Evaluation of the National Science Foundation's Graduate Research Fellowship Program

FINAL REPORT

Prepared for:
Division of Graduate Education
Directorate for Education and Human Resources
The National Science Foundation

Prepared under Contract Number:
GS-10-F0033M
Order Number:
NSFDACS08D1596
NORC at the University of Chicago

NORC
at the UNIVERSITY of CHICAGO

JANUARY 30, 2014

This page left intentionally blank

Evaluation of the National Science Foundation's Graduate Research Fellowship Program

Final Report

Prepared under Contract:
GS-10-F0033M
Order Number:
NSFDACS08D1596

Jake Bartolone
Marie L. Halverson
Thomas B. Hoffer
Gregory C. Wolniak
Lisa Setlak
E. C. Hedberg
Evan Nielsen
Vi Nhuan-Le
Melissa Yisak

Prepared for:
Division of Graduate Education
Directorate for Education and Human Resources
The National Science Foundation

January 30, 2014

NORC
at the UNIVERSITY of CHICAGO

This page left intentionally blank

Table of Contents

Acknowledgements xiv

Executive Summary xv

The Graduate Research Fellowship Program xvi

Data xvii

Survey of Fellows and Honorable Mention Designees (Follow-up Survey) xviii

Site Visits to Institutions xix

Telephone Interviews with Institutional Representatives xix

Secondary Data xx

Methods xx

Summary of Main Findings xxi

RQ1. What is the impact of the GRFP Fellowship on the graduate school experience? xxi

RQ2. What is the impact of the GRFP Fellowship on career outcomes? xxii

RQ3. What are the effects of the GRFP on institutions? xxiii

RQ4. Is the program design effective in meeting program goals? xxiii

Recommendations xxiv

Chapter 1: Introduction and Research Aims 1

The Graduate Research Fellowship Program 2

Review of Previous Research 4

Contributions of the Present Evaluation 8

Research Questions 9

Evaluation Design 9

Conceptual Model of Graduate Education and Career Outcomes 10

Study Limitations 14

Organization of the Report 15

Chapter 2: Data and Methods 17

Data 17

Survey of Fellows and Honorable Mention Designees (Follow-up Survey) 17

Site Visits to Institutions 22

Telephone Interviews with Institutional Representatives 24

Comparisons with National Data Sources 27

Methods 31

Analysis of Impact of GRFP 31

Analysis of Effect of GRFP on Institutions 33

Analysis of Effectiveness of GRFP in Meeting Program Goals 33

Chapter 3: Impacts on Graduate School Experiences and Degree Attainment 35

Evidence of GRFP Impact on Fellows 36

Perceptions of Graduate School Quality 36

Research Activities, Training, and Choice 37

Research Productivity during Graduate School 42

Degree Attainment and Time to Degree 46

Summary of Program Impacts on Graduate School Experiences and Attainment 48

Differential Impacts of the GRFP on Women and URMs 48

Chapter 4: Impacts on Careers and Professional Development 49

Evidence of GRFP Impact on Fellows 49

Employment Status and Jobs 49

Work Activities, Research Productivity, and Service 51

Summary of Program Impacts on Careers and Professional Development 57

Differential Impacts of the GRFP on Women and URMs 57

Chapter 5: Selected Characteristics of GRFP Fellows and Honorable Mention Designees 58

Characteristics of the GRFP Survey Population 58

Educational Backgrounds 61

Overview of Primary Institution Attended 63

Factors Important in the Decision to Attend a Specific Program/Institution 67

Perceptions of the GRFP Fellowship 69

Degree Completion 74

Time to Degree 80

Summary 82

Chapter 6: Selected Characteristics of GRFP Fellows and National Comparison Groups 86

Demographic Characteristics 86

Educational Backgrounds 88

Selected Characteristics of Graduate Institutions Attended 89

Graduate Fields of Study 90

Sources of Financial Support 92

Time to Degree (Ph.D.) 93

Job Congruence with Graduate Field of Study 95

Sector of Employment 96

Primary Work Activities 97

Summary 98

Chapter 7: Program Effects on Institutions 101

Program Influence on Graduate Institutions 101
Graduate Student Diversity 102
Graduate Student Quality 103
Scholarly Productivity and Research 104
Service to Departments and Graduate Student Financial Support 104

Implementation of the GRFP at Host Institutions 106
How the Fellowship Funding is Used (Tenure and Reserve) 106
Amount of the Financial Award for GRFP Fellows 108
Harmonization of Program and University/Department Policies 109
Faculty and Administrator Recommendations for Areas of Improvement 111

Chapter 8: Conclusions and Recommendations 116

Summary of Main Findings 117
RQ1. What is the impact of the GRFP Fellowship on the graduate school experience? 117
RQ2. What is the impact of the GRFP Fellowship on career outcomes? 118
RQ3. What are the effects of the GRFP on institutions? 119
RQ4. Is the program design effective in meeting program goals? 120

Recommendations 121

Directions for Future Study 123

References 126

Appendix A. Additional Methodology 129

Data Collection Methodology 129

Survey Instrumentation 131

Initial Data Collection 131

Survey Prompting 131

Locating 132

Analytical Dataset 133

Composite Scaled Measures 134

SED and NSCG/NSRCG Crosswalks 137

Appendix B. Additional Details of the Impact Models 151

Details of the Propensity Score Weighting 151

Details of the Impact Models 152
Population Average Models 153
Institutional Effect Models 154

Model Estimates 155
Appendix C. GRFP Follow-Up Survey 178
Appendix D. Institutional Site Visit Protocols 239
Interview Protocols 239
I. Departmental Staff Protocol 239
II. Departmental Faculty Protocol 240
III. University Administrators Protocol 241
Appendix E. Institutional Telephone Interview Protocol 242
Interview Protocol 242

List of Exhibits

Exhibit 1.1 Conceptual Model of Graduate Education and Career Outcomes 13

Exhibit 2.1. GRFP Follow-Up Survey Population and Sample, by Cohort and Award Status 19

Exhibit 2.2. Sample Sizes and Response Rates for the GRFP Follow-Up Survey, by Selected Characteristics and Award Status of Respondents 21

Exhibit 2.3. Site Visit Sample of Institutions, by Selected Characteristics 23

Exhibit 2.4. Telephone Interview Sample of Institutions, by Selected Characteristics 25

Exhibit 2.5. Mapping Research Questions to Data and Methods 30

Exhibit 3.1. Estimated Impact of the GRFP Fellowship on Reported Quality of Graduate School Experiences 36

Exhibit 3.2. Reported Quality of Graduate School Experiences Among Fellows by Cohort, Z-scores 37

Exhibit 3.3. Estimated Impact of the GRFP Fellowship on Reported Frequency of Research Activities and Collaboration During Graduate School 38

Exhibit 3.4. Reported Frequency of Research Activities and Collaboration During Graduate School Among Fellows by Cohort, Z-scores 38

Exhibit 3.5. Estimated Impact of the GRFP Fellowship on Graduate School Training and Instruction 39

Exhibit 3.6. Graduate School Training and Instruction Among Fellows by Cohort, Z-scores 39

Exhibit 3.7. Estimated Impact of the GRFP Fellowship on Flexibility and Choice During Graduate School 40

Exhibit 3.8. Flexibility and Choice During Graduate School Among Fellows by Cohort 41

Exhibit 3.9. Estimated Impact of the GRFP Fellowship on Positive Attitude Towards Graduate School Faculty and Peers 41

Exhibit 3.10. Positive Attitude Towards Graduate School Faculty and Peers Among Fellows by Cohort, Z-scores 42

Exhibit 3.11. Estimated Impact of the GRFP Fellowship on Working and Internships During Graduate School 42

Exhibit 3.12. Working and Internships During Graduate School Among Fellows by Cohort 43

Exhibit 3.13. Estimated Impact of the GRFP Fellowship on Presentations and Publications During Graduate School 44

Exhibit 3.14. Presentations and Publications During Graduate School Among Fellows by Cohort 44

Exhibit 3.15. Estimated Impact of the GRFP Fellowship on Grant and Patent Applications During Graduate School 45

Exhibit 3.16. Grant and Patent Applications During Graduate School Among Fellows by Cohort 45

Exhibit 3.17. Estimated Impact of the GRFP Fellowship on Graduate Degree Attainment 46

Exhibit 3.18. Graduate Degree Attainment Among Fellows by Cohort 46

Exhibit 3.19. Estimated Impact of the GRFP Fellowship on Time to Degree Completion 47

Exhibit 3.20. Time to Degree Completion Among Fellows by Cohort 47

Exhibit 4.1. Estimated Impact of the GRFP Fellowship on Employment Status 50

Exhibit 4.2. Employment Status Among Fellows by Cohort 50

Exhibit 4.3. Estimated Impact of the GRFP Fellowship on Employment in Field Related to Field of Graduate Studies 51

Exhibit 4.4. Employment in Field Related to Field of Graduate Studies Among Fellows by Cohort ... 51

Exhibit 4.5. Estimated Impact of the GRFP Fellowship on Primary Work Activities Since Graduate School 52

Exhibit 4.6. Primary Work Activities Since Graduate School Among Fellows by Cohort 52

Exhibit 4.7. Estimated Impact of the GRFP Fellowship on Presentations and Publications After Graduate School 53

Exhibit 4.8. Presentations and Publications After Graduate School Among Fellows by Cohort 53

Exhibit 4.9. Estimated Impact of the GRFP Fellowship on Patents, Grants, and Contracts After Graduate School 54

Exhibit 4.10. Patents, Grants, and Contracts After Graduate School Among Fellows by Cohort 55

Exhibit 4.11. Estimated Impact of the GRFP Fellowship on Professional Service Activities Since Graduate School 55

Exhibit 4.12. Professional Service Activities Since Graduate School Among Fellows by Cohort 56

Exhibit 4.13. Estimated Impact of the GRFP Fellowship on Teaching Activities Since Graduate School 56

Exhibit 4.14. Teaching Activities Since Graduate School Among Fellows by Cohort 56

Exhibit 5.1. Demographic Characteristics of the Survey Population of GRFP Fellows and Honorable Mention Designees, 1994–2011 59

Exhibit 5.2. Gender, URM, and Disability Status of the Survey Population of GRFP Fellows and Honorable Mention Designees by Award Status and Cohort 60

Exhibit 5.3. Educational Backgrounds and Experiences of GRFP Fellows and Honorable Mention Designees 62

Exhibit 5.4. Educational Backgrounds and Experiences of GRFP Fellows, by Cohort 62

Exhibit 5.5. Undergraduate NSF Program Participation by GRFP Fellows and Honorable Mention Designees 63

Exhibit 5.6. Undergraduate NSF Program Participation by GRFP Fellows, by Cohort 63

Exhibit 5.7. Selected Characteristics of the Primary Graduate Institutions Attended by GRFP Fellows and Honorable Mention Designees 65

