S. graduate schools are environments in which students acquire the skills and knowledge needed to compete in the global economy, as well as to solve problems of national and global scope. *The Path Forward* outlined a plan of action for ensuring that a diverse range of talented students are able to contribute to this work for their own benefit, as well as for that of the U.S. economy and society. These recommendations have garnered significant national attention and led to many transformative changes on U.S. campuses. Yet the report also indicates that our work is not done: There is still a significant gap in our understanding of the next step in the journey, the pathways from graduate school and into careers.

There are high stakes behind understanding this critical juncture between education and the U.S. workforce. The United States is generally recognized as having the most vigorous and dynamic system of graduate education in the world, but little is known at the granular level about what our graduates do, how their work life progresses, and how well the preparation they receive equips them for the careers they pursue.

Pathways Through Graduate School and Into Careers tackles these questions by examining the views of groups that directly observe and experience this transitional moment — students, universities, and employers. The distinct perspectives of these groups offer an unprecedented opportunity to better understand what these important stakeholders seek, where they find success, and where their needs and goals remain unmet. The findings and recommendations presented in these pages are intended to provide a broad range of U.S. stakeholders with new pathways forward that will support the future success of the U.S. economy and its people.

Understanding and Supporting the Journey

The Path Forward report provided a comprehensive overview of the trends, challenges, and vulnerabilities existing in the current U.S. graduate education system. Special attention was given to issues that presented potential threats to the international preeminence of U.S. graduate schools and to the ability of students to access and succeed in U.S. programs. These pressing issues included:

Lack of knowledge about career options impacts students before, during, and after graduate school.

Demographic shifts. The population in the United States is diverse and continues to grow even more so. Given current trends, the resulting demographic shifts are likely to result in a population with less education than today and lower math and reading skill levels unless efforts are made to improve access to higher education and increase educational attainment.[3]

Disruptions in the pathways. Growth in graduate school enrollment is complicated by the dropout problem seen at the high school and undergraduate levels. While lower than experienced in the past, dropout rates for individuals aged 16–24 are still higher for underrepresented populations of students[4] and the number of high school students enrolling in postsecondary education is sobering.[5] These indicators point to the challenge of retaining students in high school and college, as well as ensuring that they are prepared for and attracted to graduate education.

Growth in international education and overseas career opportunities. The growing reputation of international graduate education threatens the ability of U.S.-based graduate schools to attract and retain the best and brightest international students.[6] Obtaining work visas that allow graduates to stay and work in the United States is challenging, while job opportunities are increasingly available to these students in their home countries.

Failure to complete the degree. The attrition rate in doctoral programs is one of the most vexing problems that U.S. graduate education faces.[7] A new study underway by the Council of Graduate Schools (CGS) is also examining completion and attrition rates at the master's level in order to provide insight into this issue.[8]

Accumulated debt. Appropriate financial support for graduate students is consistently identified as one of the most important concerns of graduate deans[9] and adequate financial support is cited by graduate students as the most significant factor contributing to their ability to complete the doctoral degree.[10]

Lack of career path transparency. Clear career options for graduate degree holders are often lacking, especially at the doctoral level. This lack of knowledge impacts students before they enter a graduate school, during the program, and upon degree completion.

Among the many issues, challenges, and recommendations addressed in *The Path Forward*, the issue of career transparency presented the biggest gap in data. It also provided an opportunity to address a set of pressing questions: How effectively are graduate schools and employers working together to ensure optimal pathways through graduate school and into careers? What knowledge do students have about career pathways and the programs that lead to careers in the 21st century global economy? What do employers expect of graduate degree holders, especially in areas of critical workforce need such as energy, healthcare, education, financial services, and emerging biomedical sciences? How do we best support the preparation of a highly skilled workforce to pursue careers in these fields?

These are the pressing questions explored in the current report. Not only do we seek to better understand current pathways through graduate school and into careers, we also seek to uncover trajectories that could be made stronger and more visible and identify opportunities to forge new pathways that benefit students, universities, employers, and the U.S. economy.

Graduate Education and the Workforce

Individuals with master's and doctoral degrees work in every sector of the U.S. economy, from academia, to industry, to government, to nonprofit organizations. They work as professors, business leaders, engineers, scientists, teachers, and psychologists, and in a broad range of other important occupations. They drive innovation; create knowledge; conduct cutting-edge research; explore new frontiers in scientific, civic, and cultural areas; and apply their knowledge and skills to solve the complex problems we face today.

Between 2010 and 2020, about 2.6 million new and replacement jobs are expected to require an advanced degree.[a] It is projected that the number of jobs requiring a master's degree will increase by about 22%, while the number of jobs requiring a doctorate or professional degree is expected to increase by 20%.[11] This does not mean that all workers must have a graduate or advanced degree in the future, but it does highlight the increased opportunity for those who do.

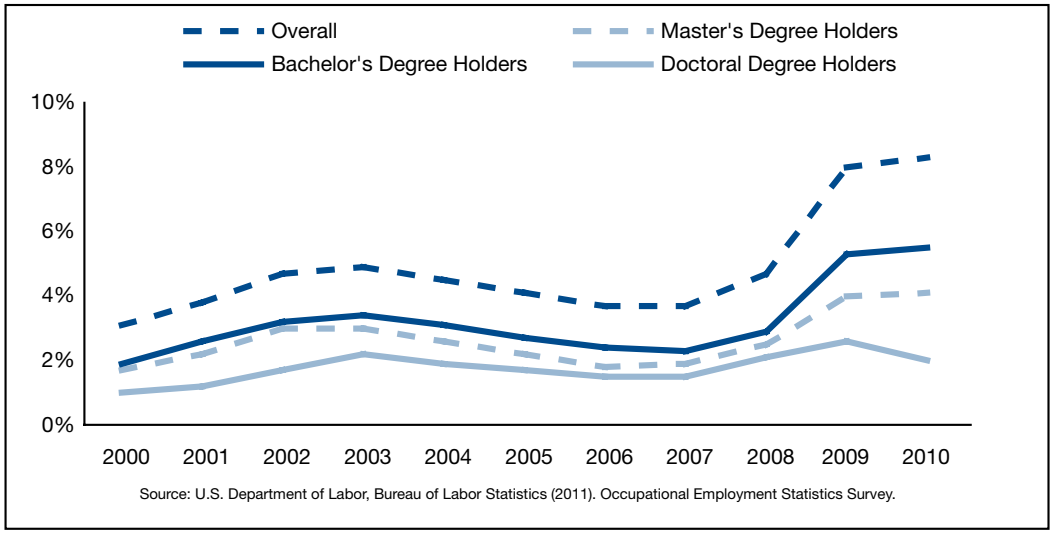
The Economic Value of an Advanced Degree

Currently, about 9% of individuals 25 years of age and older in the United States have a master's or doctoral degree.[12] In recent years, many questions have been raised about the value of an advanced degree, and the press has given particular attention to the costs and benefits of graduate education in a stressed economy.[13] However, there is strong evidence that advanced education levels continue to be associated with higher salaries. A study by the Georgetown Center on Education and the Workforce showed that across the 15 fields examined, individuals with a graduate degree earned an average of 38.3% more than those with a bachelor's degree in the same field.[14] The expected lifetime earnings for someone without a high school degree is $973,000; with a high school diploma, $1.3 million; with a bachelor's degree, $2.3 million; with a master's degree, $2.7 million; and with a doctoral degree (excluding professional degrees), $3.3 million.[15] Other data indicate that the overall unemployment rate for individuals who hold graduate degrees is far lower than for those who hold just an undergraduate degree.[16]

Over the past decade, data from the Bureau of Labor Statistics[17] also show that unemployment rates for master's and doctoral degree holders have been substantially lower than for those holding a bachelor's degree or less. Moreover, these gaps in unemployment increase during economic downturns, as shown in Figure 1, with graduate degree holders far less likely to be unemployed than their counterparts with lower levels of education.

[a] While this report is focused on graduate school degrees, *advanced degree* here refers to both professional (for example, law, medical, dental, veterinary) and graduate (master's and doctoral) degrees.

Figure 1: Unemployment rate by educational attainment (25 years and older).



Source: U.S. Department of Labor, Bureau of Labor Statistics (2011). Occupational Employment Statistics Survey.

Given the clear advantages of obtaining an advanced degree, why do so many students opt not to continue their postsecondary education past the undergraduate level?

There are many reasons, ranging from financial obligations to family and personal responsibilities to concerns about the skill set needed to be a successful graduate student.[18] **But understanding available career options and the impact on employability may also be an important factor in encouraging bachelor's degree recipients to continue their education.** Knowing the career opportunities and the long-term benefits that come from obtaining a graduate degree is the first step in ensuring that potential graduate students have all the information they need to think about and weigh opportunity costs against the career benefits of obtaining an advanced degree.

Why Is Understanding and Improving Career Transparency Important?

Individuals with graduate degrees play a vital role in the U.S. workforce, acting as the thinkers, creators, and innovators that drive the economy. Yet it is not fully understood how the careers of graduate students evolve. Some data exist to shed light on the educational aspirations of students and the initial employment outcomes for those who earn graduate degrees, but there is a lack of national data to fully illuminate careers and career pathways for graduate degree recipients, particularly for individuals who earn degrees outside science and engineering fields such as arts, humanities, and education; for those whose highest degree is a master's degree; and for individuals who enter nonacademic careers.

To address these knowledge gaps, the members of the *Commission on Pathways Through Graduate School and Into Careers* initiated three new data collection activities.

- First, we surveyed individuals who took the *GRE*® General Test between 2002 and 2011 to gather data on students' knowledge of careers and education and employment outcomes for these students.

- Second, we surveyed graduate deans to explore what universities are doing to provide career guidance and track outcomes.
- Finally, we conducted one-on-one interviews with executives and senior hiring managers from a wide range of business and government settings in order to better understand the pathways into careers in these sectors, their expectations for new hires, and the criteria used to measure success on the job.

The outcomes of these activities are provided in this report.

Understanding the opportunities and skills needed. A number of economists posit that the supply of workers with the requisite postsecondary education level will fall short of the number needed.[19] To address these concerns, it is important both to clarify new and existing career opportunities associated with an advanced degree and to define skills needed to take advantage of various career options. Better definition and communication of these topics is essential to recruiting and retaining students and supporting their completion of graduate degrees.

There is promising news in some sectors where efforts are underway to evaluate workforce demands and articulate needed skills. For example, the National Institutes of Health (NIH) recently established a task force to ensure that there is an adequate biomedical workforce to sustain the future of scientific research.[20] The task force is in the process of gathering input from students, postdoctoral fellows, investigators, grantee institutions, and others to help formulate questions related to the appropriate size of the workforce, the types of positions that allow successful careers, and the support and training needed for these positions in order to create a model for developing a sustainable and diverse biomedical research workforce. Similarly, professional societies, including the American Chemical Society, the American Historical Association, and the Modern Language Association, have voiced calls for an evaluation of degree holders' roles in a variety of work settings.[21, 22, 23]

Stakeholders from the United States and other countries are also engaged in discussions of high-level *transferable skills*, or high-level competencies that are needed across a range of employment sectors and occupations, such as skills of leadership, communication, project management, and problem-solving.[24] The Organisation for Economic Co-operation and Development (OECD) recently developed a project that will analyze and compare the efforts of national governments to support the transferable skills of researchers. In the context of graduate education, the Strategic Leaders Global Summit on Graduate Education examined this topic in a meeting convened by the Council of Graduate Schools and the University of Hong Kong in 2011.[25] Graduate leaders from 16 countries agreed that while research and the advancement of knowledge form the core of the doctorate, it is essential to integrate education in transferable skills into doctoral education. This recommendation was consistent with the summit's more general recommendation that universities, graduate schools, and faculty and academic staff work to ensure that students are aware of and prepared for a wide array of careers across a full spectrum of employment sectors.

At the same time, it is important to articulate the knowledge and skills that are specifically required of doctoral students seeking careers in academe. As many studies on the reform of doctoral education have shown, there is still a gap between doctoral training and professional demands on faculty.[26, 27, 28, 29] Advances in technology and globalization and new demands for accountability have uncovered new areas where skills must be identified and instilled in doctoral students, such as collaborating successfully with faculty at other

institutions, both in the United States and internationally; communicating the relevance of research outcomes to the public; and maintaining the highest standards of scholarly and research integrity. To ensure the quality of higher education more broadly, aspiring faculty also stand to benefit from greater articulation of the skills needed to engage undergraduates effectively and assess how well they are learning. This work would not only benefit the preparation of future faculty, but also the quality of undergraduate education.

As graduate education systems around the world continue to examine the relationship between skills development and workforce needs, U.S. stakeholders, including students, universities, and employers, must participate in an active discussion of this topic in the American context. The research outcomes of this report take a step in this direction and present the perspectives of each group regarding the skills that graduates acquire and those that are still needed.

While students are ultimately responsible for their careers, universities, industry, and the federal government also play a role in making career pathways transparent.

Career outcomes for graduate students. Our knowledge of actual career outcomes for graduate students varies by degree level and type. Earlier studies[30] have noted that many master's degree programs, such as MBA, education, and social work, are already geared towards the needs of the workplace and often lead to the careers that graduates seek. In particular, the growth of Professional Science Master's (PSM) programs shows how graduate schools respond to the needs of the industry sector. A recent CGS survey indicated that the vast majority of the new PSM graduates responding to the survey were already employed, with nearly all of them working in a job that was closely or somewhat related to their field of study.[31]

We have comparatively less evidence that the personal and financial investments of students in doctoral programs lead to the full range of careers for which students are qualified. In some fields, doctoral degree holders traditionally have obtained jobs in higher education, but changes in the academic job market have made the expected career path for new doctorate recipients less straightforward.[32, 33] Factors contributing to this trend include changes in the composition of the higher education instructional workforce (e.g., reduction of tenure track positions, increasing reliance on adjunct faculty), the time required to complete the doctoral degree, and multiple and lengthy postdoctoral research assignments prior to obtaining a faculty position, particularly for doctorate recipients in the life sciences.

There is also relatively little information about the extent to which doctoral students seek — or are aware of — career options available to them outside of the academy. The ability to guide doctoral students on career pathways that fall outside of the academy, as in government, industry, and nonprofit organizations, is often challenging. Many academic faculty may not understand the options on the path themselves or may believe that training in a doctoral program should lead to positions only at the academy. However, in fields where academic positions are limited or shrinking, many graduate schools are looking for new opportunities to help graduate students strategically prepare for a career in business, government, or the nonprofit sector.

While students ultimately are responsible for their careers, universities, industry, and the federal government can also play a role in making career pathways transparent. The path from graduate study to career is guided by a number of external forces that are explored in the next section.

Factors shaping career pathways. The path from student life to a job is not always linear, and many students commonly pursue study while engaged in full- or part-time work. While the elements influencing students typically alter as a student pursues different levels of education, these forces have a strong influence on how career-based decisions are made.

As shown in Figure 2, prior to graduate school, students are influenced by parents, teachers, and peers, and much of their knowledge of and the desire to seek particular careers comes from these forces. During graduate school, career aspirations are refined and re-defined through information provided by graduate faculty, students' programs, and the university, as well as former and current graduate students. Opportunities to engage in different job-related tasks, such as teaching and research through school- and employer-based activities, also help with this process. Finally, as students exit graduate school and enter their first job, their past preparation and employer expectations help guide them to success.

Figure 2: Career pathways influencers.

The Employer Perspective on Graduate Education

Graduates' skills and employer needs. A recent report[34] from The Conference Board concluded that the ability to produce a highly skilled workforce is critical to the future competitiveness of U.S. business, as well as to ensure continuing prosperity of local communities. It is the responsibility of government, educational institutions, and businesses, the report asserted, to work together to achieve that goal.

Yet when employers in various sectors are consulted about the skills of graduate degree holders, in some cases they identify ways in which the preparation of students could better meet current and evolving workforce demands. Meanwhile, universities are not always informed about the skills and knowledge for which the employers of their graduates are looking.

Without understanding employer expectations regarding skills and abilities of graduates, it will be difficult for graduate schools to provide appropriate training in those areas.

Without an understanding of employer expectations regarding the skills and abilities of graduates, graduate schools will find it difficult to provide the training and education required by industry, government, and nonprofit sectors. If new workers do not have the appropriate skills, employers will feel responsible for providing it themselves. Some evidence suggests that this is already occurring. A survey[35] conducted by *The American Workforce* reported that most employers view the role of industry in educating and training the workforce to be similar to that of higher education.

Some data currently exist as to which skills employers expect new graduates to possess as they enter the workforce, but these focus primarily on four-year degree recipients, not those with graduate degrees. Nevertheless, understanding the skills of undergraduates that are deemed necessary by employers may allow us to generalize employer expectations for individuals with graduate degrees.

A report released in 2010[36] found that workers face increasingly complex demands as part of their job and that these demands require higher levels of knowledge. Of the employers interviewed,[b] the majority indicated that a greater emphasis on learning outcomes such as knowledge of human cultures, intellectual and practical skills, integrated learning, and accepting personal and social responsibility, were needed at the higher education level.

An earlier report,[37] created through collaborative efforts of The Conference Board, the Partnership for 21st Century Skills, Corporate Voices for Working Families, and The Society for Human Resource Management, indicated that young people, including those with degrees from four-year colleges, do not possess the critical skills necessary to succeed at their jobs. In addition to requisite content knowledge, five categories of critical skills were defined as important to job success: (a) professionalism and work ethic, (b) oral and written communication, (c) teamwork and collaboration, (d) critical thinking and problem solving, and (e) ethics and social responsibility. Richard Cavanagh, President and CEO of The Conference Board, has drawn a direct link between such skills and U.S. economic strength: "Less than intense preparation in critical skills can lead to unsuccessful futures for America's youth, as well as a less competitive U.S. workforce. This ultimately makes the U.S. economy more vulnerable in the global marketplace" (p. 1).[38] Many employers recognize that these five categories of personal skills are mastered in graduate education. When asked about how their hiring practices are likely to change, for example, 42% of employers surveyed indicated that their hiring of individuals with post-bachelor's degrees would increase.[39]

[b] A total of 302 employers whose organizations had at least 25 employees took part in the interviews.

At the doctoral level, many countries are working to help doctoral degree holders understand the skills needed in different employment sectors. In the United Kingdom, for example, there have been efforts to raise awareness of the value and contribution of researchers with advanced degrees in the workforce. Vitae, a research-based organization, surveyed employer practices[40] in the United Kingdom and found that nearly three-quarters of employers would welcome more applications from individuals holding doctorates and that a third of them were actively targeting such individuals. Working with employers, Vitae has defined a list of researchers' skills and competencies valued in sectors that employ and recruit researchers.[41] In Canada, Mitacs, a government-supported organization, is working with government, universities, and companies to connect faculty with Canadian companies through collaborative research projects.[42] Finally, the European Tuning project[43] is contributing to the creation of a framework of comparable and compatible learning outcomes and competencies across the countries of the Bologna process.

In addition to CGS, a number of U.S.-based organizations have recently joined this effort. To help doctorate holders develop, maintain, and improve skills that are needed in academia, industry, government, and private enterprise, the National Postdoctoral Association has identified six core competencies,[44] defined as skills that are needed to provide adequate or high-level job performance and that should be acquired as part of a postdoctoral experience: (a) discipline-specific conceptual knowledge, (b) research skill development, (c) communication skills, (d) professionalism, (e) leadership and management skills, and (f) responsible conduct of research.

The efforts described above have laid an important foundation for a focused U.S. effort to understand and close gaps between graduate preparation and the skills needed in different employment sectors. To understand this issue more deeply, we gathered data directly from employers, conducting a series of interviews with a broad range of organizations and companies.[c] This approach has limitations because it was not possible to interview employers from all industry sectors and the number of employers that could be interviewed was limited, but it provides qualitative input on many important workforce issues.

What did employers tell us? The employer interviews gathered basic information regarding the proportion of the company's workforce with graduate degrees, as well as the types of positions held by these individuals. The focus of the interview was on understanding expectations of graduate degree holders at the time of their hire, criteria used to determine job success, criteria used as part of promotion, and the employer's view of the benefits and value-added of hiring individuals with graduate degrees.

Employers represented a variety of industry sectors and included both for-profit and nonprofit organizations. Many of the employers were industry leaders in their field. Interviews were conducted with company leaders, such as CEOs/presidents/vice presidents, heads of human resources, company recruiters, and senior-level managers. All of the employers hired a substantial number of individuals with master's degrees or doctorates from a number of disciplines (science, technology, humanities, social science, and business, among others). The number of staff members possessing a master's degree[d] generally exceeded the number with a doctorate. This is not unexpected, given that the number of master's degrees

[c] Ten large employers were interviewed. Employers were from the science, technology, mathematics, humanities, financial, or management consulting fields.

[d] At some companies, employees with MBAs comprised the majority of graduate degree holders.

awarded annually is 10 times that of doctorates.[45] However, in some of the research divisions within a particular company, the number of staff with doctoral degrees exceeded the number with master's degrees. The particular job category defined the degree required, with the overwhelming number of staff possessing doctorates holding positions such as researcher, scientist, technical advisor, and scholar. For employees with master's degrees, positions in business development, finance, management consulting, technology, and research support were most common.

Employers clearly indicated that graduate degree holders bring value to their organization. Employees with graduate degrees are viewed as having the advanced knowledge, and frequently, real work experience that allows them to quickly lead and design projects. They believe these staff become engaged immediately in their work and have the skills to examine and solve problems from different views. Ronald Townsend, Executive Vice President of Global Laboratory Operations for Battelle Memorial Institute, stated the issue in these succinct terms: graduate degree holders, especially those with doctorates, provide the "... scientific and technological leadership to drive scientific discovery, inspire innovation, and solve tough challenges."[46]

Graduate degree holders "... drive scientific discovery, inspire innovation, and solve tough challenges."

— Ronald Townsend, Battelle Memorial Institute

Yet employers also indicated that some graduate degree recipients lack certain other skills necessary for success on the job. In particular, skills related to working in a team environment, creating and delivering presentations, business acumen (skills necessary to deliver outcomes on schedule and on budget), project management, and the ability to discuss technical issues with nontechnical individuals were identified as sometimes being absent. These skills were similar to those identified in earlier reports[47] and one or more of them were expressed as missing across all employer interviews, regardless of their sector, organization size, or percentage of graduate degree holders they employed.

We also learned that employers had a strong interest in participating in the education and training of students and future employees. Most employers offered a variety of work experiences for students through internships, co-ops, and postdoctoral opportunities that were part of the organization's recruitment strategy. Employers believed that such opportunities gave students real, hands-on experience and that it also provided an opportunity for the employer to "try out" an individual before offering full-time employment. In particular, postdoctoral and graduate students brought "fresh eyes" and "new ideas" to the employer's organization and helped create positive networks with universities and other students. As one employer put it, "Interns create a great bridge between us and the university." Most employers indicated such work experiences were available for both graduate and undergraduate students.

Some of the employer representatives who were interviewed had graduate degrees themselves and indicated that their own career pathways had taken unexpected turns. As a result, they saw the need to clearly define the opportunities that existed in their organization for new hires. Most employers had established programs for employees that were focused on career opportunities and advancement within the organization; only one indicated that they did not have clearly defined criteria for promotion.

Connecting to the university. Most, but not all, employers have ongoing relationships with universities, graduate programs, or faculty. The relationship is often one of recruitment, and many recruit from specific schools or programs, sometimes from schools in their region. The basis for determining the schools and programs from which to recruit is based

on a combination of the match of the school or program curriculum and the employer's needs, the quantity of graduates from the school or program, and the job success of those students hired from a particular school or program.