Exhibit 5.8. Selected Characteristics of the Primary Graduate Institutions Attended by GRFP Fellows, by Cohort 66

Exhibit 5.9. Factors Influencing Decision to Enroll in Graduate Program by Fellowship Award Status 68

Exhibit 5.10. Factors Influencing Fellows' Decision to Enroll in Graduate Program by Cohort 68

Exhibit 5.11. Percentage of Fellows Reporting That Other Fellowships in Their Field Were More Desirable and Reasons Why 69

Exhibit 5.12. Percentage of Fellows Reporting That Other Fellowships in Their Field Were More Desirable and Reasons Why, by Cohort 70

Exhibit 5.13. Percentage of Fellows Reporting That Other Fellowships in Their Field Were More Desirable and Reasons Why, by Cohort and Field of Graduate Study 71

Exhibit 5.14. Percentage of Awardees Who Declined the GRFP Award by Cohort 73

Exhibit 5.15. Reasons for Declining the GRFP Award, Cohort 4 Awardees Who Did Not Accept the GRFP Award 73

Exhibit 5.16. Whether Specific GRFP Requirements Influenced the Decision to Decline the GRFP Award, Cohort 4 Awardees Who Declined the Award 74

Exhibit 5.17. Percentage Completing Master's and Ph.D. Within Specified Time Period by Fellowship Award Status 75

Exhibit 5.18. Percentage Completing Master's and Ph.D. Within Specified Time Period by Fellowship Award Status and Field of Graduate Study 76

Exhibit 5.19. Percentage Completing Master's and Ph.D. Within Specified Time Period by Demographic Characteristics and Fellowship Award Status 77

Exhibit 5.20. Percentage Completing Master's and Ph.D. Within Specified Time Period by Cohort and Fellowship Award Status 78

Exhibit 5.21. Percentage Completing Master's and Ph.D. Within Specified Time Period by Demographic Characteristics, Cohort, and Fellowship Award Status 79

Exhibit 5.22. Mean Time to Degree (in Years) for the Doctoral Degree by Fellowship Award Status and Cohort 81

Exhibit 5.23. Mean Time to Degree (in Years) for the Doctoral Degree by Fellowship Award Status, Cohort, and Field of Graduate Study 82

Exhibit 6.1. Demographic Characteristics of GRFP Degree Completers and National Comparison Groups 87

Exhibit 6.2. Community College Attendance of GRFP Degree Completers and National Comparison Groups 89

Exhibit 6.3. Selected Characteristics of the Primary Graduate Institution Attended of GRFP Degree Completers and National Comparison Groups 90

Exhibit 6.4. Field of Graduate Study of GRFP Degree Completers and National Comparison Groups 92

Exhibit 6.5. Sources of Financial Support for GRFP Ph.D. Completers and National Comparison Groups 93

Exhibit 6.6. Mean Time to Degree for GRFP Ph.D. Completers and National Comparison Groups 94

Exhibit 6.7. Mean Time to Degree for GRFP Ph.D. Completers and National Comparison Groups by Field of Graduate Study 95

Exhibit 6.8. Relatedness of Current or Most Recent Job to Graduate Field of Study of GRFP Degree Completers and National Comparison Groups 96

Exhibit 6.9. Employment Sector of Current Job of GRFP Degree Completers and National Comparison Groups 97

Exhibit 6.10. Primary Work Activities of GRFP Degree Completers and National Comparison Groups 98

Exhibit A.1. Data Collection Methodology 130

Exhibit A.2. Cases Included in Analysis Dataset 133

Exhibit A.3. Scaled Measures of Perceptions of Graduate School Quality 134

Exhibit A.4. Scaled Measures of Attitudes Towards Faculty and Peers During Graduate School 135

Exhibit A.5. Scaled Measures of Research Activities and Collaboration During Graduate School 136

Exhibit A.6. Scaled Measures of Dimensions of Graduate Training Received 137

Exhibit A.7. Crosswalk Between SED Fine Field of Study and GRFP Broad Field of Study 138

Exhibit A.8. Crosswalk Between NSCG/NSRCG Fine Field of Study and GRFP Broad Field of Study 143

Exhibit A.9. Crosswalk Between SED and GRFP Sources of Funding During Graduate School 146

Exhibit A.10. Crosswalk Between NSCG/NSRCG and GRFP Occupational Fields 147

Exhibit B.1. Additional Models of Estimated Impact of the GRFP Fellowship on Reported Quality of Graduate School Experiences 156

Exhibit B.2. Additional Models of Estimated Impact of the GRFP Fellowship on Reported Frequency of Research Activities and Collaboration During Graduate School 158

Exhibit B.3. Additional Models of Estimated Impact of the GRFP Fellowship on Graduate School Training and Instruction 159

Exhibit B.4. Additional Models of Estimated Impact of the GRFP Fellowship on Flexibility and Choice During Graduate School 161

Exhibit B.5. Additional Models of Estimated Impact of the GRFP Fellowship on Positive Attitudes Towards Graduate School Faculty and Peers 162

Exhibit B.6. Additional Models of Estimated Impact of the GRFP Fellowship on Working and Internships During Graduate School 163

Exhibit B.7. Additional Models of Estimated Impact of the GRFP Fellowship on Presentations and Publications During Graduate School 165

Exhibit B.8. Additional Models of Estimated Impact of the GRFP Fellowship on Grant and Patent Applications During Graduate School 166

Exhibit B.9. Additional Models of Estimated Impact of the GRFP Fellowship on Graduate Degree Attainment 167

Exhibit B.10. Additional Models of Estimated Impact of the GRFP Fellowship on Time to Degree Completion 168

Exhibit B.11. Additional Models of Estimated Impact of the GRFP Fellowship on Primary Work Activities Since Graduate School 169

Exhibit B.12. Additional Models of Estimated Impact of the GRFP Fellowship on Presentations and Publications Since Graduate School 171

Exhibit B.13. Additional Models of Estimated Impact of the GRFP Fellowship on Patents, Grants, and Contracts Since Graduate School 172

Exhibit B.14. Additional Models of Estimated Impact of the GRFP Fellowship on Teaching Activities Since Graduate School 173

Exhibit B.15. Additional Models of Estimated Impact of the GRFP Fellowship on Professional Services Undertaken Since Graduate School 174

Exhibit B.16. Additional Models of Estimated Impact of the GRFP Fellowship on Employment 176

Exhibit B.17. Additional Models of Estimated Impact of the GRFP Fellowship on Employment in Field Related to Field of Graduate Studies 176

Acknowledgements

We thank the sponsor of this work, the National Science Foundation, and the program directors, NSF staff, and contracting officers' representatives who have overseen and guided the project over these past four years. We particularly thank those directly involved in supporting the project—Corby Hovis, Gisele Muller-Parker, Carol Stoel, Valerie Wilson, Bernice Anderson, William K. Hahn, Gilbert John and Carmen Sidbury—who provided invaluable guidance and advice throughout the course of this project.

We owe an enormous debt of gratitude to our Technical Advisory Group whose members include: Ronald Ehrenberg of Cornell University, Lisa Frehill of the Energetics Technology Center, Lewis Siegel of Duke University, Paula Stephan of Georgia State University, and William Trent of the University of Illinois at Urbana-Champaign. They provided thoughtful and constructive reviews of the study design, findings, and interpretation, and the final report is considerably improved as a result of their suggestions and recommendations.

We are indebted to the over 10,000 study participants across the country: the Graduate Research Fellowship Program (GRFP) current and former Fellows and the Honorable Mention designees who participated in the 2012 GRFP Follow-up Survey and generously provided a wealth of information on their graduate school experiences and subsequent careers; and the over 150 administrators, graduate deans, faculty, and staff at the institutions who participated in the site visit and telephone interviews and generously shared their valuable time and insights with us. We are also grateful to the federal program officers who participated in a related study (that is not a part of this report) of other federal fellowship programs.

We are deeply indebted to Sheila Nataraj Kirby for lending her insight and expertise to the project team at many critical junctures throughout the study.

Executive Summary

As part of the National Science Foundation's (NSF) continued commitment to graduate education in the U.S., the Graduate Research Fellowship Program (GRFP) supports advanced education in Science, Technology, Engineering and Mathematics (STEM) fields by awarding merit-based fellowships to U.S. citizens, nationals, and permanent residents for graduate study in research-oriented programs in fields within NSF's mission. The two overarching goals of the GRFP are to (1) select, recognize, and financially support early in their careers individuals with the demonstrated potential to be high achieving scientists and engineers; and (2) broaden the participation of underrepresented groups, including women, minorities, persons with disabilities, and, since 2012, veterans, in science and engineering fields. Started in 1952, the GRFP is the largest fellowship program in the U.S., awarding approximately 2,000 Fellowships annually since 2010. Over the first 60 years of operation, the GRFP has awarded approximately 48,000 Fellowships.

NSF contracted with NORC at the University of Chicago to undertake a study with three major purposes:

- Provide descriptive information related to the GRFP goals on the demographics, educational decisions, career preparation, aspirations and progress, and professional productivity of GRFP Fellows and comparable non-recipient applicants and national populations of graduate students and doctorate recipients.
- Provide rigorous evidence of the impact of the GRFP Fellowship on individuals' educational decisions, career preparations, aspirations and progress, and professional productivity.
- Provide an understanding of how universities currently implement the program and whether and how specific program policies could be adjusted to make the program more effective in meeting its goals.

NORC designed a comprehensive, multifaceted evaluation of the program that included survey data collection from current and former Fellows and Honorable Mention designees (hereafter referred to as "HM designees"), in-person and telephone qualitative interviews with university faculty, administrators, and departmental staff members from institutions that host Fellows (GRFP institutions), and analysis of secondary (pre-existing) data on graduate students and doctorate recipients from national surveys for benchmark comparisons with the GRFP Fellows. The survey data were collected in 2012 from 7,014 current and former Fellows and 3,199 HM designees from Fellowship award years 1994 through 2011. The earliest Fellowship year not included in the previous evaluation was 1994 and 2011 was the most

recent Fellowship year for which application data were available at the time of survey sampling (2012). The survey response rate was 78.1 percent among a sample of 8,817 Fellows and 4,238 HM designees taken from the total population of 19,319 Fellows and 9,440 HM designees from 1994 through 2011. Over 150 university faculty, administrators, and departmental staff members from 24 GRFP institutions participated in qualitative interviews about their perceptions of and experiences with current GRFP policies during 2012 and early 2013.

The study is organized around the following research questions that were designed to address the three major purposes of the study:

RQ1. *What is the impact of the GRFP Fellowship on the graduate school experience?*

RQ2. *What is the impact of the GRFP Fellowship on career outcomes?*

RQ3. *What are the effects of the GRFP on institutions?*

RQ4. *Is the program design effective in meeting program goals?*

The impact estimates for RQ1 and RQ2 are derived from comparisons of Fellows with HM designees with respect to aspirations, educational trajectories, career outcomes, and professional productivity. RQ3 and RQ4 were designed to address both GRF program goals as well as the underlying NSF strategic goal of excellence in management.