Employers have developed many other relationships with universities and graduate programs, including corporate sponsorships that offer opportunities for employees to interact with faculty; research and other scholarly collaborations; sponsorship of certification programs offered by a graduate department; acting as partners in competition grants; and supporting employees who serve in faculty positions (e.g., adjuncts, joint faculty appointments).

However, despite the belief that one of the most important criteria in recruiting is the match between the graduate school or program's curriculum and the employer's needs, very few employers indicated that they collaborate with graduate schools or programs regarding the development of or revisions to courses or curriculum.[e] One employer that has worked directly with universities on this front acknowledged that it is not easy to do so because the work is often one-on-one and not necessarily scalable.

Employers believe that employees with graduate degrees bring value to their organization, but they also believe that some lack skills necessary for sucesss on the job.

Nevertheless, all employers felt that there needed to be stronger ties between graduate school curricula and workforce needs. In particular, employers felt that graduate schools need a multidisciplinary focus — in other words, that graduate students needed to understand how knowledge in one area could be applied to solve problems in another. They felt that graduate students needed better training in how to innovate, how to think like entrepreneurs, and how to work in multidisciplinary teams.

One employer, noting the importance of preparing students while they are still at the university, suggested that project-based learning activities focused on real industry needs should be considered. This type of activity, done in conjunction with an employer, provides assignments that directly connect the university and industry. The IBM Corporate Service Corps provides a model for this approach.[48]

Some employers also expressed concern about the quality of graduate degrees, especially the MBA, that are offered only as online programs. A recent report[49] reflects this concern, indicating that while 65% of higher education institutions say that online learning is a critical part of their long-term strategy, academic leaders are concerned that the quality of such instruction is not on a par with that delivered in a classroom. One employer indicated, for example, that online programs are a "solo experience." Since employers indicated that skills related to working in a team environment and the ability to interact with and discuss technical issues with nontechnical individuals were critical to job success, such a stance is not unexpected. However, there is a strong trend toward increasing interaction within online programs, many of which require face-to-face interaction with faculty and classmates through the use of new collaborative multimedia tools.[50] New and more rigorous metrics for measuring the quality of online courses have also been established and implemented.[51]

[e] It should be noted that engineering and business schools traditionally have had strong external advisory boards that include representatives from industry.

The Role of Government

Government, like the employment sector, has a critical role to play in supporting graduate education and in developing the future highly skilled workforce that will enable the United States to out-innovate, out-create, and out-think the world. Previous reports[52, 53] have noted the importance of enhancing investments in graduate education as a key component of a national strategy to support innovation and bolster workforce development in the United States. The benefits of past federal investments in graduate education are well known and documented. For example, the National Science Foundation's (NSF) Graduate Research Fellowship program[54] has a long history of selecting recipients who achieve high levels of success in their future academic and professional careers. Past fellows include numerous Nobel Prize winners, such as U.S. Secretary of Energy Steven Chu, Google® founder Sergey Brin, and *Freakonomics* co-author Steven Levitt.

Broadening participation in graduate education by individuals from all demographic and socioeconomic groups remains a national priority.

Broadening participation in graduate education by individuals from all demographic and socioeconomic groups remains a national priority, as does the need to make graduate education a viable option for a growing number of U.S. citizens. Some progress has been made along three fronts: access to graduate education, support during graduate education, and access to careers in government.

Access to graduate education. While an average 3% annual increase in graduate enrollment occurred over the most recent decade,[55] most students receiving a bachelor's degree do not continue with their education. For example, only slightly more than one-quarter of students receiving an undergraduate degree in 1992–1993 had earned a master's, doctoral, or professional degree 10 years later.[56] In addition, while there has been an average annual increase of about 4% for all minority groups enrolling in graduate school since 1998,[57] the representation of minority students in graduate education is still below the representation of these groups in the U.S. population, according to U.S. Census data.[58]

Some initiatives exist at the federal level to increase access to graduate education. A prime example is the Ronald E. McNair Postbaccalaureate Achievement Program,[59] which awards funds to institutions to prepare students from disadvantaged backgrounds for doctoral studies. McNair programs include opportunities for research, internships, tutoring, seminars, academic counseling, and other activities designed to help students prepare for doctoral programs.

Support during graduate education. The impact of receiving financial support at the student and institution level cannot be underestimated. Providing adequate financial support is critical for motivating students to enroll in a graduate program and to ensure that those who do enroll complete their degree. Financial challenges, such as a change in family status, the need to work, and other financial concerns, are frequently indicated as top reasons for leaving graduate school.[60]

While federal grant aid to students has increased since the late 1990s, the cumulative student loan debt burden for graduate students has increased substantially. Accumulated debt burdens may have serious consequences because they may affect which students are able to attend and complete graduate education.

The America COMPETES Reauthorization Act of 2010[61] recognized the role that graduate education plays in our nation's ability to maintain a highly skilled workforce. Among other things, the act authorized increases to the budget at the NSF and tied increased funding for the Graduate Research Fellowships (GRF) and the Integrative Graduate Education and Research Training (IGERT) programs together to ensure balance between them. It also authorized NSF to offer grants to "implement or expand research-based reforms in master's and doctoral level STEM[f] education that emphasize preparation for diverse careers" through the 21st Century Graduate Education provisions.

Other provisions of the COMPETES Act relative to graduate education financing include the reauthorization of the Protecting America's Competitive Edge (PACE) fellowship program, as well as increased funding for the Department of Energy's Office of Science.

Access to careers in government. The federal and state governments are also large employers of people with graduate degrees. Several initiatives at the federal level are underway to create opportunities for graduate students to gain experience working in the government sector and to examine future workforce needs. For example, the goal of the NIH Graduate Partnerships Program (GPP)[62] is to facilitate professional opportunities that intertwine the graduate academic experience with participating in research.

Another example is the Office of Personnel Management's recently proposed regulations to implement the Pathways Programs[63] intended to provide a pathway to federal internships and careers in government. These programs include graduate students and contain a strong mentoring and training component.

Other initiatives are underway to examine workforce development needs in critical fields. As mentioned above, the NIH recently established a task force[64] to examine the future needs of the biomedical research workforce in the United States.

Finally, the COMPETES Act authorized a national study to examine the scientific workforce in the areas of oceanic and atmosphere research and development to determine whether there is a shortage of individuals with advanced degrees in oceanic and atmospheric sciences who have the ability to conduct high-quality scientific research in physical and chemical oceanography, meteorology, and atmospheric modeling and related fields for government, nonprofit, and private sector entities. This study will also examine what federal programs are available to help facilitate the education of students with advanced degrees and what can be done to increase the number of individuals with such post-baccalaureate degrees.

[f] STEM = science, technology, engineering, and mathematics.

The Missing Link(s)

An advanced degree offers many benefits. There is a clear economic advantage in terms of earning potential and job stability in times of recession. Yet how students learn about career possibilities prior to and during graduate school is not well understood. And there is little known about how graduate schools equip their students with this knowledge and with the skills needed to be successful in their careers.

In order to better understand the student and university perspective, we conducted two online surveys. One survey gathered data from students on their knowledge of careers and education before, during, and following graduate school. The second survey gathered information on what universities are doing to provide career guidance, who provides this guidance, and how they track career outcomes.

What Graduate Students Know — And Don't Know

Educational aspirations by students have increased over the past several decades.

Educational aspirations by students have increased over the past several decades, and several underlying causes have been identified.[65] First, higher aspirations have been promoted by a system of education that encourages college for all, where previous systems had not.[66] Second, as we shift to a knowledge economy, students recognize that higher levels of education are required for more prestigious jobs.[67, 68] Finally, amidst increased globalization of the labor market, students see increased levels of education as an increasingly valuable credential, whether or not that credential is actually required by the position.[69]

Unfortunately, it appears that students have also disassociated their educational aspirations from their occupational ones. Large national surveys[70] conducted in 1980, 1990, and 2002 examined tenth graders' educational aspirations and found that while degree expectations and job expectations were significantly related at each time point, the strength of this relationship grew smaller over time. One explanation for this finding was that the increased norm of higher education has led some students, particularly socioeconomically disadvantaged students, to aspire to educational goals that were not rooted in occupational plans.

Research frequently treats *educational aspirations* as separate from *career aspirations*. For example, in some large, national surveys (e.g., NCES' Baccalaureate & Beyond,[71] NSF's National Survey of Recent College Graduates[72]) questions about educational plans and current/future careers are asked and analyzed separately. Students who indicate they plan to attend graduate school are asked about their intended degrees, fields of study, and graduate school experiences, while those who are planning to enter careers are asked about their employment status, field of work, and career outcomes. These surveys do not ask future graduate students if they have considered the type of career a graduate degree will allow them to pursue.

What is known from a broader base of sociological research, however, is that the relationship between educational and occupational aspirations is complex. Students who expect more prestigious jobs are more likely to attain higher levels of education.[73] More recently, researchers have determined that the jobs students expect also shape their educational plans.[74]

Students believe that obtaining a graduate degree provides them with better career opportunities ...

Other data support this gap between educational plans and career knowledge. Overall, students appear to perceive value in obtaining an advanced degree when it comes to furthering their career. In a recent survey of 571 college graduates, only 21% believed that a bachelor's degree was sufficient for a successful career.[75]

In order to more fully understand what students know about career opportunities and when they learned it, we surveyed individuals[g] who took the *GRE* General Test between 2002 and 2011. While this data source does not capture all individuals who attended, or planned to attend, graduate school during this time period, it does provide access to a large number of students from a variety of demographic groups, fields of study, and institution types. Responses to the survey provide interesting student perspectives regarding career knowledge, but because this is a sample of convenience, the results may not accurately represent all graduate students. The survey,[h] administered online, reflects a total of nearly 6,000 responses and includes students who have completed, are still enrolled in, or still plan on pursuing a graduate degree.

Career knowledge prior to graduate school. There are many factors that influence students' decisions to pursue graduate education and the expected outcomes of that decision in terms of job satisfaction and economic reward. Our own survey indicated that more than 14% of the students who had received master's degrees and 17% of students who received doctorates said they knew they wanted to attend graduate school before they entered their undergraduate program.

Research has shown that the formation of career aspirations is a lifelong process that begins as early as middle and high school, and perhaps even as early as elementary school.[76, 77] Parents certainly play a key role, as career aspirations are frequently formed before students arrive at the university as undergraduates. Indeed, from television spots to signs in subways, students are surrounded with statistics showing the income benefits of continuing their education.

Some research has inquired about students' views of careers before entering graduate school. For example, a survey of 500 undergraduates at institutions across the United States who are pursuing degrees in STEM fields indicated that 57% made the decision regarding their major while they were still in high school.[78] In the same survey, 68% of these students indicated that this decision was motivated by the potential for high salaries.

But research has also found that students know little about how to explore and evaluate graduate programs, let alone really comprehend the career opportunities that result from them.[79]

What did students tell us? Overall, students perceive value in obtaining a more advanced degree and this belief was reflected in our survey. Of those who had received a graduate degree, 85% agreed that it gave them better career opportunities and 76% said that it increased their income potential. The vast majority — over 90% — of both graduate degree recipients and current graduate students said that, given the chance,

[g] Only individuals who provided email addresses at the time of test registration were invited to respond to the survey.

[h] Only high-level data from this survey are presented in this report. More detailed analyses by subpopulation groups, field of study, and other appropriate categories will be provided in a future research report.

they would enroll in graduate school again. Even among those who failed to complete a degree, nearly three-quarters said that, given what they know now, they would attend graduate school. And even those students who plan on attending graduate school in the future saw value in obtaining a graduate degree: Nearly 88% agreed that a graduate degree would provide them with better career opportunities and over 84% agreed that it would provide them with increased earning potential.