The Graduate Research Fellowship Program

GRFP awards Fellowships directly to individuals who intend to go to graduate school (senior undergraduates) and to students who are in the early stages of their graduate programs in a STEM field. Individuals may apply as a senior undergraduate, as a first-year graduate student, or as a second-year graduate student, and recipients must pursue a research-focused master's degree or Ph.D. in a science or engineering field within NSF's mission[1] at a university, college, or non-profit academic institution of higher education accredited in and having a campus located in the United States.

The program currently awards 2,000 Fellowships annually, with a stipend of $32,000 per year and a cost-of-education allowance of $12,000 per year (institutions are not allowed to charge Fellows for any required tuition and fees above this allowance), for up to three years total within a five-year window. Applications are reviewed in panels that are convened by NSF based on the applicant's chosen field of study and discipline. The panels include disciplinary and interdisciplinary scientists, mathematicians, and

[1] The list of fields allowed under the 2012 competition can be found in the appendix of the 2012 program solicitation (http://www.nsf.gov/pubs/2012/nsf12599/nsf12599.htm#appendix)

engineers and other professional experts in graduate education. Applicants rated in the highest quality group (QG1) are highly recommended to receive the Fellowship. Applicants rated in the next group (QG2) are recommended for Fellowship support by the panel. NSF makes final decisions on which applicants receive Fellowship offers, and QG2 applicants who do not receive Fellowship offers receive Honorable Mention designation.

Two key features of the GRFP are portability and flexibility. The awards are portable, such that Fellows may transfer to another institution, and the use of the funds is flexible such that Fellows may use their three years of funding (stipend plus cost-of-education allowance) in any three years within a five-year window, with the restriction that they must decide their active Fellowship status ("Tenure") or "Reserve" status (not currently receiving GRFP funding but still actively enrolled in the graduate program) on a yearly basis. NSF stipulates that Fellows must be engaged full time in their studies.

Data

The study collected data from several different sources, including both primary data collection and secondary (existing) data, to address the underlying research questions:

Primary Data Collected:

- The Follow-up Survey of GRFP Fellows and HM designees;
- In-person interviews with administrators, faculty, and staff members during site visits to six institutions; and
- Telephone interviews with administrators, faculty, and staff members from a sample of 18 institutions.

Secondary Data:

- 1996–2011 Survey of Earned Doctorates (SED), 2010 Survey of Doctoral Recipients (SDR), and data from the National Survey of College Graduates (NSCG) and the National Survey of Recent College Graduates (NSRCG) in the 2010 Scientists and Engineers Statistical Data System (SESTAT) file, all of which are NSF survey products.
- Application data provided the population of potential sample members and was used to replace missing Follow-up Survey demographic data.

Each of these sources is discussed in greater detail below.

Survey of Fellows and Honorable Mention Designees (Follow-up Survey)

The evaluation collected data in 2012 from QG1 and QG2 Fellows and QG2 HM designees via a web-based survey (Follow-up Survey). GRFP application records from 1994 through 2011, which contained 19,139 Fellows and 9,440 HM designees, formed the sampling frame for the evaluation. For analytical purposes, Fellows and HM designees were divided into four cohorts based on application year: Cohort 1 (1994-1998), Cohort 2 (1999-2004), Cohort 3 (2005-2008), and Cohort 4 (2009-2011). Cohort 1 represents the earliest group of applicants that was not included in the previous GRFP evaluation, which included Fellows from 1979 through 1993 (Goldsmith, Presley, & Cooley, 2002). The cohorts were defined by NSF to contain roughly equal numbers of applicants and to correspond to significant changes in program policy; Cohort 1 includes recipients of the Minority Graduate Fellowship Program (MGF) that began in 1978 and was consolidated into the GRFP in 1999.

The population of 19,319 Fellows and 9,440 HM designees from 1994 through 2011 was stratified in terms of cohort and award status (QG1 Fellows, QG2 Fellows, and QG2 HM designees), and individuals were randomly selected within each stratum to ensure that the sample was representative of the applicant population. Within each cohort, approximately equal numbers of individuals were randomly selected among QG1 Fellows, QG2 Fellows, and QG2 HM designees for a total sample of 13,055 Fellows and HM designees out of a population of 28,579 cases (45 percent of the population was sampled). The sampling plan was designed to select a sample large enough to make statistically valid estimates of program outcomes relevant to the evaluation and to allow comparisons across different subgroups.

The survey asked all individuals about their graduate school experiences, and asked individuals who were no longer enrolled in a graduate program about career outcomes, including job history and professional productivity. Graduate school experience topics included factors influencing the decision to enroll in a graduate program; program climate, quality, and offerings; participation in various research and professional activities; and professional productivity and financial support during graduate school. The survey also collected demographic and educational background data, and information about participation in other NSF-sponsored programs.

The overall response rate was 78.1 percent during a five month data collection period. The response rates for QG1 and QG2 Fellows were 78.1 percent and 80.2 percent, respectively, while the response rate for HM designees was 75.8 percent. Because the challenge of locating individuals increases with time since contact information was gathered, the response rate was somewhat lower among the earlier cohorts, and ranged from 69.9 percent for Cohort 1 (1994–1998) to 84.5 percent for Cohort 4 (2009–2011) members. Women had a higher response rate than men (80.9 percent versus 75.6 percent). Underrepresented

minorities (URMs, defined as neither non-Hispanic white nor Asian) responded at a slightly lower rate than non-URMs overall (74.7 percent versus 78.6 percent). The respondent sample was weighted to adjust for nonresponse bias so that the weighted results reflect the survey population across selected characteristics.

Site Visits to Institutions

The evaluation included site visits to six GRFP institutions in 2012 or early 2013 during which the NORC team conducted a total of 61 interviews with administrators, faculty, and staff members associated with the GRFP. Site visit interviews focused on how the presence of Fellows affected the institution, as well as respondents' perceptions of current GRFP policies and procedures.

The sample of institutions was selected by NORC in consultation with GRFP program staff, based primarily on the number of current Fellows attending the institution, while balancing other institutional characteristics. Each institution's GRFP Coordinating Official (CO) was asked to identify approximately ten interviewees who were involved with the GRFP in different ways, including departmental staff members who work with graduate students, graduate program coordinators, faculty members, and university administrators. The CO was asked to include both him or herself and the institution's GRFP Primary Investigator (PI; typically a Vice Provost or Dean of Graduate Studies or other similar administrator) in this list of interviewees.

Telephone Interviews with Institutional Representatives

The evaluation included 78 telephone interviews during 2012 and early 2013 with administrators, faculty, and staff from a set of 18 GRFP institutions. These interviews covered topics similar to the site visit interviews, but were shorter and more focused on respondents' perceptions of current program structure and policies.

The sample of institutions was selected by NORC in consultation with GRFP program staff primarily based on the same criteria used to select site visit institutions; however, we also included two institutions based on their relatively high percentage of underrepresented minority graduate students (University of Arizona and University of New Mexico). The sample was evenly split between public and private institutions and was balanced across regions (5 each in the Midwest and Northeast, and 4 each in the South and West). As in the site visits, each institution's CO was asked to identify approximately five interviewees, including the CO and PI, who were familiar with the program and who could provide insights into how the GRFP affects their institution.

Secondary Data

Secondary data sources were used to benchmark the GRFP Follow-up sample against national comparison groups. These included (1) the 1996–2011 annual Survey of Earned Doctorates (SED), which gathers information about graduates' educational histories, funding sources, and postdoctoral plans from all recipients of a research doctorate earned from any degree-granting institution in the U.S.; (2) the 2010 Survey of Doctorate Recipients (SDR), which surveyed a sample of 44,000 individuals under the age of 76 who received a research doctorate by June 30, 2009 in the U.S. in a science, engineering, or health-related field; and (3) the 2010 National Survey of College Graduates (NSCG) and the National Survey of Recent College Graduates (NSRCG),which are longitudinal sample surveys that collect data from U.S. college graduates.

The benchmark samples drawn from the SDR and the SED data sets included all U.S. citizens and permanent residents who received their first Ph.D. between 1996 and 2011 (SED) or 1996 and 2009 (SDR) in a field of study that matched the list of current fields eligible for the GRFP. The benchmark samples from the NSCG and NSRCG were restricted to U.S. citizens and permanent residents who received their first master's degree between 1996 and 2009 (inclusive) in a field of study matching the list of current fields eligible for the GRFP.

These secondary data sources were used to provide the context for understanding the educational and career outcomes of GRFP Fellows relative to nationally-representative samples.

Methods

The evaluation employed several different analytical approaches to address the research questions listed above.

Impact Estimates. To address RQ1 and RQ2, the evaluation used quasi-experimental methods to compare the outcomes of Fellows with outcomes of a control group of HM designees. We restricted these impact analyses to QG2 Fellows and QG2 HM designees to limit background (pre-award) differences. Preexisting differences between QG2 Fellows and QG2 HM designees were further controlled for by matching applicants based on the predicted probability that they would receive the treatment (the Fellowship) instead of the control (the Honorable Mention designation), based on all available background (i.e., pre-GRFP award) information. The estimated probabilities, or propensity scores, were estimated using a logistic regression with a set of individual and institutional background measures as covariates (Austin, 2011). The impact of the GRFP Fellowship on the outcomes was then calculated as

the difference between the average outcomes of the QG2 GRFP Fellows and HM designees, with propensity score weighting applied.

The propensity-weighted differences were subjected to a series of additional analyses designed to assess possible differences in the impacts between different demographic groups, graduate fields of study, and graduate institutions; these are described in Appendix B.

Descriptive Analysis. To provide additional context for the impact analyses related to RQ1 and RQ2, the evaluation used descriptive methods to examine differences in survey responses across the three groups of respondents (QG1 Fellows, QG2 Fellows, and QG2 HM designees). Descriptive analyses also contributed to the approach to addressing RQ4.

Comparative Benchmarking. Comparison groups selected from the SED, SDR, NSCG and NSRCG were used to provide additional context for understanding the educational and career outcomes of GRFP Fellows relative to nationally-representative samples of graduate degree completers (RQ1 and RQ2). SED and SDR data were used for comparisons of doctoral recipients in Science and Engineering (S&E) fields, and NSCG and NSRCG data were used for comparisons of master's degree completers in S&E fields. The analyses compared Fellows who completed graduate degrees to nationally-representative samples of degree completers across the outcome measures included in the study.

Qualitative Analysis. To address RQ3 and RQ4, the evaluation analyzed the qualitative interview data from the site visits to institutions and telephone interviews with institutional representatives, during which representatives from 24 GRFP institutions shared their perceptions of the ways in which Fellows affect institutions as well as how the GRFP is implemented at their institution and the effectiveness of current GRFP policies and procedures.