Yet this perceived value of graduate education is tied to seemingly insufficient information about viable careers. Among those who responded to our survey, more than two-thirds reported they had received as much information as they needed about *graduate school* before enrolling. However, only slightly more than one-third felt they had received as much information as needed to understand their *career options* prior to entering graduate school.

... yet the perceived value of a graduate degree is tied to insufficient information about viable careers.

Students also indicated they received less helpful and accurate information about careers compared to information provided about graduate school itself. For example, more than one-half (58%) of students reported that the information they received about *graduate school* was helpful and more than one-third (38%) considered it extremely helpful. Responses about *career information* were less encouraging, with only about 18% of students indicating the information was extremely helpful and 62% helpful — but nearly 21% said that the information was not helpful at all. And while 35% of students found the information about *graduate school* to be extremely accurate, only 19% said the same for information about *careers*.

Where did students learn about graduate school and career possibilities? We asked students to identify who they consulted when they were considering graduate school, both academic and nonacademic sources as well as formal and informal sources.

Informal sources, such as friends, family, or coworkers, appeared to be the most common source consulted by all students (67%), followed closely by undergraduate faculty (64%). Other academic sources were less often identified, such as conferring with current graduate students (48%), academic advisors (41%), institutional programs (30%), and significant others (26%). And sources that might have provided information on career opportunities resulting from obtaining a graduate degree were cited far less often: employers (18%) and career counselors (11%).

Are there differences among domestic and international students? International doctoral and research students are vital to graduate schools and historically make up a significant proportion of the total graduate population in the United States.[80, 81] Only a small number of studies have examined career aspirations of such students and they are limited by their size, method, and/or scope (single institution studies). Thus, our survey, which includes over 1,000 international students, presents a unique perspective on their experiences. Among these students, more than one-third (38%) had completed their graduate degree, a little less than one-half (47%) were still working on their degree, and a small number (11%) had not yet enrolled but were planning on pursuing a graduate degree.

Domestic and international students held similar beliefs regarding the amount of information they received about graduate school and careers prior to enrolling. Domestic students (70%) were somewhat more likely to feel they had received a sufficient amount of information about graduate school than international students (60%), although both groups of students responded similarly regarding receiving insufficient information about careers.

Students from both groups indicated they consulted more than one source of information prior to considering graduate school: domestic (88%) and international (83%). However, domestic students pursued a slightly larger number of sources than international students, with roughly one-half (49%) of domestic students seeking more than three sources, compared to about one-third (37%) of international students.

Domestic students were more likely to seek information from academic sources (such as faculty and advisors) and nonacademic sources (such as employers) than were international students.

Career knowledge during graduate school. Little is known about students' perceptions of the role of graduate education in providing information on career options and in fostering careers. Our survey provided the opportunity to explore these perceptions in some detail. We first examined their reasons for attending graduate school.

Though there were some minor differences, reasons for attending graduate school did not differ much by degree level or field of study. Students generally provided three reasons for enrolling in graduate education: personal enrichment (65%), supplementing undergraduate education (60%), and fulfilling a future job requirement in their current career path (59%). Although about one-quarter of the respondents indicated that they attended graduate school to change career paths, few indicated that uncertainty on what to do in life (16%), economic factors (11%), or current job requirements (9%) motivated them to seek a graduate degree.

One factor that did show a difference in the motivation for attending graduate school was the number of years between completion of the bachelor's degree and completion of the master's degree. Among master's-only recipients, those who received their master's degree within three years of their bachelor's were more likely (71%) to indicate supplementing their undergraduate education as a reason for attending graduate school compared to those who received their master's more than three years after their bachelor's (53%). Of those who received their master's within three years of their bachelor's, only a small percentage (15%) indicated a change in career path as a reason for attending graduate school compared to the 39% of students who received their master's more than three years after completing their bachelor's.

Do career expectations change during graduate school? The few studies that have examined graduate students' initial career knowledge and expectations have focused on how those factors change over the course of a graduate education. These studies are often framed from the larger perspective that graduate education, especially at the doctoral level, is no longer simply designed to train the next generation of faculty.

Many master's programs are geared toward the needs of the workforce, a view reinforced by the employers we interviewed. At the doctoral level, a motivating factor has traditionally assumed to have been the ability to obtain a tenured faculty position. However, securing

a tenured position has become more difficult as universities replace departing tenured faculty with nontenured staff.[82, 83] In addition, as faculty positions continue to be in short supply, students are increasingly presented with a host of other viable career paths.[84, 85]

A survey conducted by the Pew Charitable Trusts indicated that the career goals of students seeking a doctorate change during their graduate education. Roughly one-third of students seeking doctorates became less interested in faculty positions during graduate school, while one-fifth became more interested. The survey also reported that students felt that encouragement to consider nonacademic careers was limited: More than one-half (56%) were encouraged to attend academically oriented training, while less than one-third (32%) were encouraged to attend training geared toward nonacademic positions.[86]

Another study of doctoral students in the University of California system also reflected decreased interest in becoming faculty members as their education progressed. However, this decrease was only for research-focused faculty positions; interest in teaching-focused positions remained stable. Why did graduate students lose interest in such positions? Negative experiences as a doctoral student, other life interests, and excessive time required by professional activities were the most cited reasons. Women tended to cite more personal and family related reasons, while men cited more professionally related reasons.[87]

A study of doctoral students in the United States and Europe used a cross-sectional comparison of students to determine how career attitudes changed during graduate school.[88] As with the previous studies, many students — about one-half of U.S. students and one-third of European students — reported that they were somewhat less likely to pursue a research career than when they started their graduate program. The most often cited reason for this? Perceived competition for academic jobs and personal changes in students' interests.

In our survey, we explored career knowledge and aspirations somewhat differently. Indeed, we did find that a sizable number of current graduate students (39%) reported changes in their career goals after entering graduate school. However, students were more likely to report that these changes were expansive in nature (identifying new goals [58%] or expanding their existing goals [55%]), rather than restrictive (narrowing goals [17%] or discarding initial goals [17%]).

Who provides career information during graduate school? In order to understand how students gather knowledge and develop their career plans during graduate school, it is important to consider the major sources of influence. Overwhelmingly, research points to the crucial roles of graduate faculty as teachers, advisors, role models, and mentors. Particularly under the auspices of mentoring, the importance of faculty in student career development has been stressed for academic positions,[89, 90, 91, 92] nonacademic positions,[93, 94] and in professional schools.[95, 96, 97] In particular, research on the impact of mentoring has been published in the fields of psychology[98, 99, 100] and education.[101, 102]

Our survey also supports the critical role of graduate faculty in providing career information, with 73% of students reporting that they spoke with a faculty member or advisor about their career, far more than any other group.

We also asked students about their career interests, as well as their perceptions as to the careers that faculty encourage. These two factors appeared to be closely aligned.

For example, teaching/faculty and research positions were, by far, the two most endorsed careers by students; students also felt that faculty endorsed these positions. Positions in community service, business/corporate, government, and nonprofit organizations were of interest to students, but were endorsed less frequently by faculty. And entrepreneurial and military careers were very rarely of interest to students or encouraged by faculty.

Programs and training provide another potential source of career information for many graduate students. The Pew Charitable Trusts survey showed that career development opportunities not only varied depending on the type of career, but that students felt that programs provided few opportunities for professional development, such as internships or formal training in career responsibilities, particularly those related to faculty positions.[103] However, university assistantships, either teaching, research, or other university work, may provide an opportunity to apply the knowledge and skills learned in a graduate program.

Where do those with doctorates work? About one-half of new doctoral degree recipients find initial employment in business, government, and nonprofit organizations but this varies depending upon field of study.

Our survey showed a high level of participation in assistantships, with roughly two-thirds of current and previous graduate students having engaged in some form of assistantship. However, assistantships did not appear to provide additional career information to students.

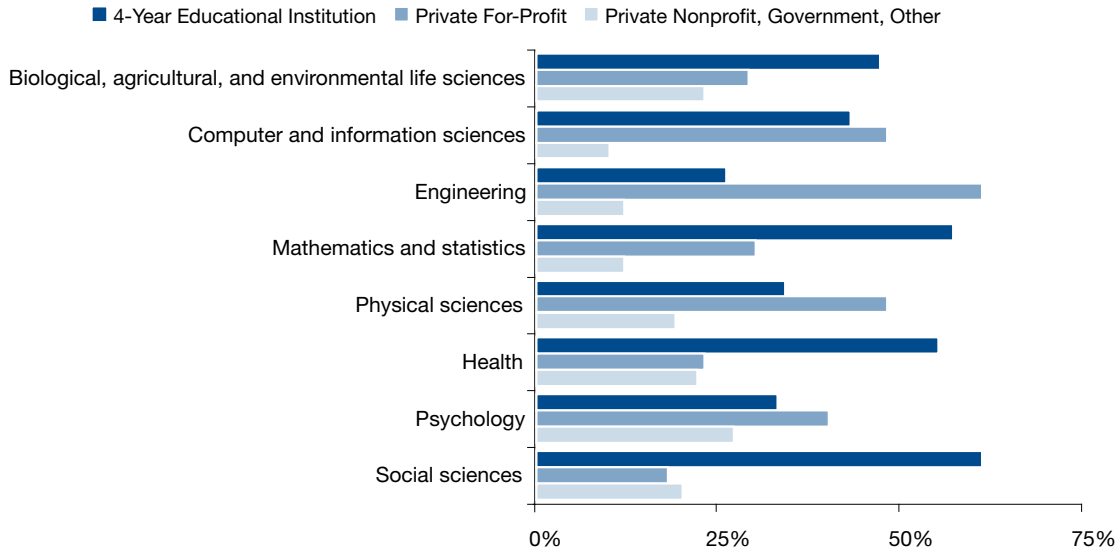
One area that is notably absent as a guide during graduate school is that of the use of a *career counseling* or *placement office*. Generally, career counseling and placement offices focus only on undergraduates. Some recent research has called for more established practices and involvement of career services offices in the development of graduate students.[104] Indeed, our survey showed that only 12% of students discussed career options with a career counseling or placement office during graduate school.

Career pathways after graduate school. In general, research examining the career paths of graduate degree recipients has focused on rates or sectors of employment — i.e., to what extent are graduate degree holders able to find work and where are they working? Studies by the NSF found that unemployment rates for doctoral-level scientists and engineers — including those in the social sciences — were well below the national average.[105] Other studies,[106, 107] as indicated earlier in this report, point to the economic and monetary value of graduate degrees, especially during times of economic downturn.

What are the pathways for doctoral degree holders? About one-half of all new doctorate recipients find initial employment in business, government, and nonprofit jobs. This trend has remained relatively consistent over the past two decades. By broad field of study, individuals earning doctoral degrees in humanities are most likely to secure *initial* employment in academia (85%), while those in engineering are least likely to enter academia (15%). In contrast, engineering doctorate recipients are most likely to go initially into business/industry and humanities doctorate recipients are least likely to do so.[108]

As seen in Figure 3, recent data from the NSF's *Survey of Doctorate Recipients*[109] show that 41% of all doctorate recipients in science, engineering, or health fields work in four-year colleges or universities. But more than one-half of doctoral degree holders work outside of the academy, with one-third employed in private, for-profit businesses. These findings vary depending on field of discipline. For example, only 26% of those holding engineering doctorates work in colleges and universities, while 61% work in the industry sector. These numbers are reversed — 57% and 30%, respectively — for those holding doctorates in mathematics and statistics.

Figure 3: Employed holders of U.S. doctorates in science, engineering, and health fields by employment sector and field of study.



Note: 4-year educational institutions include 4-year colleges, universities, medical schools (including university-affiliated hospitals or medical centers), and university-affiliated research institutes.
Source: National Science Foundation/Division of Science Resources Statistics, Survey of Doctorate Recipients (2008).

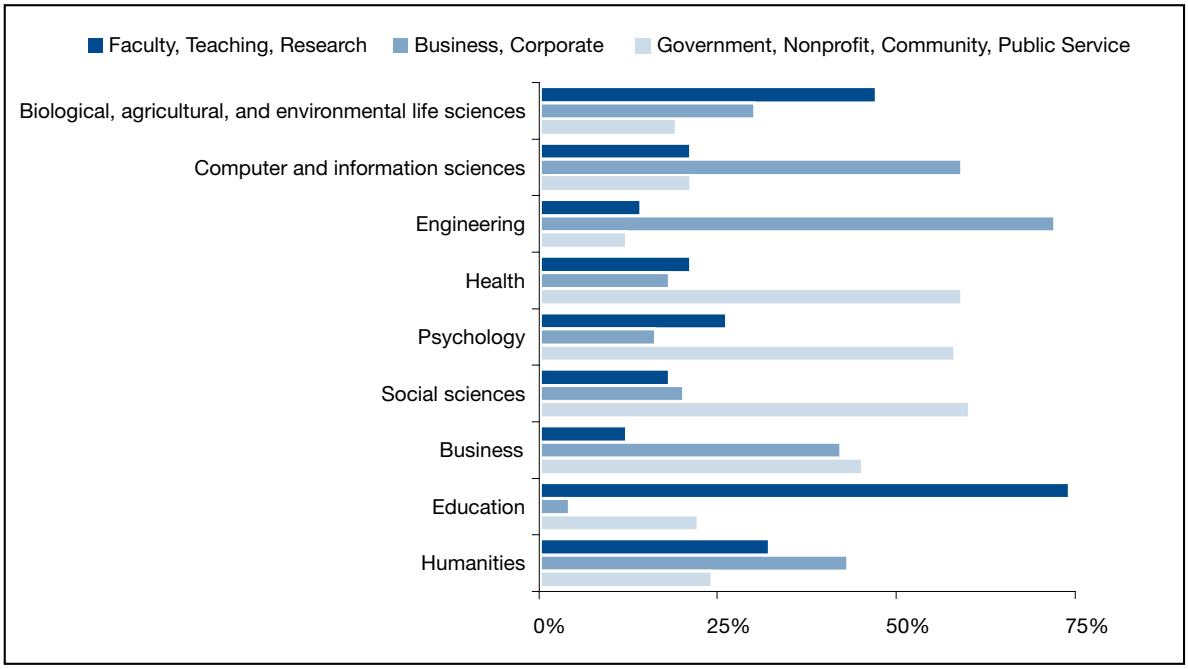
Findings are drastically different in other fields, such as the humanities. The Modern Language Association's *Survey of Ph.D. Placement*[110] showed that 81% of those who received doctoral degrees in English, foreign languages, or comparative literature worked in colleges or universities, primarily in faculty positions. These findings, however, refer to employment within the first year of graduation, while the NSF data include a longer range of experience. And a paper[111] presented at the recent American Historical Association meeting suggested that the time had come for history departments to consider nonacademic careers as viable options for doctoral students.

What are the pathways for master's degree holders? The majority of studies examining career paths focus on doctorate recipients. But, as stated earlier, 10 times more master's degrees than doctoral degrees have been conferred in recent years. Our survey provided a unique opportunity to understand the career pathways for those with master's degrees.

We examined data from more than 1,500 students who had received a single master's degree and had not pursued or received a doctoral degree. Business and private corporations (30%) represent the largest sector of employment for these individuals, followed by teaching or faculty positions (22%). These students also work in other sectors, such as nonprofit (12%), community/public service (11%), government (11%), and research (9%) organizations. As displayed in Figure 4, percentages vary heavily within fields, but overall showed that master's degree holders, even more so than doctorate recipients, work in a variety of settings.

Where do those with master's degrees work? Even more so than those with doctorates, master's degree holders work in a variety of settings.

Figure 4: Employed holders of master's degrees by employment sector and field of study.



The University Role in Clarifying Career Pathways

Universities play a critical role at both the undergraduate and graduate levels in helping students find pathways through graduate school and into careers, but based on our student survey, this important role is often neglected. Although the focus of this section is on the role of universities in career preparation and planning, it is recognized that faculty members are but one influencer in the decision to pursue a graduate education and on the expected outcomes of that decision in terms of job satisfaction and economic reward.

At the undergraduate level, faculty may advise their best students to consider going to graduate school, but these faculty members may have a limited view of who should go to graduate school and for what reasons. Undergraduate faculty understandably tend to be most aware of their own career trajectories, and so are likely to present the graduate school option to their students as a pathway to a career in academia. They may devalue nonacademic careers as only for those students who could not make their way into the professoriate. Lack of career guidance from faculty and advisors also continues in graduate school, as indicated by some students in our survey.

Other studies also examined the relationship of faculty, students, and career advice. The National Survey of Student Engagement[112] asked college seniors how often they talked about career plans with a faculty member or advisor. Across all types of colleges, about 18% of students indicated they had never talked with a faculty member or advisor about this important topic. For colleges with a Carnegie classification of *Baccalaureate Colleges-Arts & Sciences*, 8% answered "never," but for *Research Universities*, an important training ground for future graduate students, 20% answered "never." Furthermore, opportunities for out-of-class discussions about career options and pathways were limited. About 48% of the seniors reported that they never "worked with faculty members on activities other than coursework."[i] Again, there was some variation across type of institution, from a low of 28%

reporting "never" in *Baccalaureate Colleges-Arts & Sciences* to 50% of students in *Research Universities* reporting "never."

Pre-determined and pre-defined career outcomes. Whatever their intentions when students enroll in graduate school, career pathways are often molded by immersion in the graduate school culture.[113, 114, 115] Although some universities and departments may clearly value careers beyond the academy, the opposite is often true. Anthony T. Grafton and Jim Grossman — the president and executive director, respectively, of the American Historical Association — stated the case clearly:[116]

> [G]raduate programs have proved achingly reluctant to see the world as it is. For all the innovation in the subjects and methods of history, the goal of the training remains the same: to produce more professors; the unchanged language of supervisors and students reflects this. We tell students that there are "alternatives" to academic careers. We warn them to develop a "plan B" in case they do not find a teaching post. And the very words in which we couch this useful advice make clear how much we hope they will not have to follow it — and suggest, to many of them, that if they do have to settle for employment outside the academy, they should crawl off home and gnaw their arms off. (p. 1)

This perception of careers beyond the academy as a less desirable path is not limited to history majors or students in the arts. Focusing on doctoral-level biomedical science graduates, a recent study[117] suggested that students who choose nonacademic careers may be perceived as simply leakage from the desired pipeline. The authors stated:

> As the number of trainees has outpaced the availability of academic positions, an increasing number of Ph.D.-trained scientists have pursued paths outside of academia. These scientists are often described as "leaking" from the pipeline. Unfortunately, this metaphor perpetuates the negative perception that scientists who "leak" are outside the norm and represent failures within the system. (p. 239)

The 2010 NRC assessment of doctoral programs appears to further bolster this perception.[118] In this study, the student career outcome was defined as the percentage of doctorates with definite plans for an academic position. The university community's response to the NRC assessment routinely made the point that this overly narrow definition of a successful career outcome was neither helpful nor realistic.[119, 120]

Is this really the graduate school's job? In earlier decades, graduate institutions, especially at the doctoral level, did not seem to believe that career preparation was a part of their mission. This was true even for careers in academia, as there was little explicit instruction on the teaching skills that would be needed in the presumed academic career. Recognizing this need, a program entitled Preparing Future Faculty (PFF) was launched in 1993 by CGS and several partners.[j] This program resulted in a national movement to transform the way aspiring faculty members are prepared for their careers. As stated on the website,[121] "PFF programs provide doctoral students, as well as some master's and postdoctoral students, with opportunities to observe and experience faculty responsibilities at a variety of academic institutions with varying missions, diverse student bodies, and different expectations for faculty." While this is clearly a needed and valuable resource

The Preparing Future Faculty Program resulted in a national movement to transform the way aspiring faculty members are prepared for their careers. Comparable career preparation is needed for those seeking nonacademic careers.

[i] This includes committees, orientation, student life activities, etc.

[j] The Preparing Future Faculty program included CGS and the Association of American Colleges and Universities with support from The Pew Charitable Trusts, the National Science Foundation, and The Atlantic Philanthropies.

for potential faculty members, comparable career preparation for students seeking nonacademic careers is not yet universally in place. Nevertheless, more attention is becoming focused on this problem, as suggested by a recent article in the *Chronicle of Higher Education*.[122]

In order to better understand the perceived need for providing more information to students on nonacademic career options and to document the kinds of resources currently provided by graduate schools, we conducted a survey of CGS member graduate deans.[k] CGS universities award about 90% of all doctorates granted each year in the United States and about 75% of all master's degrees. Thus, its membership provides access to a wide variety of schools from major comprehensive research universities to much smaller master's-only institutions. Focus groups composed of graduate deans were also held, which allowed us to gather expanded information on some of the questions in the survey.

The survey was given online and graduate deans accessed it through a provided link. We requested information on four types of programs: professional master's, research master's, professional doctorates, and research doctorates. Nearly all (91%) of the responding deans indicated that their institution had research master's programs, 90% had professional master's programs, 77% had research doctorate programs, and 72% had professional doctorate programs. Although the professional degrees and the research doctorate degree are relatively easily defined, the research master's degree was a somewhat problematic category; this degree may be a terminal degree, but it is also often seen as a stepping stone to a doctoral degree. Thus, data from the research master's represent two types of degrees — those that are terminal and those that are "en route" to the doctorate.

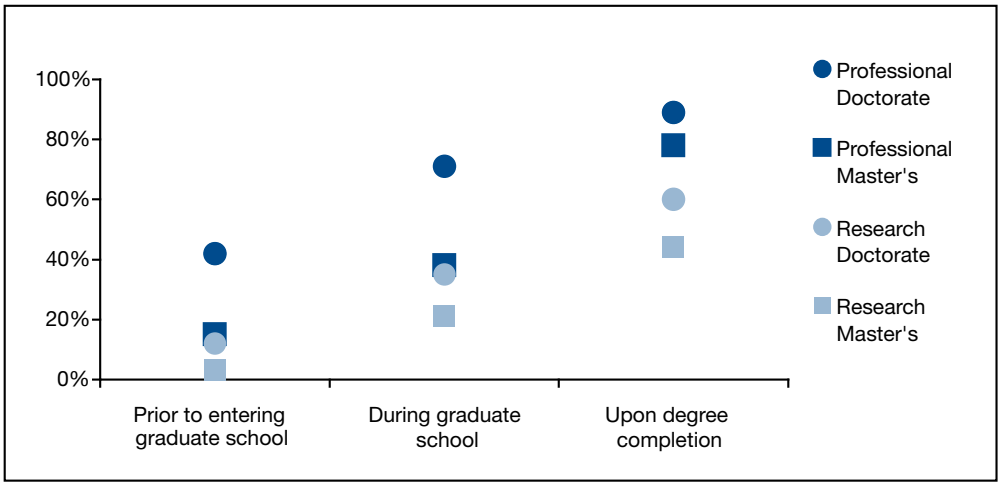
Graduate deans' perspectives. Graduate deans' perceptions confirmed what students had told us — students are not very knowledgeable about career options. We asked deans about students' knowledge of career options at three time points: prior to entering graduate school, during graduate school, and upon completing their graduate degree.

Few deans (less than 10%) believed that students had little knowledge at any one of these time points. But there were striking differences across the categories of degree programs in the percentage of deans who believed that students were very knowledgeable. As shown in Figure 5, fewer than 20% of the deans thought students in professional and research master's programs and in research doctorate programs were very knowledgeable of career options prior to starting graduate school; more disturbing is that this number was still well below 50% during graduate school. However, even though students in professional master's and research doctorate programs generally were seen as very knowledgeable by the time they graduated, 40% of the deans indicated that, even when they had completed their graduate degrees, students receiving a research doctorate were only somewhat knowledgeable about career options; for research master's students, this number was 54%.