Summary of Main Findings

The key findings are organized under the four main research questions that guide the evaluation.

RQ1. What is the impact of the GRFP Fellowship on the graduate school experience?

The GRFP affected Fellows' graduate school experiences in several ways. The program had a positive impact on the likelihood of completion of a Ph.D. within ten years, indicating that a higher proportion of QG2 Fellows completed their degree programs than non-Fellow HM designees, although the program did not appear to affect actual time to degree among those who completed the degree program. QG2 Fellows

also reported greater flexibility in choosing their own research project and they presented more papers at international meetings compared to HM designees.

The impact analysis indicates that the GRFP program had a negative impact on working for pay and applying for grants or contracts during graduate school. In addition, QG2 Fellows reported fewer opportunities to receive training or instruction on research, teaching, industry, or policy and to engage in other research activities through training compared to HM designees.

Our benchmarking analysis found that Fellows, on average, completed the doctoral degree in less time than the SED comparison group (5.95 years compared with 6.69 years). While not a direct measure of the impact of the GRFP, this descriptive finding helps place the Fellows in a national context.

Additional regression analyses found that GRFP participation had different effects for some subpopulations on some of the graduate school experience outcomes, including one difference for women (a positive impact on the number of patents applied for during graduate school). The GRFP program had no different effects on URMs or students with disabilities on graduate school experiences. The additional regression analyses also found some differences by field of graduate study.

RQ2. What is the impact of the GRFP Fellowship on career outcomes?

In addition to the Fellowship's positive impacts on Fellows' graduate school experiences, the program also had several significant positive impacts on Fellows' post-graduate careers and experiences. The Fellowship had positive impacts on the number of papers presented at national or international meetings, the number of papers published (both in refereed journals and overall), and the number of grants and contracts awarded as a PI after graduate school. Similarly, the program had positive impacts on the likelihood of serving on a committee or panel and providing review services, both activities related to successful STEM-related careers. Additionally, the analysis indicated no negative impacts of being a Fellowship participant on post-graduate career productivity and experiences, particularly in terms of academic career pursuits.

The national benchmark comparisons in the current study, while purely descriptive, also showed that Fellows who completed a Ph.D. were more likely than the national population of Ph.D. recipients to be employed in higher education institutions and to report research and development and teaching as primary work activities than their national counterparts.

Additional regression analyses found different effects of the Fellowship for some subpopulations on some of the career and professional development outcomes, including one difference for URMs (a negative

impact on the number of patents applied for after graduate school). The Fellowship had no different effects on women or students with disabilities on career and professional development outcome measures.

RQ3. What are the effects of the GRFP on institutions?

The nature and extent of effects of the GRFP on graduate institutions were assessed through a series of site visit and telephone qualitative interview questions. Faculty and administrators were asked for their views on financial aspects of the Fellowship including adequacy of the cost-of-education allowance and ability to free up resources to provide funding to other students, the extent to which Fellows participate in departmental teaching and research ("service to the department"), effects on student diversity and student quality, and effects, if any, on scholarly productivity and research. Data from the interviews were used to draw out broad themes regarding perceived effects on the institution and perceived benefits to the department of hosting GRFP Fellows.

Faculty and administrators generally saw the GRFP as having strong positive effects on their institutions and departments. They believed the Fellows were high-achieving students who were well-qualified for the award. With regard to demographic characteristics, Fellows were generally viewed as representative of the graduate student population. Administrators noted that GRFP funding for students freed funding from other sources for non-Fellows, thus improving opportunities for more students and increasing diversity.

RQ4. Is the program design effective in meeting program goals?

NSF has two main program goals for the GRFP. The first is to select, recognize, and financially support, early in their careers, individuals with the demonstrated potential to be high achieving scientists and engineers. Two previously discussed results address this program goal: that QG2 Fellows were more productive than HM designees in terms of several measures of scientific and academic productivity, and that Fellows who completed a Ph.D. were more likely than the national population of STEM Ph.D. recipients to be employed in higher education institutions and to report research and development and teaching as primary work activities.

The program's second goal is to broaden the participation of underrepresented groups, including women, minorities, and persons with disabilities, in science and engineering fields. The national benchmark data showed that women and URMs are more highly represented among Fellows than in the general population of STEM doctorate recipients, though the differences are not large. Data from the Follow-Up Survey showed that the proportion of women and students with disabilities selected as Fellows increased over time. Our statistical models found minimal differences in how the Fellowship affected women compared to men and on URMs compared to non-URMs, which suggests that the program is successful in

ensuring that the benefits of the Fellowship accrue to all Fellows, regardless of demographic characteristics.

About one-third of Cohort 4 (2009–2011) Fellows noted that there were other Fellowships that were more desirable than the GRFP Fellowship (a proportion that has increased over time), primarily because they offered larger stipends, were more prestigious, and/or (to a lesser degree), offered more years of support. This perception varied by field of study, with roughly one-half of Cohort 4 Fellows in most physical science and engineering fields (including Chemistry, Computer and Information Sciences and Engineering, Engineering, Mathematical Sciences, and Physics and Astronomy) holding this perception compared to less than ten percent of Cohort 4 Fellows in Psychology and Social Sciences and between 20 and 30 percent of Cohort 4 Fellows in Geosciences, Life Sciences, and other fields of study.

Most of the small percentage of awardees who declined the GRFP award (less than 3 percent in Cohort 4) reported they had received a fellowship with a higher stipend and/or better non-stipend support (expenses for research, travel, etc.).

Recommendations

The survey findings and interview data converged on a number of strengths of the GRFP. Some recommendations for improvements emerged both directly from the study participants and from NORC's efforts to interpret and synthesize the findings.

Strengthen links between NSF's programs supporting undergraduates and the GRFP. The proportion of Fellows who participated in an NSF-sponsored program as an undergraduate increased from 22.1 percent in Cohort 1 to 30.5 percent in Cohort 2, with most of these Fellows having participated in Research Experiences for Undergraduates, suggesting a valuable link between these NSF programs and GRFP. Further strengthening these ties may provide fruitful in continuing to prepare highly qualified undergraduates for graduate school and strengthening the pipeline between NSF's undergraduate and graduate research funding opportunities, potentially broadening the pool of qualified applicants to GRFP.

Reassess the comparability of GRFP funding levels with other fellowship programs and consider other non-stipend support. Despite the substantial increases in the amount of the annual stipend from $15,000 per year in 2000 to the current $32,000 per year, some faculty and administrators indicated during the interviews that GRFP awards are now falling short of some other fellowships, including department assistantships, which may make the Fellowship less attractive to potential applicants. Additionally, some faculty and administrators (and at least one Fellow who participated in the Follow-up

Survey) noted that the cost-of-education allowance did not fully meet tuition costs. About one-third of Fellows from 2009 through 2011 noted that other fellowships were more desirable because they had larger stipends or better non-stipend support (particularly among Fellows in physical science or engineering-related fields). Furthermore, the majority of awardees who had declined the GRFP award (less than 3 percent in Cohort 4) reported they had received a fellowship with a higher stipend and/or better non-stipend support.

The Department of Energy Computational Science Graduate Fellowships (CSGF), for example, is a four-year fellowship which offers $36,000 yearly stipend, payment of all tuition and fees, $5,000 academic allowance in the first fellowship year, and $1,000 academic allowance each renewed year. The Department of Defense National Defense Science and Engineering Graduate (NDSEG) Fellowship, while offering support for three years similar to the GRFP program, offers full tuition and all mandatory fees, a stipend (approximately $31,000/year), and up to $1,000 a year in medical insurance. The Science, Mathematics And Research for Transformation (SMART) Scholarship for Service Program, which offers support for one to five years, pays full tuition and education related fees (not meal plans, housing, or parking), cash awards ranging from $25,000–$41,000 depending on prior educational experience (may be prorated depending on award length), health insurance reimbursement allowance up to $1,200 per calendar year, and a book allowance of $1,000 per academic year.

Consider reducing restrictions on research assistantships during Tenure. The survey data showed that Fellows were less likely than HM designees to have research assistantships. The faculty and administrator interview data indicated that Fellows were missing out on participation in research assistantships (except in departments in which every graduate student joins a lab, in which case the experiences of Fellows were similar to those of non-Fellows) , which can provide valuable exposure to faculty members' larger and more complex research projects. However, the comparison with the SED data indicated that Fellows were as likely to have had either a teaching or research assistantship as the general population of doctorate recipients.

Consider adding, as part of the award requirements, a provision requiring Fellows to provide current contact information. As noted above, NSF's broader strategic organizational goals include learning through assessment and evaluation of NSF programs, processes, and outcomes. As such, the GRFP should track its Fellows and continue to measure the impact of the Fellowship on graduate school experiences and career outcomes. This study found Fellows and HM designees to be responsive, but locating the selected Fellows and HM designees was challenging, especially among the earlier cohorts. If Fellows provided current contact information and participated in periodic surveys, organizations

contracted by NSF to conduct future studies would be able to achieve increased response rates at a lower cost. Additionally, having an updated database of Fellows and HM designees would allow NSF to conduct quick turnaround studies in-house on particular topics of interest.

Conduct outreach to reach students in underrepresented fields. Life Sciences, Psychology, and Social Sciences are underrepresented among Fellows compared to the national population of Ph.D. completers. The differences in the fields of study between Fellows and the national comparison group demonstrate how students within different fields of study access the GRFP as a source of support, and the fields of study that are underrepresented within the population of Fellows (and therefore likely to be underrepresented within the pool of applicants) may be productive targets for outreach from the program to increase awareness of or access to the GRFP.

Consider if the GRFP is reaching underserved populations to the greatest degree possible. A higher proportion of Fellows who completed a Ph.D. were women and URMs compared to the national population of Ph.D. recipients, suggesting success in the GRFP program goal to broaden the participation of underrepresented groups, including women, minorities, persons with disabilities, and, since 2012, veterans, in science and engineering fields. Fellows are also more likely than the national population of Ph.D. recipients to have parents with advanced degrees, suggesting that Fellows may come from more advantaged backgrounds. In order to truly broaden the participation of underrepresented groups, the GRFP may need to make inroads with first-generation college graduate applicants. Partnerships with other NSF programs such as Research Experiences for Undergraduates may help create a path for such students to apply for the GRFP and attend graduate school.

Chapter 1: Introduction and Research Aims

Graduate education is a critical stage for developing new scientists and engineers and, through them, ensuring the continued growth of research and the scientific and technological development that such education builds and catalyzes. As part of the National Science Foundation's (NSF) continued commitment to graduate education in the U.S., the Graduate Research Fellowship Program (GRFP) supports advanced education in Science, Technology, Engineering and Mathematics (STEM) fields by awarding merit-based Fellowships to U.S. citizens, nationals, and permanent residents for graduate study in research-oriented programs. Started in 1952, the GRFP is the largest fellowship program in the U.S., currently awarding approximately 2,000 Fellowships annually. Over the first 60 years of operation, the GRFP has awarded a total of approximately 48,000 Fellowships.