Survey responses further suggested that providing career guidance to graduate students is often not a high priority. This does not mean that deans do not believe that it is important, but given the list of other priorities and lack of resources, it does not rise to the top. Only 18% of the deans indicated that providing career guidance for graduate students was a significant focus and 13% said it was not a focus.

[k] The invitation to participate in the survey was sent to 494 deans and responses were obtained from 213 (43%).

Figure 5: Percent of deans who believe students are very knowledgeable about career options.



Consistent with this lack of focus, the deans indicated dissatisfaction with their institution's ability to support graduate student career goals, provide career guidance, and prepare graduate students for nonacademic careers. In all three of these areas, more than one-half of the deans indicated that they were very or somewhat dissatisfied with the services provided; fewer than 10% of the deans were very satisfied with the ability of their institutions to provide these supports. As one of the deans commented, "A robust Preparing Future Faculty program exists, as well as other activities that pertain to academic careers. Very little is done to prepare students for nonacademic careers."

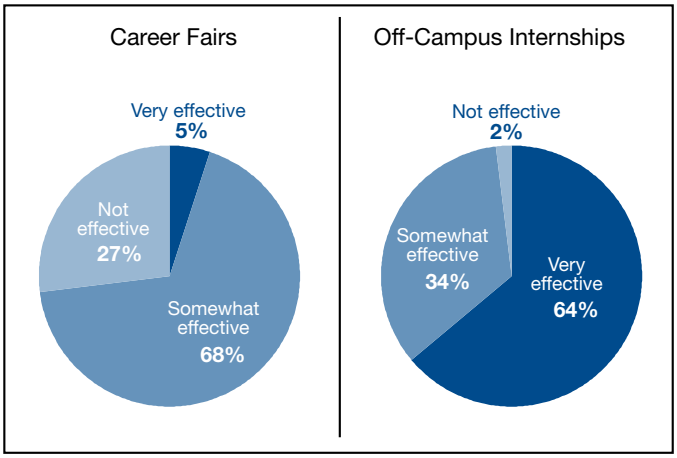
At some universities, career guidance is primarily a departmental or program activity, while at other universities, aspects of career guidance take place within the graduate school. Therefore, support for career guidance appears to vary widely both within and across universities. At one dean's institution, "Engineering supports nonacademic careers; biomedical sciences frowns and discourages nonacademic careers." Another dean commented, "Graduate students in our engineering programs probably enjoy the greatest amount of support for a diversity of career options while humanities students probably are most strongly directed toward faculty careers." This variability points to the need for university leaders to find effective strategies and programs to provide appropriate career guidance and information about career pathways.

While some deans noted that their campus career and placement offices focused almost exclusively on undergraduates, others noted that they had career services offices specifically targeted to the needs of graduate students. One of these offices "offers numerous workshops on career planning and job search in higher education and industry/government/nonprofits [with] more than 1,000 individual student advising appointments each year."

Although some deans indicated that their universities provided a number of career development activities for graduate students, only some of these activities were seen as very effective. Figure 6 shows the perceived effectiveness of the two most common career development activities — career fairs and off-campus internships.

Most campuses had career fairs, but they were not seen as a very effective mechanism for promoting career development for graduate students. On the other hand, off-campus internships were seen as very effective by 64% of the deans, with only 2% indicating that they were not effective. There was wide variation in the availability of internships with some

Figure 6: Deans' perceptions of the effectiveness of career fairs and off-campus internships.



programs providing these experiences for virtually all students and others providing them for virtually none. For students who participated in off-campus internships, at least two-thirds of the deans indicated that the following outcomes were very important: obtaining practical experience in the field, developing workplace skills, forming relationships with practitioners in the field, and connecting with potential employers.

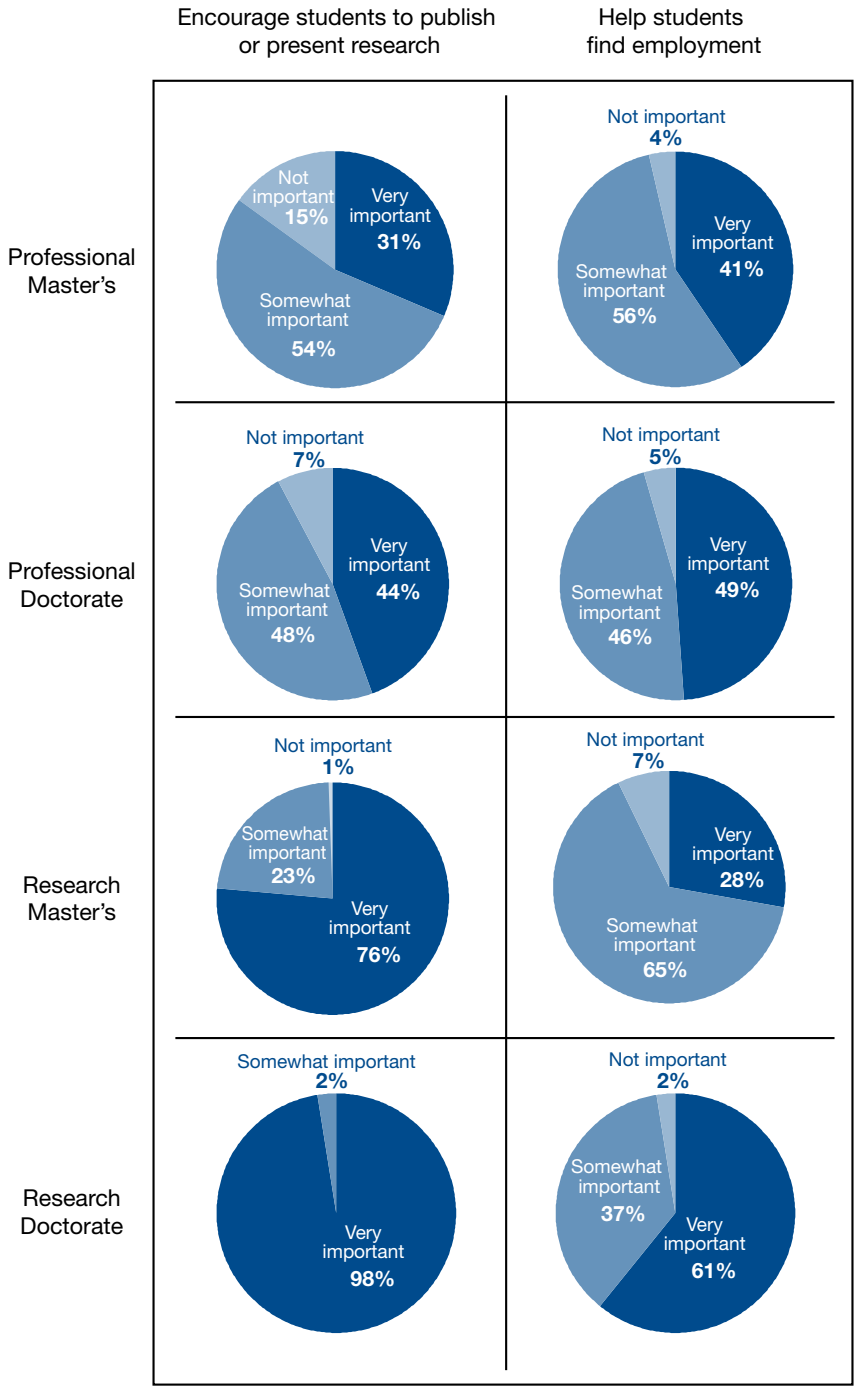
While more common in business and engineering, internships and postdoctoral experiences in the humanities outside of the academy are provided by some employers. As indicated in the employer interviews, internship experiences are frequently used as a recruitment tool or as a proving ground prior to an employment offer, but this is not always the case.

Career goals and graduate student selection. Deans reinforced the notion that students' career goals are not necessarily considered as the most important variable by graduate faculty when selecting students for a graduate program. Just over one-half (51%) of the deans indicated that career goals had significant weight in the admissions process for research doctorate students. This factor was viewed as much more significant in professional doctorate programs (71%). For professional master's programs, 52% of deans indicated that career goals had significant weight in admissions, about the same as in the research doctorate.

In contrast, the match between the program's focus and the applicants' content area and research interests was seen as very important in research doctorate programs, with 94% of the deans reporting that this had significant weight in student selection. For professional doctorate programs, 56% of the deans reported the match had significant weight; for professional master's programs, only 36% indicated that the match between the program's focus and applicant's interests was significant.

What is the role of faculty? We asked graduate deans to indicate the importance of various activities of faculty advisors for students who are near the end of their graduate careers. Two of these activities stood out as the most important: helping students publish or present research and helping students find employment opportunities. As seen in Figure 7, the majority of the deans felt that helping students publish or present research was a very important faculty responsibility for research master's and research doctorate students (76% and 98%, respectively). But far fewer indicated that helping these students find employment

Figure 7: Level of importance for faculty advisor to:



opportunities was an important task for faculty advisors: 61% for research doctorates and 28% for research master's. Helping students find employment opportunities and helping them publish or present research were seen as about equally important tasks for faculty advisors of professional master's and professional doctoral students. Fewer than one-third of the deans indicated that helping students find employment was very important for students in research master's programs, but this may partially reflect the "en route" master's degrees in which the student would not be expected to be seeking employment until the doctorate was completed.

Faculty play an important role in supporting academic careers and certainly should not discourage the wide range of good career options available outside of the academy. But new structures for organizing information about careers are needed beyond what faculty can provide to introduce the rich reality to students. This means collaboration across the graduate school, its programs, and even institutional research or other services that together might help build a robust information system. Some budding examples of promising efforts in this regard are described below.

Providing support along the pathways: What some schools are doing. From the initial selection process and throughout the graduate experience, there appears to be relatively little attention paid to the pathways to careers for graduate students. But there are a growing number of examples of how individual universities are providing additional information and resources about career options outside of the academy. Links to alumni appear to be a fairly common method of helping students better understand the career options outside of academia. While alumni in nonacademic settings are undoubtedly a valuable resource, they are only of value to students who have already considered a nonacademic career as an option. Thus, they supplement, but cannot replace, efforts at the university to make students more aware of nonacademic options.

An example of a comprehensive approach to connecting graduate students to information about career opportunities is the Laney Graduate School at Emory University. In the Student Resources section of the website, the Laney Graduate School has a section devoted to networking and mentoring programs.[123] One of these programs, Pathways Beyond the Professoriate, has the following introductory statement, "In this competitive job market, it is important for students to have a better understanding of the diverse career opportunities available to them once they leave Emory. [The program] connects students with distinguished alumni who have chosen a career path outside of the Academy. Alumni from a variety of fields return to Emory to network with our students and discuss their career paths and the unique ways that they have used their Masters or PhD degrees to discover industries and identify positions that current students may never have considered." The alumni mentoring program helps students finishing their dissertations with such activities as preparing curricula vitae, managing work/life balance, and negotiating salaries, to name a few.

A recent survey of graduate programs conducted at the University of Georgia[124] found a variety of ways in which programs provide information to graduate students regarding career transition. These include (a) structuring curriculum to allow students to focus on subdisciplines when there is a wide variety of expertise in a given field; this structure has been successful for students planning to enter one of several different careers in a particular discipline; (b) offering a job market seminar at the department level; (c) holding a department-level career workshop or research day with visiting scientists, including those working in industry, academia, research laboratories, government, and other agencies; (d) strengthening the alumni database, which graduate students can access; and (e) using alumni from different programs to serve as mentors to graduate students.