There are two overarching goals of the GRFP. The first is to select, recognize, and financially support early in their careers individuals with the demonstrated potential to be high achieving scientists and engineers. The second goal is to broaden the participation of underrepresented groups, including women, minorities, persons with disabilities, and, since 2012, veterans, in science and engineering fields. Additionally, this evaluation is informed by NSF's broader strategic organization goals, including to "learn through assessment and evaluation of NSF programs, processes, and outcomes; continually improve them; and employ outcomes to inform NSF planning, policies, and procedures" (National Science Foundation, 2011).

Previous studies of the GRFP were largely completed in the mid-1970s to the mid-1990s. The most recent study, published in 2002, examined GRFP Fellow cohorts from 1979 through 1993 (Goldsmith, Presley, & Cooley, 2002). Although the NSF GRF program collects data on an ongoing basis through multiple sources (annual reports from the Fellows, GRFP Committee of Visitors, annual surveys of the review panelists, informal comments from Fellows and university GRFP coordinating officials, and data compiled from the applications), those data have only been systematically compiled in recent years and offer limited information on prior years. More importantly, they do not systematically address program impact or implementation.

NSF contracted with NORC at the University of Chicago to undertake a study with three major purposes:

- Provide descriptive information related to the GRFP goals on the demographics, educational decisions, career preparation, aspirations and progress, and professional productivity of GRFP

Fellows and comparable non-recipient applicants and national populations of graduate students and doctorate recipients.

- Provide rigorous evidence of the impact of the GRFP on individuals' educational decisions, career preparations, aspirations and progress, and professional productivity.
- Provide an understanding of how the program is implemented by universities and whether and how specific program policies could be adjusted to make the program more effective in meeting its goals.

NORC designed a comprehensive, multifaceted evaluation of the program that included survey data collection from current and former Fellows and Honorable Mention designees (hereafter referred to as "HM designees"), in-person and telephone qualitative interviews with university faculty, administrators, and departmental staff members from institutions that host Fellows (GRFP institutions), and analysis of secondary (pre-existing) data on graduate students and doctorate recipients from national surveys for benchmark comparisons with the GRFP Fellows. The survey data were collected in 2012 from 7,014 current and former Fellows and 3,199 HM designees from Fellowship award years 1994 through 2011. 1994 is the earliest Fellowship year not included in the previous evaluation, and 2011 was the most recent Fellowship year for which application data were available at the time of survey sampling (2012). The survey response rate was 78.1 percent among a sample of 8,817 Fellows and 4,238 HM designees taken from the total population of 19,319 Fellows and 9,440 HM designees from 1994 through 2011. Over 150 university faculty, administrators, and departmental staff members from 24 GRFP institutions participated in qualitative interviews about their perceptions of and experiences with current GRFP policies during 2012 and early 2013.

The remainder of the Introduction provides a brief overview of the GRFP, describes key findings from past evaluations of the GRFP and related research that informed the current study, outlines the contributions of the study, describes the evaluation design and the specific research questions that guided the study, and describes the organization of the report.

The Graduate Research Fellowship Program

GRFP awards Fellowships directly to individuals who intend to go to graduate school (senior undergraduates) and to students who are in the early stages of their graduate programs in a STEM field. Individuals may apply as a senior undergraduate, as a first-year graduate student, or as a second-year graduate student, and recipients must pursue a research-focused master's degree or Ph.D. in a science or

engineering field within NSF's mission[2] at a university, college, or non-profit academic institution of higher education accredited in and having a campus located in the United States.

The program currently awards 2,000 Fellowships annually, with a stipend of $32,000 per year and a cost-of-education allowance of $12,000 per year (institutions are not allowed to charge Fellows for any required tuition and fees above this allowance), for up to three years total within a five-year window. The number of awards doubled from 500 to 1,000 per year in 1991, and doubled again to approximately 2,000 per year in 2010. Most of the Fellowships are awarded to individuals planning to complete research doctorate programs in STEM fields and awards are also made to students in master's programs.[3] The GRFP is a highly-competitive program: it currently receives between 12,000 and 13,000 applications each year and grants 2,000 Fellowships, an award rate of about 17 percent per year in recent years (up from 11–12 percent from 2003 to 2008).

Award decisions are made by NSF, based on panel recommendations. Applications are reviewed in panels that are convened by NSF based on the applicant's chosen field of study and discipline. The panels include disciplinary and interdisciplinary scientists, mathematicians, and engineers and other professional experts in graduate education. Consistent with the GRF Program Solicitation, panelists review the applications holistically in the context of applying NSF's Merit Review Criteria, Intellectual Merit and Broader Impacts (National Science Foundation, 2012), and the GRFP emphasis on demonstrated potential for significant achievements in science and engineering. These are evaluated based on an assessment of all available information in the application and reference letters attesting to the applicant's qualifications. Applicants rated in the highest quality group (QG1) are highly recommended to receive the Fellowship. Applicants rated in the next group (QG2) are recommended for Fellowship support by the panel. NSF makes final decisions on which applicants receive Fellowship offers, and QG2 applicants who do not receive Fellowship offers receive Honorable Mention designation.[4]

The GRFP Fellowship awards represent a substantial direct financial benefit and also carry considerable prestige in the STEM education and research communities. NSF publicizes the names of awardees and of many HM designees (applicants may choose this option), and the Honorable Mention status is considered

[2] The list of fields allowed under the 2012 competition can be found in the appendix of the 2012 Program Solicitation (http://www.nsf.gov/pubs/2012/nsf12599/nsf12599.htm#appendix)

[3] The survey data collected for this study show that 95.3 percent of individuals awarded the Fellowship in 2009, 2010, or 2011 were enrolled in a doctoral program (including 70.5 percent in a doctoral program and 24.8 percent in a combined doctoral/master's program) and 3.5 percent were enrolled in a master's-only program (the remainder were enrolled in another type of program, including combined professional degree programs, which are against program policy, or had an unknown program status).

[4] The review criteria are described in more detail in the Solicitation.

a noteworthy achievement that may improve one's chances for other funding and admission to top graduate programs.

Two key features of the GRFP are portability and flexibility. The awards are portable, such that Fellows may transfer to another institution, and the use of the funds is flexible such that Fellows may use their three years of funding (stipend plus cost-of-education allowance) in any three years within a five-year window, with the restriction that they must decide their active Fellowship status ("Tenure") or "Reserve" status (not currently receiving GRFP funding but still actively enrolled in the graduate program) on a yearly basis. NSF stipulates that Fellows must be engaged full time in his or her studies.

The GRFP monitors progress of Fellows through their graduate studies primarily with information collected in mandatory annual activity reports. These reports include academic progress, activities that contribute to career preparation such as acquisition of research skills and other professional skills, descriptions and updates on career plans, participation in internships and assistantships, and other sources of financial support. Fellows' faculty advisors are asked to verify satisfactory academic progress on a yearly basis, and institutions are asked to verify the Fellows' enrollment status.

Review of Previous Research

Several previous studies inform this evaluation of the GRFP. Two studies by Chapman and McCauley (1993, 1994) tested for differences in early career achievement of GRFP participants who applied to the program between 1967 and 1976. The 1993 study focused solely on applicants assigned the same quality grouping (QG2) and compared the outcomes of those who received the Fellowship versus those who did not. The 1994 study focused only on participants who received the Fellowship award, but whose applications yielded different quality ratings (QG1 vs. QG2 Fellows) as a means of testing the predictive validity of the NSF quality ratings. Both studies drew from a variety of secondary data sources for examining seven early career outcomes, including: (1) Ph.D. completion obtained from the NSF Cumulative Index data in combination with data from the Survey of Earned Doctorates (SED); (2) Attainment of faculty status based on the National Faculty Directory; (3) Attainment of faculty status in a highly rated department; (4) Application for at least one NSF research grant based on NSF records; (5) Success rate of NSF grant applications; (6) Application for at least one National Institutes of Health (NIH) or Alcohol, Drug Abuse and Mental Health Administration (ADAMHA) grant; and (7) Success rate of NIH or ADAMHA grant applications. Together, the two studies provided evidence that the Fellowship award increased the likelihood of completing a Ph.D. across most fields of study, and that quality ratings were valid predictors of Ph.D. completion for Fellows in the most technical fields

(Mathematics, Engineering, and Physics and Astronomy) and other measures of early career success for Fellows in Social and Behavioral Sciences.

Other research has sought to understand the sources of variability in outcomes among the Fellows. In his study of Fellows, Baker (1998) examined female and minority progression to a Ph.D. and demonstrated the pervasive influence of prior academic achievement, as defined by Graduate Record Examination (GRE) scores, college grades, and GRFP panel evaluations of applicants. Controlling for differences in these factors reduced differences in Ph.D. completion rates across racial/ethnic categories. However, the results also demonstrated persistent disadvantages among women in completing a Ph.D. (particularly in Life Sciences, and less so but still present in Behavioral and Social Sciences and Engineering, Math, and Physical Sciences) that could not be attributed to differences in prior academic achievement. From a policy perspective, these findings indicate the challenges faced by programs aimed at increasing the prevalence of Ph.D. completion among women.

The most recent comprehensive evaluation of the GRFP published in 2002 was based on a mixed-method analysis of several data sources (Goldsmith, Presley, & Cooley, 2002). Attendance patterns, completion rates, and time to degree of 1979 to 1993 award recipients were assessed through secondary analyses of SED data. In addition, information and attitudes related to educational backgrounds, careers, and financial support during graduate school were analyzed using data from a graduate student follow-up survey, which was administered to Fellows and a comparison group of students in Biochemistry, Economics, Mathematics, and Mechanical Engineering at 16 institutions ("Disciplinary sample"). Interestingly, international students, who are ineligible for the GRFP, were included as part of the comparison group. In addition, surveys were administered to (a) a sample of minorities who were awarded GRFP Fellowships through the Minority Graduate Fellowship (MGF) and were enrolled in 33 disciplines at 62 institutions ("MGF sample"); and (b) a sample of women who were awarded GRFP Fellowships through the Women in Engineering (WENG) competition and were enrolled in all engineering fields at 46 institutions ("WENG sample"). Finally, institutional site visits to six research universities yielded information on institutional attributes as well as qualitative data on the GRFP-related experiences of administrators, faculty, staff, and Fellows and comparison group of students in the four fields listed above.

Goldsmith, Presley, and Cooley (2002) found that Fellows who participated (in 2002) valued the Fellowship for the financial support, prestige, and choices it gives them. However, Fellows and faculty noted that the stipend and cost-of-education allowance were too low to cover costs and lower than that offered by other fellowships. About two-fifths mentioned the time limit on support (three years) as a disadvantage; about one-fifth identified reduced teaching opportunities as a problem. Few cited isolation

or less opportunity to work with faculty on research projects as concerns (6 percent and 5 percent, respectively).