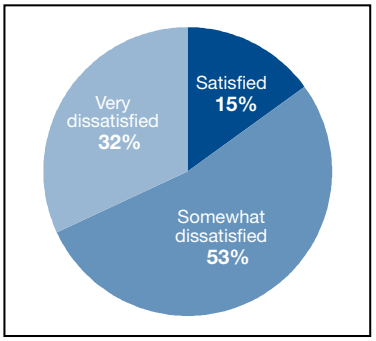
An additional example of a comprehensive career planning resource for graduate students is Yale University's Graduate School of Arts & Sciences' Graduate Career Services Center.[125] While some of the center activities are directed toward academic careers, the center also includes resources for graduate students considering careers beyond academia. The center "initiates programs and develops links with employers who seek the skill of our students and alumni/ae," and students are encouraged "to begin using the services of the office early in their graduate careers in order to expand the choices they will have upon completion of their degrees." Center activities in the fall of 2011 included "Federal Career Month," "Turn that Ph.D. into a J-O-B!" and "What can you be with a Ph.D.?: A science and technology career convention!"

University-based programs, especially through graduate school efforts, are growing to support students who want to explore nonacademic careers as cited here. There are, however, many other universities that provide little support for students on a nonacademic track. While there has been increasing attention to the general lack of information provided to prospective and active graduate students, there is still a long way to go to address the problem adequately.

Following graduates into their careers. One important step in developing and improving these programs is to provide better tracking of recent graduates so that both faculty and students can become aware of the various pathways taken by students after they obtain their degree. MBA programs are especially good at following their graduates because the rankings produced by *BusinessWeek* center on where their students take jobs and the satisfaction of the corporate recruiters who hire them.[126] Although many graduate programs track students into their first jobs, there is little information on the graduates' subsequent jobs. This problem is especially serious for a doctoral degree holder, as increasingly the first job, or even the first two jobs, may be a postdoctoral experience resulting in little information on jobs beyond the postdoctoral.

In our survey, we asked deans to indicate their level of satisfaction with their institution's ability to track graduate student alumni outcomes. As indicated in Figure 8, the majority of the deans (85%) indicated they were either somewhat or very dissatisfied with their ability to track outcomes. The deans also indicated there were a number of impediments to collecting this information. More than one-half of the deans indicated problems with time, money, and available personnel, but the most overwhelming problem, cited by 90% of the deans, was the lack of accurate contact information.

Figure 8: Level of satisfaction with ability to track alumni outcomes.



It takes an intensive effort to locate participants for a long-term longitudinal sample, such as the NSF's *Survey of Doctorate Recipients*. This survey follows a sample of graduates in science, engineering, and health fields from the award of the doctoral degree through age 76.[127] The survey is extremely valuable for understanding long-term employment trends on a national level, but it does not provide data at the level that would be useful

A first step is for graduate schools to understand the various career pathways taken by their own students.

to individual graduate schools or programs that need information about the employment experiences of their own graduates. For example, knowing that 43% of mathematics and statistics doctorate recipients are employed outside of academia is useful, but it would be much more useful to a particular program if they also knew how many of their graduates were in positions outside academe and which specific employers hired their graduates. Furthermore, although the NSF survey takes a broad definition of "science" to include psychology and the social sciences, it does not track career trajectories for students in the arts or humanities, and it does not follow students with master's degrees as their highest degree.

For U.S. graduate schools, understanding the various career pathways taken by their own graduates is a necessary first step in ensuring that graduate education is providing well-prepared, highly skilled, and innovative individuals needed to ensure continuing global prosperity of the United States. Knowing the types of positions that graduates fill and *communicating* this to faculty and the leadership in graduate programs will help graduate schools understand career pathways and, in the process, improve their programs.

Recommendations and Actions

This report has examined the need for greater transparency of pathways to careers for graduate students both in and beyond the academy. Clearly, U.S. graduate education is the producer of the future faculty and leadership who will educate undergraduate and graduate students. Despite changes in the academic labor market, preparation of the future faculty for U.S. universities is critical to our system of higher education and more particularly to the goal of regaining our leadership in college completion rates by 2020. This report also highlighted the need to prepare more graduate students for the full spectrum of careers across sectors including industry, government, and nonprofit organizations. The need to clarify and strengthen career pathways for graduate students should be a central component of a larger national strategy to enhance U.S. innovation and competitiveness and develop a world class workforce.

This workforce is necessary to support our capacity to out-innovate, out-create, and out-think the rest of the world and to create jobs of the future for the American populace. It is people — highly skilled people — that provide the competitive advantage across industries and sectors around the world. The highly skilled intellectual talent needed to fuel the U.S. competitive advantage in the global economy is prepared in our nation's graduate schools. The following policy recommendations provide a framework to guide strategies, new ways of thinking and operating, and strategic investments in graduate education to provide the human capital the United States needs going forward.

Recommendations for Universities

Universities, graduate leaders, and faculty are on the front line of preparing the workforce of the future. Today's graduate students are tomorrow's industry leaders, scientists, engineers, policymakers, and faculty. Developing clear pathways into careers for master's and doctoral students is essential to develop the talent we need while productively utilizing scarce resources.

Make early connections with students. Since career and education aspirations begin during middle and high school, programs aimed at understanding the connection between education and career paths should be established. This will require that relationships be built between K–12, community colleges, four-year colleges, and graduate education systems so that students understand routes of progression. Many middle and high schools do provide career guidance programs and these programs should be expanded to include more information about career options that are possible with various levels of education, including graduate education. And for many students, especially those underrepresented in higher education, the journey to graduate education begins at the community college level.[128]

Make career counseling services available to graduate students. Some universities, such as Emory University, The Ohio State University, Pennsylvania State University, and University of Georgia, are actively engaged in providing career counseling for graduate students to acquaint them with information about the full spectrum of careers available to them along with resources and strategies for preparing for a career. Career counseling services should provide graduate students at the master's and doctoral levels with professional skills development, resources, and guidance in preparing for a variety of career pathways.

It is critical to track outcomes and job placement information beyond the first or second job in order to gather meaningful information about career trajectories.

Track career outcomes and job placement information for graduate students. Good reliable data and metrics on career outcomes and placement are critical to understanding and improving the education of, and career transparency for, graduate students. Many graduate schools have already invested in methods to track career outcomes and those who have not yet done so should voluntarily pursue similar efforts. University leaders, including graduate deans, need to work at all levels to establish specific responsibility for collecting and using student outcomes data by program. The time frame for collecting and using outcomes data should cover a period of time that is long enough to capture information beyond the first or second job and to convey meaningful information about career trajectories. Graduate faculty need to be provided with this information so that they understand, value, and communicate to students about the full spectrum of career pathways. This information will also be invaluable in recruiting new graduate students and providing them with information about career possibilities at the time they are making the decision about which graduate program and career to pursue.

Connect graduate students with graduate alumni. Successful alumni can provide inspiration, guidance, and advice to graduate students, as well as information about successful careers in nonacademic sectors. Many graduate schools bring alumni back to campus to speak with and interact with graduate students as real-life examples of what one can accomplish with a graduate degree. This is a useful strategy to highlight career possibilities for graduate students while simultaneously connecting them with a potential employer. Graduate schools should collaborate with their alumni offices to create or utilize existing networks of alumni in different fields/areas and facilitate structured opportunities for interaction with graduate students.

Broaden the focus of graduate education to include development of professional skills. Graduate education leaders should work across campus to broaden the development of professional skills to include communications, teamwork, creativity, presentation skills, oral communication, writing skills, analysis and synthesis of data, and planning and organization for graduate students, particularly doctoral students. Our interviews with employers stressed the importance of oral presentation skills, as well as the ability to discuss technical content with nontechnical individuals. While recognizing that deep expertise in one's field is the hallmark of graduate education, the development of additional competencies will help prepare graduates for the broader array of careers and occupations in both domestic and international environments. Employers are increasingly citing these types of skills as invaluable in building relationships with clients, communicating with customers, and ensuring a company or organization is successful in the global economy. It is a multidisciplinary approach that uses the advanced knowledge and expertise provided by graduate education in combination with professional skills that make graduate degree recipients so valuable to employers.

Emphasize and support innovative master's degrees. University leaders should increase efforts to convey the value and importance of innovative master's degrees in preparing students for jobs of the future. This is especially important given that the majority of students pursuing graduate degrees do so at the master's level. Enhancing support for master's degrees must be a key component of developing the human talent our country needs going forward.

Provide opportunities for graduate school faculty to engage with industry, government, and other sectors. Many faculty members do not have direct knowledge of or experience with sectors beyond the academy. Graduate school faculty and leaders

cannot illuminate pathways for their students if they do not have an awareness and understanding of the pathways themselves. Faculty members are the main point of contact for graduate students, serving as mentors and advisors, and could play a critical role in providing career advice and guidance to them. Universities should consider providing sabbaticals and/or research opportunities for faculty to gain experience and understanding in other sectors including business, government, and nonprofit organizations to provide faculty members with first-hand understanding and knowledge of other viable and exciting career paths for their students.

Enhance collaboration with industry and government. Other countries are actively engaged in developing links between graduate schools, students, and employers. For example, the European University Association has created the DOC-Careers project to focus on the development of collaborative programs established between universities and industry, whether government, university, or industry led.[129] With over 50% of doctorate holders in Europe moving into careers beyond the academic sector, the importance of such collaborative programs is evident. In the United States, many universities as well as individual graduate programs provide graduate students with opportunities to engage in research or internships in the corporate or government sectors. Such relationships should be strengthened and enhanced so that faculty, students, and employers develop strong connections with the ultimate goal of preparing highly skilled talent for careers in a variety of settings. University leaders should devote special attention to addressing the challenges faced by students from underrepresented groups and the need to enhance efforts to illuminate pathways into careers for these students.

Create advisory committees of employers. Where appropriate, graduate schools and graduate programs should create advisory committees of employers to provide input and expertise in designing or modifying existing graduate education to provide a framework for developing the skills needed for success in a career. PSM programs provide an excellent example in this regard. Most PSM programs have an advisory board consisting of six to 12 business representatives from organizations within the region of the university. The advisory board assists in the conceptualization of the program and provides ongoing advice and feedback concerning the programs and graduates, as well as providing internship opportunities.

Recommendations for Employers

Employers in industry, the nonprofit sector, and government are in a position to signal the knowledge and skills necessary for success in nonacademic sectors. Increasingly, employers across these sectors indicate a need for professionals who excel in teamwork, communications, problem identification and solutions, and the ability to have a broad view. Many professionals from the nonacademic sectors serve as adjunct faculty for graduate students and this practice could be expanded to enhance communication and collaboration between graduate school faculty and potential employers of people with graduate degrees across a range of fields.

Enhance and expand collaborative relationships. Many universities, graduate schools, and programs have relationships with employers. These relationships need to be structured and ongoing with the goal of working collaboratively to support and develop graduate students and new employees with graduate degrees. Employers should reach

out to universities in their state and region to develop and formalize relationships to provide internship and research opportunities for graduate students, post-doctorates, and faculty. Employers should provide feedback to graduate institutions and programs on the training and performance of students and recent graduates to help improve the education and training of graduate students in preparing them for 21st century careers. Such collaborative initiatives should also have a forward-looking focus to assess future workforce demands and the associated education and training that will be required to prepare graduate students for cutting-edge occupations and careers.

Employers need to enhance and expand collaborative relationships with universities, graduate schools, graduate programs, and graduate faculty.

Make strategic investments in graduate education programs. Businesses should consider enhanced investments in graduate education programs that align closely with their future workforce needs. The information technology industry provides an example with the commitment of Intel® to invest $100 million over five years in universities to fund about a half-dozen campus centers that will focus on research in computing and communications.[130] Endowing a graduate fellowship at a university is another way employers can invest in graduate education, while remaining focused on areas of study most relevant to the company's field.