Graduate students in the same academic programs were quite similar in terms of academic quality, largely because the institutions GRFP Fellows attend are highly competitive and prestigious. The percentage of women Fellows increased over time (from 29 percent in 1979 to 43 percent in 1993).

In terms of completion of the doctorate degree, Goldsmith et al. (2002) found that the percentage of Fellows completing a Ph.D. within 11 years of enrolling in a graduate program increased from 68 percent for the 1979–1983 cohort to 73 percent for the 1984–1988 cohort. The percentage of Fellows graduating from research-intensive institutions (in the current version of the Carnegie Classification system[5], this is comparable to the list of institutions classified as having very high research activity) increased from 66 percent in 1979 to 69 percent in 1993. The increase was particularly marked among the MGF recipients (from 33 percent to 66 percent over the same time period). QG1 Fellows completed at higher rates (72–75 percent) than QG2 Fellows (65–69 percent) who in turn completed at somewhat higher rates than QG2 HM designees (63–65 percent). Despite faculty and student perceptions that the Fellowship may shorten the time to degree for Fellows compared to their peers, the study pointed out that this was more perception than reality. The average time to degree for Fellows and the comparison group was 5.5 years and this did not change over time. However, compared with Fellows, two-thirds of whom completed within six years, a slightly lower percentage of QG2 HM designees (62 percent for the 1984–1988 cohort) completed within six years. As expected, time to degree varied by discipline.

Overall, Goldsmith et al. (2002) found that completion rates for MGF Fellows were lower than for those awarded the GRFP Fellowship but that the gap closed substantially between the 1979-1983 cohort and the 1984-1988 cohort (from 21 percentage points to 13 percentage points). For the 1984–1988 cohort, 61 percent of MGF Fellows completed their doctorate in 11 years compared with 74 percent of GRFP Fellows. Among MGF Fellows, QG1 Fellows experienced a more marked increase in completion (from 56 percent to 68 percent) than QG2 Fellows (46 percent to 51 percent). Female Fellows increased their completion rates from 64 percent to 72 percent across the two cohorts. The 1984–1988 cohort completion rates for women were within 6 percentage points of completion rates for men in most disciplines, with the exception of computer science/mathematics and social sciences.

[5] For more information, please see http://classifications.carnegiefoundation.org/.

Among study participants who were no longer enrolled in graduate school, career paths varied by discipline.[6] For example, over 70 percent of both Disciplinary Fellows (Fellows in the disciplinary sample) and the comparison group who studied Mechanical Engineering were pursuing careers outside of academia while the majority of those who studied Mathematics or Biochemistry were working in higher education (although mostly in non-tenure track positions or postdoctoral appointments). In Economics, Fellows were much more likely to hold a tenure-track position than their peers (61 percent versus 35 percent) while in Mathematics, Fellows were more likely to hold faculty positions than their counterparts. Research and development was the most commonly mentioned primary work responsibility, followed by teaching. Fellows in Economics and Mathematics displayed higher levels of professional productivity and teaching than their peers.

The report offered a number of recommendations for program improvement, a number of which were implemented including increasing the stipend and cost-of-education allowance and allowing flexibility in the use of the award across the five years, expanding the fellowship to support master's students in addition to doctoral students, and providing a $1,000 travel allowance for international research (rescinded in 2011 in favor of developing new international research opportunities for Fellows through the Graduate Research Opportunities Worldwide [GROW] initiative). A recurring theme throughout the 2002 report is the large extent to which educational and occupational experiences, decisions, and outcomes vary by discipline and the report recommended that future assessments of the GRFP pay close attention to contextual factors that can affect the program's operation and effectiveness. Additional recommendations were to develop broader measures of career success, given that many students were disillusioned about academic careers.

Several studies have also examined, both conceptually and empirically, how differences in graduate training in the U.S. affect students' chances for success. Taken together, these point to the importance of the graduate school experience, expressed interest in graduate school, clarity of expectations, faculty mentoring and guidance, student socialization into academic communities, a belief in the traditional norms of science, and the successful training of doctoral students (Anderson & Louis, 1994; Anderson, Oju, & Falkner, 2001; Anderson & Swazey, 1998; Ehrenberg, Jakubsen, Groen, So, & Price, 2007; Solem, Lee, & Schlemper, 2008; Weiler, 1993). Another set of studies also highlight the importance of financial support in reducing attrition and fostering completion, and reveal that opportunity costs and labor market conditions (including starting salaries of Ph.D.s, academic ratings and prestige of graduate programs, and student perceptions of both pecuniary and nonpecuniary characteristics of academic

[6] The sample sizes of respondents for these analyses were fairly small (ranging from 15 to 44, depending on award status and discipline).

careers) play an important role in determining demand for graduate degrees (Breneman, 1976; Clotfelter, Ehrenberg, Getz, & Siegfried, 1991; Ehrenberg, 1991; Ehrenberg & Mavros, 1995; Freeman, 1971; Froomkin, Jamison, & Radner, 1976).

These several studies informed the design and analysis of the present evaluation, including the questions included in the survey and interviews as well as the statistical models used to analyze the data.

Contributions of the Present Evaluation

The present evaluation offers three main contributions to the existing literature on graduate education.

First, the study seeks to provide evidence of the impact of the GRFP on individuals' educational decisions, career preparations, aspirations and progress, as well as professional productivity. Evidence of differences between Fellows, HM designees, and national comparison groups should not be equated with program impacts, because the differences are likely to reflect to some extent, and possibly entirely, selection bias rather than program effects. That is, the differences may be due to differences between Fellows and others that were in place before the GRFP award and thus not attributable to the program. Thus, to isolate the impact of the program, we limit the impact analyses to comparisons between QG2 Fellows and QG2 HM designees and we use statistical controls to adjust for pre-existing differences in factors related to the outcomes of interest. These impact analyses measure whether participation in the GRFP impacts Fellows by comparing individuals who are the same in all relevant aspects with respect to quality group placement except for being Fellows or not.

Second, it provides descriptive information on how GRFP Fellows compare with non-recipient HM designees and national populations of graduate students and doctorate recipients with respect to demographics, graduate school experiences, and professional productivity. This information is useful in assessing the extent to which Fellows are representative of the larger populations in terms of demographic background variables of policy interest, including race/ethnicity, gender, and parental education. A clear picture of how graduate school experiences and outcomes, including degree completion and time to degree, differ is heuristically useful in understanding how Fellows compare and contrast with the larger population of which they are members.

The third contribution of the study is to provide an understanding of how the program is currently implemented by universities and whether and how specific program policies could be adjusted to make the program more effective in meeting its goals. The focus on implementation is essentially descriptive

and heuristic, seeking to obtain basic information that has heretofore not been systematically collected or analyzed and that relates to current (2012) program policies and practices.

Research Questions

The study focuses on the following research questions:

RQ1. *What is the impact of the GRFP Fellowship on the graduate school experience?*

RQ2. *What is the impact of the GRFP Fellowship on career outcomes?*

RQ3. *What are the effects of the GRFP on institutions?*

RQ4. *Is the program design effective in meeting program goals?*

As noted above, a necessary component of RQ1 and RQ2 is examining how Fellows compare with HM designees with respect to aspirations, educational trajectories, career outcomes, and professional productivity. RQ3 and RQ4 were designed to address both GRF program goals as well as the underlying NSF strategic goal of excellence in management.

Evaluation Design

To address these questions, this evaluation study was designed to collect vital new information while capitalizing as much as possible on extant data. Several considerations required collecting new information from the Fellows. First, the program needed information on graduate school experiences and outcomes from recent cohorts of Fellows. The previous evaluation of the GRFP (Goldsmith, Presley, & Cooley, 2002) collected these types of information from Fellows, but 1993 was the most recent Fellowship year included and no similar data have been collected since then. Furthermore, the prior evaluation did not select representative samples of all Fellows from the Fellowship years included in the study. In order to address program impact questions, the full population of Fellows should be represented and with sufficient numbers to make statistically sound inferences. Second, the questions about the impact of GRFP participation on outcomes require a carefully selected control group for comparisons. Third, the question about effects on institutions requires new data collected from key institutional actors in order to give necessary updates to the institutional analyses conducted in the previous evaluation.

The design developed for this study includes data collection from a 2012 large-scale sample survey of Fellows and HM designees and a purposive sample of GRFP institutions from which administrators, faculty, and staff who work with the GRFP were recruited and interviewed. The survey provides recent data on a representative sample of over 10,000 Fellows and HM designees who received a Fellowship

award or HM designation between 1994 and 2011. The institutional interviews were conducted with over 150 university administrators, faculty, and departmental staff from 24 institutions selected to represent the settings experienced by the great majority of Fellows.

The final piece of the evaluation design consisted of collecting national datasets of comparable populations in order to make benchmark comparisons with the Fellows. Several high-quality datasets developed by NSF were drawn on for this purpose, including the Survey of Earned Doctorates (SED), the Survey of Doctorate Recipients (SDR), the National Survey of College Graduates (NSCG), and the National Survey of Recent College Graduates (NSRCG). Taken together, these nationally-representative surveys provide several useful points of comparison with the new GRFP data.

Conceptual Model of Graduate Education and Career Outcomes

Our analytic approach was informed by a conceptual framework adapted from past research on the doctoral production process and graduate student socialization. Rooted in human capital theory and economic models of rational behavior, Breneman (1976) provided a foundation for understanding the Ph.D. production process that has proven influential to past GRFP evaluations as well as other studies of graduate school degree completion. Breneman's model builds on aspects of human capital theory[7] while incorporating institutional dimensions such as institutional control, departmental quality, and measures of faculty behavior and enrollments. Central to doctoral production models is recognition of the differences in graduate education and the decision-making process by field of study. According to the doctoral production framework, analytic models aimed at understanding aspects of the graduate education should incorporate human capital measures that affect rates of return on the educational investment, including student demographic characteristics (age, sex, race/ethnicity), field of study, and institutional characteristics (Carnegie Classification, departmental prestige).

Weidman's (2001) work on the socialization of graduate students suggests that academic and career development are determined by knowledge and skill acquisition, as well as students' dispositions towards the graduate school experience. Following Brim's (1966) definition, Weidman characterizes socialization as "the process by which persons acquire the knowledge, skills, and dispositions that make them more or less effective members of their society" (Weidman, 2001, p.4). At the center of Weidman's graduate socialization model are measures of: (1) teaching, research and services, (referred to as the "normative context"); (2) interaction, integration and learning ("socialization processes"); and (3) knowledge acquisition, investment, and involvement ("core elements"). Building on Weidman's work, Antony

[7] For a comprehensive overview of human capital theory, please refer to Becker (1993).

(2002) focused on the increasing diversity among doctoral student populations in arguing for more unique and individualistic models of socialization.

Incorporating the conceptual elements from these models, the GRFP evaluation was grounded in the assumption that participants are influenced by an array of individual, environmental, and institutional factors that we need to control for in the model because they can confound the observed relationships between GRFP participation and educational and career outcomes. It is important to note that the population of GRFP applicants represents a self-selected group of high achieving individuals whose applications were ranked highly and who ultimately received the GRFP Fellowship or Honorable Mention designation. Panelists are instructed to review the applications holistically in the context of applying NSF's Merit Review Criteria of Intellectual Merit and Broader Impacts and the GRFP emphasis on demonstrated potential for significant achievements in science and engineering. NSF determines the successful applicants from these recommendations, with Fellowships and Honorable Mention designations offered based on the GRFP portfolio within the context of NSF's mission. As described above, eligibility criteria are based on citizenship status, maximum amount of graduate education completed, and intended type of graduate education (research-based master's and doctoral degrees in fields of study within NSF's mission). While the unique high achievement qualities of the GRFP sample population of Fellows and HM designees limit the variance in the variables studied and the generalizability of the findings, these qualities also provide opportunity to isolate the impacts of the GRFP Fellowship within a select population with similar educational and career motivations.

These several studies informed the design and analysis of the present evaluation, including the questions included in the survey and interviews as well as the statistical models used to analyze the data. The ways in which the graduate education and career outcomes are affected by various factors, and the interrelationships among those factors, are schematically represented in Exhibit 1.1. The population to which this model refers is those who complete bachelor's degrees and are thus eligible to attend graduate school. The arrows in the diagram represent hypothesized paths of influence. As the diagram illustrates, the outcomes listed in the rightmost box are likely to be influenced most proximately by one's graduate school experiences in addition to GRFP participation.

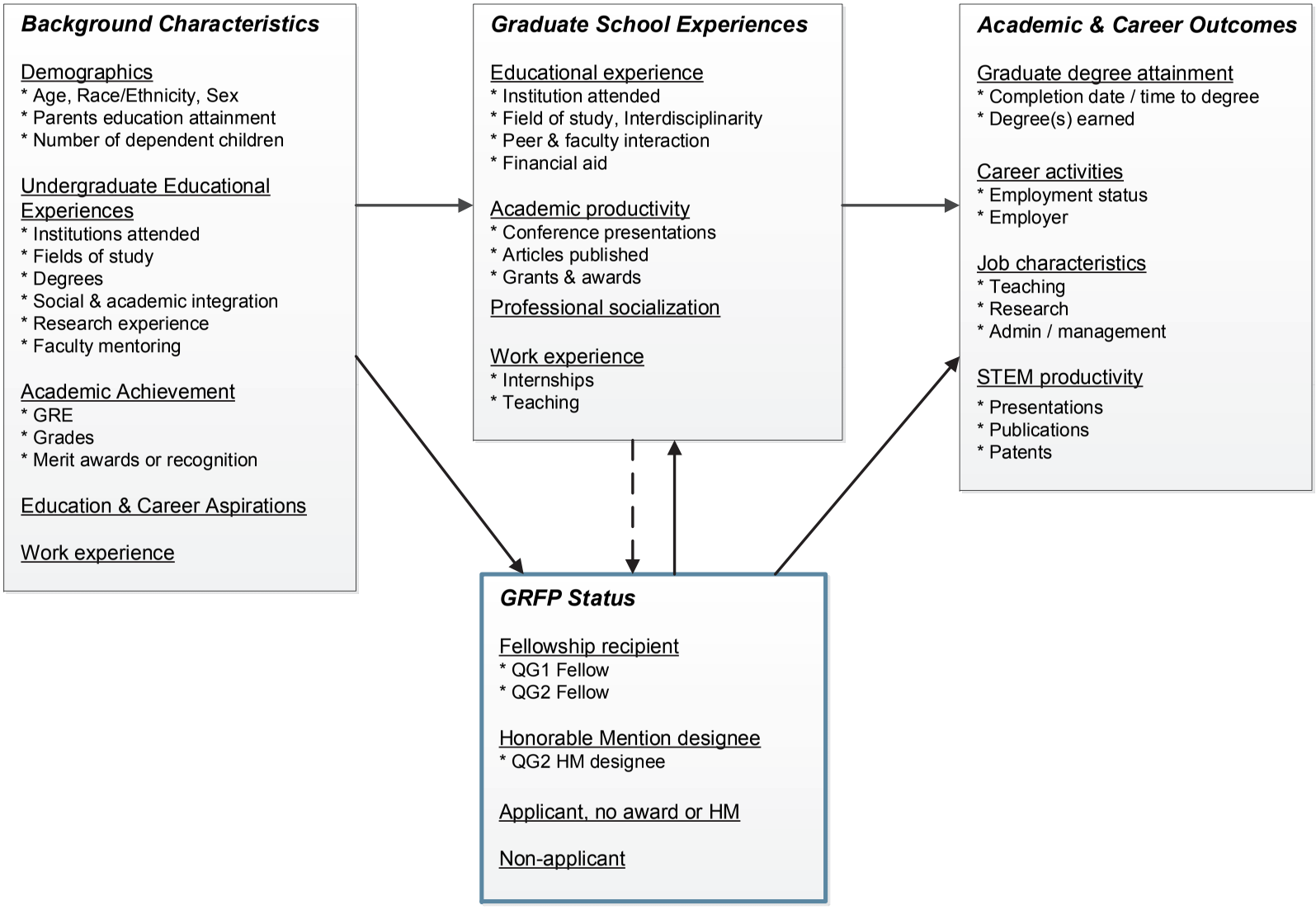
Reflecting the fact that GRFP Fellowships can be awarded to individuals with graduate school experience, the diagram shows a path of possible influence with the dotted line from graduate school experiences to GRFP status. The impact of the GRFP on outcomes is hypothesized to be both indirect, through impact on graduate school experiences related to the outcomes, and direct, mainly by the status

that the award confers on recipients and the benefits of that status for job placement and winning funding for research.

Graduate school participation and experiences are in turn likely to be influenced by an array of background factors (leftmost box in Exhibit 1.1), including prior education experiences and outcomes as well as personal attitudes and orientations, and other factors associated with demographic characteristics. In order to assess the impact of the GRFP participation on the outcomes, it is necessary to recognize and take into account the aspects of students' backgrounds and experiences that are potentially related to both GRFP participation and the educational and career outcomes.

The analysis presented in this report compares GRFP Fellows' outcomes to general benchmarking populations of college graduates and graduate students and also to the much smaller and more select population of GRFP HM designees. As a highly select group of outstanding students, the GRFP Fellows are likely to differ greatly from the general populations of college graduates and even graduate-school applicants and entrants. Because of those large pre-existing differences, one cannot infer program effectiveness from outcome differences between Fellows and these larger populations. However, the HM designees and QG2 Fellows are closely comparable in most respects and do provide a relatively strong basis for estimating program impacts. As the diagram illustrates, it is still important to assess the extent to which the QG2 Fellows and HM designees differ on background variables potentially related to the outcomes in question. Insofar as differences are found, these should be statistically controlled so that, as far as possible, those differences can be ruled out as possible explanations for group differences on the outcomes.

Exhibit 1.1 Conceptual Model of Graduate Education and Career Outcomes



Study Limitations

Its strengths and scale notwithstanding, the study has important limitations that should be acknowledged. First, the study is focused on impacts of the Fellowship on various outcomes, relying mainly on comparisons of Fellows with HM designees. However, the study does not address the question of how individuals find their ways into the applicant pool and whether that process works to bring the most talented and accomplished individuals into the pool. There are several good reasons to believe the process does work well, but these were not tested in this study. Those reasons include the fact that the GRFP is the largest fellowship program in the U.S. and is a widely-known feature of graduate education at the universities where most research is conducted. Scientific disciplines function to channel talent into particular undergraduate and graduate institutions with faculties and administrations that are embedded in professional networks, and the prominence of the GRFP makes it likely that the most talented and committed students will be made aware of the program and encouraged and helped with the application process. The program does not lack for strong applicants and must turn away thousands of applicants each year. But whether and to what extent individuals with outstanding talent that could ultimately help fulfill the long-term goals of the program are somehow not receiving information about the program and failing to apply are unknown.

Second, the study is not truly experimental and inferences about the impact of participation on outcomes are based on assumptions about the comparability of treatment and control group cases. An experimental study would involve random assignment of qualified applicants to the Fellowship and non-Fellowship recipient groups and compare group outcomes to assess the program impact. Instead, the study relies on the close comparability of the QG2 Fellows and HM designees, buttressed with additional statistical controls for residual measured differences among the groups, to approximate a random assignment design. In the absence of randomization, it is always possible that unmeasured characteristics related to program award and the outcomes in question can confound the apparent effects of the program on the outcomes and lead to incorrect conclusions.

Third, the study collected data at a single point in time and did not follow the study participants longitudinally. The study does examine successive cohorts of Fellows and HM designees in order to collect data across the full span of graduate school and early career stages, but it is important to recognize that the early career outcomes examined for the older cohorts may turn out to be different from the early career outcomes that will eventually be realized by the current younger cohorts.

Organization of the Report

The remainder of this report presents the design and findings of the evaluation, along with conclusions and recommendations for areas of further study. The next chapter, *Data and Methods*, describes the methodological details of the evaluation, including the survey design, sampling procedures, response rates, weighting procedures, and respondent characteristics for the Follow-up Survey; the sample selection, interview protocols, and institutional characteristics for the site visits and institutional telephone interviews; the outside data sources used to benchmark GRFP survey data against a comparable national sample; a map representing what data and methods address which research questions; and the analytical procedures used in the impact analysis, descriptive analysis, comparative benchmarking, and qualitative analysis components of the study.

The next five chapters present the results of the analyses. Chapters 3 and 4 present the results of the statistical modeling: *Impacts on Graduate School Experiences and Degree Attainment* presents impact estimates of the GRFP Fellowship on experiences during graduate school and degree attainment (addressing RQ1: *What is the impact of the GRFP Fellowship on the graduate school experience?*), and *Impacts on Careers and Professional Development* presents impact estimates of the GRFP Fellowship on experiences after graduate school, including career outcomes, work productivity, and professional development (addressing RQ2: *What is the impact of the GRFP Fellowship on career outcomes?*). Chapter 5, *Selected Characteristics of GRFP Fellows and Honorable Mention Designees*, describes the demographic and educational backgrounds of GRFP Fellows and QG2 HM designees, disaggregated by gender, URM status, and disability status, including changes over time. Chapter 6, *Selected Characteristics of GRFP Fellows and National Comparison Groups*, presents cross-tabulations of weighted survey data and compares GRFP Fellows and matched counterparts drawn from national data on demographic and educational characteristics and early career outcomes. Chapters 5 and 6 provide context for the results presented in Chapters 3 and 4, address the first goal of the evaluation (to provide descriptive information related to the GRFP goals on the demographics, educational decisions, career preparation, aspirations and progress, as well as professional productivity, of GRFP Fellows and comparable non-recipient applicants and national populations of graduate students and doctorate recipients), and also partially address RQ4 (*Is the program design effective in meeting program goals?*). Chapter 7, *Program Effects on Institutions*, presents the findings from the site visits and institutional telephone interviews on how the GRFP affects institutions that host GRFP Fellows, as well as how the program is implemented at host institutions and how GRFP policies and procedures affect these institutions, addressing RQ3 (*What are the effects of the GRFP on institutions?*) and partially addressing RQ4 (*Is the program design effective in meeting program goals?*).