Provide internship and research opportunities for graduate students. Many industries and corporations provide internship and research opportunities for graduate students. For example, Microsoft operates the largest doctoral internship program in the information technology industry. Each year, nearly 1,000 top computer science students have the opportunity to work at one of the Microsoft Research locations around the world.[131] By offering students a chance to work in a nonacademic environment, an internship broadens the students' views and understanding of the careers for which their program of study qualifies them. Additionally, employers often find that an internship offers a chance to evaluate a potential employee who can then be brought on after graduation in a full-time capacity.

Provide sabbatical and research opportunities for graduate faculty. It is critical that graduate school faculty obtain a broadened awareness of career opportunities in the business sector and the rewards associated with such careers. Faculty members are the primary advisors to graduate students, particularly doctoral students, who need additional information, encouragement, and support to be able to pursue a career in the business, government, or nonprofit sectors. Universities and graduate schools need to support and reward faculty who are willing to take on opportunities in industry.

Provide support for employees to pursue graduate studies while employed. Many employers provide financial assistance and other types of support for their employees to pursue graduate study while employed. A high percentage of master's degree students pursue their studies after gaining experience in the workforce, determining what program of study would help them succeed in their chosen career, and its relationship to their career goals with the current employer and sometimes beyond. Employers should provide financial support and encouragement to their employees to pursue and complete their graduate studies.

Recommendations for Policymakers: The Federal Role

There is strong bipartisan recognition of and support for the value of education as the bedrock that supports the development of human talent, innovation, new discoveries, entrepreneurship, and success in the global economy. Other countries and regions of the world are investing in education, particularly in graduate education. Despite fiscal constraints, the United States must also make support for graduate education a top priority.

Create an advisory commission of leaders in business and graduate education to support workforce priorities. The Obama Administration should convene an advisory commission of leaders in business and graduate education, led by appropriate officials of the executive branch of the federal government. The blue ribbon commission should develop strategies and plans for clarifying career pathways for graduate students in key areas of national priority including energy independence, biomedical advances, climate change, financial industry reforms, and healthcare reforms, among others. Further, this commission should provide guidance on 21st century careers, the workforce needs, and the associated knowledge and training and career prospects for graduate degree holders.

A blue ribbon advisory commission comprised of leaders in business and education should be convened.

Establish a Professional Plus Program for graduate students on research assistantships. Graduate schools have begun to initiate professional development programs for graduate students, but a key challenge is the lack of capacity within the university to provide these services, especially to graduate students funded on research assistantships. These students are well-prepared in their disciplines, but they must be provided with the opportunity to develop the full range of professional skills that will prepare them for the variety of career options open to them, as identified earlier in this report. Employers expect these skills of new hires and graduate students recognize the need to be better prepared for the careers they pursue. Federal agencies should develop a Professional Plus Program that would provide an enhancement to any grant on which research assistantships are funded. This funding would support the graduate school or an appropriate university office in providing and maintaining professional development programs for all graduate students engaged in research projects with faculty. This type of professional development would be invaluable in terms of preparing researchers with a broader set of skills increasingly needed for research careers of the future.

Implement a COMPETES doctoral traineeship program. The America COMPETES Act Reauthorization Act of 2010 authorized a number of programs that are critically important to maintaining American competitiveness and innovation in the 21st century global economy. Key elements of the law that recognize the role of graduate education in maintaining a highly skilled workforce include:

- Authorizing NSF to offer grants to "implement or expand research-based reforms in master's and doctoral level STEM education that emphasize preparation for diverse careers" through the 21st Century Graduate Education section.
- Reauthorizing the Protecting America's Competitive Edge (PACE) competitive fellowship program at the Department of Energy (DoE) for students pursuing doctoral degrees in math and engineering, as well as increased funding for DoE's Office of Science.

Support a new Integrative Graduate Humanities Education and Research Training (IGHERT) program. More Americans must be prepared to be globally competent. Among other things, global competence requires knowledge of and understanding of other languages, cultures, and regions of the world. The existing IGERT

program at the NSF provides grants to implement or expand master's and doctoral level STEM education that emphasize preparation for diverse careers, but no such program exists for the humanities. The federal government should support a new IGHERT program to develop essential skills in critical thinking and problem solving. A proposal for a planning grant from the Consortium of Humanities Centers and Institutes provides a model for such a program.[132] Modeled on the NSF IGERT program, IGHERT would facilitate interdisciplinary and international collaboration in humanistic inquiry focused on language, literature, and culture. Clarifying career pathways for humanities professionals is increasingly important to address the social challenges confronting the nation and the world. Increasingly, U.S. corporations and other entities are involved in global projects that require expertise in humanities, business, and/or STEM fields that provide important opportunities for novel collaborations among people in different disciplines. The success of many global projects hinges on understanding the language, history, and culture of both host and participating countries.

Give funding priority to proposals from collaborations between business and universities. Federal agencies should give funding priority to joint collaborative proposals that support graduate students and their career pathways. The federal government is in a strong position to encourage innovative and entrepreneurial projects and collaborations that may lead to new models of education and training focused on current national and international challenges.

Adopt progressive visa policies designed to retain international talent in the United States. U.S. graduate schools continue to attract the best and brightest domestic and international students despite increased competition and investments in graduate education in other countries and regions of the world. Several policy proposals have been put forward over the past few years to streamline the process for those international students who receive graduate degrees, particularly in STEM fields, who want to remain in the United States and contribute to our economy. For example, the STAPLE Act of 2011 would exempt foreign-born individuals who have earned a doctorate from a domestic school in STEM fields from the limits on the number of employment-based green cards and H-1B visas awarded annually. Recent legislation introduced in the U.S. Senate would create a STEM Visa program for up to 50,000 immigrants per year who graduate with a master's or doctorate in STEM fields, giving them the opportunity to stay in the United States and put their skills to work. Policymakers should adopt a 21st century visa policy to retain talented international scholars who receive graduate training in the United States to help bolster our economy and spur job creation.

Implement tax policies that encourage employer-provided assistance for graduate study. The research and development (R&D) tax credit provides incentives for companies to invest in research and development of new technologies. By offering a similar credit for employers who provide assistance for graduate study, the federal government would incentivize human talent development. Employers would receive a tax credit for investing in their workforce, employees would gain new skills and further opportunities to study, and the U.S. economy would benefit from a more educated populace.

Provide federal support for studies that help us understand the pathways. Support for continuing studies aimed at understanding the journey through graduate school and into careers is needed. Efforts, such as NSF's *Survey of Doctorate Recipients* and the Scientists & Engineers Statistical Data System (SESTAT), should be continued and expanded to include efforts that look at other fields (humanities, etc.) as well as master's students.

In Summary

Individuals with graduate degrees play a vital role in our workforce. They drive innovation, create knowledge, explore new frontiers, and apply their knowledge and skills to solve complex problems. As demonstrated in *The Path Forward* report, the global competitiveness of the United States hinges fundamentally on the ability of graduate schools to prepare individuals with the knowledge and skills to meet critical workforce needs.

The current report explored a number of issues along the journey from student to professional. We found there is a clear understanding of the tie between education and careers. Parents and students see the economic value of better jobs and believe that advanced education leads to these jobs. Projections indicate a steady increase in positions requiring graduate degrees. Yet there is a lack of understanding among students of the career pathways that graduate school affords them.

In order to address this gap, we undertook three data collection activities.

We surveyed students to gather data on their knowledge of careers and education before, during, and following graduate school.

We found that many students thought about getting a graduate degree prior to even entering undergraduate school. They perceived value in obtaining an advanced degree and believed it would lead to increased income benefits. Yet this perceived value is tied to insufficient information about viable careers. Only about one-third of students felt they received sufficient information to understand career options prior to entering graduate school.

Most students relied on faculty — both at the undergraduate and graduate levels — to provide career information. But, many of these faculty understandably are only aware of their own career trajectories and are uninformed about pathways beyond academe. In reality, we found that graduate degree holders at both the master's and doctoral level work in a wide variety of settings.

We surveyed graduate deans to gather information on what universities are doing to provide career guidance, the challenges they face in providing such guidance, and how they track career outcomes.

Graduate deans' perceptions confirmed what students had told us — students are not very knowledgeable about career options, even as they finish their graduate degree. While some graduate schools provide information or programs regarding career options, providing career guidance has not been a high priority for many given other priorities facing the university.

Who was — and who should be — responsible for providing information on the full range of career opportunities was not clear from our survey and career guidance varied widely both within and across universities. In this report, we have identified a clear recognition of the value of strengthening career knowledge on the part of graduate deans. We also pointed to a number of innovative program development opportunities at graduate schools indicating that these units may be ready to take up this challenge.

One important step for graduate schools would be to track career outcomes of students, to better understand the jobs taken by their students after they obtain their degree and as they move through their career. However, the majority of deans expressed dissatisfaction with their ability to track students once they graduated. Although some departments track students into their first jobs, there is little information on the subsequent jobs of their graduates.

And we talked with employers in a wide range of business and government settings to better understand their expectations of new hires with graduate degrees, how they measured job success, and the pathways into careers.

It was clear that employers believed that graduate degree holders brought value to their organization. Such employees are viewed as having the advanced knowledge and problem-solving skills that allow them to become immediately engaged in projects.

But employers also felt that graduate degree holders lacked some essential skills needed for success on the job, such as teaming skills, presentation skills, and the ability to discuss technical issues with nontechnical individuals. They felt that there needed to be stronger ties between the graduate school curricula and workforce needs. In particular, they felt that graduate schools needed to have a multidisciplinary focus so that advanced knowledge could be applied to solve problems in multiple areas. Graduate students needed to be trained to innovate and to think like entrepreneurs.

Universities, employers, and policymakers each have a role in clarifying and strengthening career pathways for graduate students, as detailed in this report's recommendations. Universities need to expose graduate students to a wide range of career options, including those within and outside the academy. By providing innovative degree programs, professional development opportunities, and career counseling services, universities will better prepare graduate students for their chosen careers. Universities and employers should enhance and expand collaborative relationships to inform faculty members about careers outside the academy and to ensure that students are gaining the skills needed for success in a career. These goals can be accomplished through internships for graduate students, research opportunities for graduate faculty, and employer advisory committees for graduate programs. Ultimately, however, we must track real career outcomes of graduates and use that information to inform robust professional development programs in our universities. Federal agencies should support professional development for graduate students and collaboration between business and universities by giving funding priority to proposals that include these elements. In addition, policymakers should implement programs to enhance U.S. competitiveness and global competence, such as a COMPETES doctoral traineeship program and an IGHERT program. Policymakers should also adopt progressive visa policies designed to retain international talent in the United States, implement tax policies to encourage employer-provided assistance for graduate study, and provide support for studies that help us understand career pathways.

Changes at the university, industry, and government levels are essential to support students on their journey through graduate school and into careers. Closer ties between academia and industry will help ensure that graduate degree recipients are ready to take on the challenges facing the United States. Support from the government will encourage students to continue into graduate school. Most importantly, career transparency is the responsibility of the student, the university, and industry. Helping students understand the career options a graduate degree provides will help ensure a future workforce that is highly skilled, innovative, and ready to take on current and future challenges.

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The Commission on Pathways Through Graduate School and Into Careers — led by the Council of Graduate Schools (CGS) and Educational Testing Service (ETS) — spearheaded a research effort to address such issues as graduate student knowledge of career options, how students learn about occupational opportunities, the role of graduate programs and graduate faculty in informing and guiding students along the path to professional occupations, and career pathways that individuals with graduate degrees actually follow. Throughout this effort, the Commission helped identify the appropriate questions to ask, suggested possible data sources and experts to consult in this work, assisted in the preparation of the final report findings, and provided advice on policy recommendations. The ultimate goal of the 14-member Commission — composed of industry leaders, university presidents, graduate deans, and provosts — is to encourage a national conversation about why understanding the pathways through graduate school and into careers is vital to our nation's success in the 21st century.

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