Chapter 8, *Conclusions and Recommendations*, highlights key findings from the evaluation mapped back to the research questions and presents recommendations for program improvements and directions for future study.

This report includes seven appendices. Appendix A contains additional details about the methodology used in the evaluations, including the data collection methods used for the Follow-up Survey, the construction of scaled measures used for analysis, and crosswalks for comparing categorical variables from the national comparison data sets. Appendix B contains additional details about the methodology used to construct propensity score weights and impact models, and describes the additional impact analyses referenced in the two chapters reporting the results of the statistical modeling. Appendix C contains the Follow-up Survey instrument, Appendix D contains the institutional site visit interview protocols, and Appendix E contains the institutional telephone interview protocol.

Chapter 2: Data and Methods

Data

The research questions outlined in the previous section guided our data collection efforts. We collected data from several different sources, including both primary data collection and secondary (existing) data, to address the underlying research questions:

Primary Data Collected:

- The Follow-up Survey of GRFP Fellows and HM designees;
- In-person interviews with administrators, faculty, and staff members during site visits to six institutions; and
- Telephone interviews with administrators, faculty, and staff members from a sample of 18 institutions.

Secondary Data:

- 1996–2011 Survey of Earned Doctorates (SED), 2010 Survey of Doctoral Recipients (SDR), and data from the National Survey of College Graduates (NSCG) and the National Survey of Recent College Graduates (NSRCG) in the 2010 Scientists and Engineers Statistical Data System (SESTAT) file, all of which are NSF survey products.
- Application data provided the sample frame and was used to replace missing Follow-up Survey demographic data.

Each of these sources is discussed in greater detail below.

Survey of Fellows and Honorable Mention Designees (Follow-up Survey)

Survey Design. The survey population consisted of applicants in the top two quality groups (QG1 and QG2) based on NSF's merit review criteria. Applicants rated in the highest quality group (QG1) are highly recommended to receive the Fellowship. Applicants rated in the next group (QG2) are considered worthy of NSF Fellowship support by the panel. NSF makes final decisions on which applicants receive Fellowship offers, and QG2 applicants who do not receive Fellowship offers receive an Honorable Mention designation. GRFP application records provided the sampling frame from which cases were randomly selected to be representative of the study population in terms of award status (Fellowship recipients and HM designees) and applicant quality grouping (QG1 and QG2). For purposes of this

evaluation, NORC defined Fellowship recipients as Fellowship awardees who accepted their award and were Fellows for a period of time ranging from one to five years.

The sampling data file contained unit-record identifiers, application information, and QG rankings for all eligible GRFP applicants who received the Fellowship or Honorable Mention designation from four cohorts: Cohort 1 (1994–1998), Cohort 2 (1999–2004), Cohort 3 (2005–2008), and Cohort 4 (2009–2011). Within each cohort, equal numbers of cases were randomly selected among QG1 Fellows, QG2 Fellows, and QG2 HM designees, for a total sample of 13,055 cases. Some individuals who did not receive the Fellowship award applied to the program in subsequent years. Prior to drawing the sample, repeat applicants were assigned a single status and application cohort reflecting their final award status (this resulted in the removal of 472 duplicate entries for applicants from the sample file). Thus, each applicant was represented once in the sampling frame.

The sampling plan was designed to select a sample large enough to make statistically valid estimates of program outcomes relevant to the evaluation and to allow comparisons across different subgroups, given expected response rates among these subgroups. While the size of the analytic sample, minimum detectable effects, and statistical power vary with the specifications of a given comparison, we broadly assessed statistical power and minimum detectable effects for a given subgroup to ensure that each was sufficient for answering the research questions.

The proposed sample was sufficient to detect effect sizes (mean differences between two groups) as small as 0.10 for pooled sample comparisons between QG1 Fellows, QG2 Fellows, and QG2 HM designees, for comparisons between cohorts, and for comparisons between men and women. For pooled sample comparisons between other subgroups of interest (for example, students with disabilities versus students without disabilities, or underrepresented minorities versus other respondents) the proposed sample was sufficient to detect effect sizes between 0.10 and 0.20 based on the proportion of each group present in the application data.

The effect size is the standardized mean difference between the two groups, i.e., the difference between the means of the two groups, divided by the standard deviation, generally estimated as the 'pooled' standard deviation of the two groups. One feature of an effect size is that it can be converted into statements about the overlap between the two samples in terms of a comparison of percentile. For example, in considering the difference between QG2 Fellows and HM designees, an effect size of 0.10 means that the score of the average QG2 Fellow exceeds the scores of 54 percent of the HM designees. Similarly, an effect size of 0.20 means that the score of the average student without disabilities, for

example, exceeds the scores of 58 percent of students with disabilities (Coe, 2002). Thus, with our sample sizes, we are able to detect smaller differences among Fellows and HM designees or among men and women than among students with and without disabilities or URMs versus non-URMs. In conventional qualitative terms, an effect size of 0.20 is considered small, 0.50 is considered medium, and 0.80 is considered large (Cohen, 1988).

Exhibit 2.1 presents the population and sample sizes for each award status within cohort group. After accounting for repeat applicants, the sample size ranged from 3,202 to 3,301 cases within each cohort and from 1,057 to 1,123 cases across the award status within cohort groups.

Exhibit 2.1. GRFP Follow-Up Survey Population and Sample, by Cohort and Award Status

Cohort	Fellowship Status	Population	Sample
Cohort 1 (1994–1998)	QG1 Fellows	2,574	1,092
	QG2 Fellows	2,037	1,092
	QG2 HM designees	1,480	1,083
Cohort 2 (1999–2004)	QG1 Fellows	2,895	1,096
	QG2 Fellows	2,557	1,098
	QG2 HM designees	2,020	1,008
Cohort 3 (2005–2008)	QG1 Fellows	2,034	1,123
	QG2 Fellows	1,722	1,105
	QG2 HM designees	2,094	1,057
Cohort 4 (2009–2011)	QG1 Fellows	2,766	1,108
	QG2 Fellows	2,554	1,103
	QG2 HM designees	3,846	1,090
	Total	28,579	13,055

Survey Instrument. We used a single survey instrument, hereafter referred to as the "Follow-up Survey," to collect data from the Fellows and the HM designees in the sample. The Follow-up Survey draws on other successful surveys, including from the previous GRFP evaluation (Goldsmith, Presley, & Cooley, 2002). A full list of source materials is available upon request.

However, different portions of the Follow-up Survey captured data from different sample populations. Thus, the Graduate Student Experiences portion of the survey collected data from all sample members, and asked about program climate, quality, and offerings, participation in various research and professional activities, and professional productivity and financial support during graduate school. The Career Outcomes portion of the survey collected data only from sample members who completed or dropped out

of their reference program, defined as the graduate program attended as a Fellow or HM designee. These sample members were asked about job history and professional productivity since leaving graduate school. In addition, Fellows were asked about the influence of program elements (choice, flexibility, and monetary value) on their decision to enroll in and successfully complete STEM graduate programs. The survey also collected demographic and educational background data and information about participation in other NSF-sponsored programs.

The GRFP Follow-up Survey was administered by NORC between March 19th and August 19th of 2012, and fielded as a Web-based instrument accessible to respondents using a combination of personalized PIN and password. Information on data collection methodology is provided in Appendix A.

Response Rates. The overall response rate achieved was 78.1 percent (Exhibit 2.2). The response rate for QG1 and QG2 Fellows was 78.1 percent and 80.2 percent, respectively, while the response rate for HM designees was 75.8 percent. Within each of the four cohorts, QG2 Fellows responded at a slightly higher rate than QG1 Fellows, and HM designees responded at a lower rate than both groups of Fellows (with the exception of Cohort 1, in which HM designees responded at a slightly higher rate than QG1 Fellows). Not unexpectedly, the response rate was somewhat lower among earlier cohorts (Exhibit 2.2) and ranged from 69.9 percent for Cohort 1 (1994–1998) to 84.5 percent for Cohort 4 (2009–2011) members. Because a critical component of the analysis is comparisons across subgroups, Exhibit 2.2 also shows response rates by gender and underrepresented minority (URM) status, which was defined to include all participants who were neither non-Hispanic white nor Asian. Women had a higher response rate than men overall (80.9 percent and 75.6 percent respectively) and within each of the three types of respondents (QG1 Fellows, QG2 Fellows, and HM designees). URMs responded at a slightly lower rate than non-URMs overall (74.7 percent versus 78.6 percent) and within each of the three types of respondents.

Weighting. Non-response weights were created to address possible bias due to non-response patterns. First, a set of base weights was calculated to represent the probability of selection from the sampling file. All sample cases received a non-zero base weight, the inverse of the sampling probability for each stratum (cohort and award status). Second, eligibility weights were created to account for unknown eligibility. Base weights associated with cases with unknown eligibility were distributed to cases with known eligibility status. This adjustment preserves the weighted distribution of known eligible and known ineligible cases.

Next, nonresponse weights were created for all complete cases to adjust for nonresponse patterns. Within each adjustment cell, the eligibility-adjusted base weight of each respondent was inflated by the inverse of the response rate of that cell. The effect of the weighting is to make the respondents represent the population from which they were selected and to redistribute the weight total associated with eligible non-respondents to eligible respondents.

Eligibility and nonresponse adjustment cells were defined by the cross of cohort, award status, URM status and gender. These subgroups comprised 48 adjustment cells, and both eligibility adjustment and nonresponse adjustment were done within each cell.

The survey sample of 13,055 Fellows and HM designees represented approximately 45 percent of the total applicant population with slightly different proportions by subgroup (full details on the applicant population and survey sample by award status and cohort can be found in Exhibit 2.2).

Exhibit 2.2. Sample Sizes and Response Rates for the GRFP Follow-Up Survey, by Selected Characteristics and Award Status of Respondents

	Total	QG1 Fellows	QG2 Fellows	QG2 Honorable Mention Designees
		Sample Size		
Total	13,055	4,419	4,398	4,238
Cohort				
Cohort 1	3,267	1,092	1,092	1,083
Cohort 2	3,202	1,096	1,098	1,008
Cohort 3	3,285	1,123	1,105	1,057
Cohort 4	3,301	1,108	1,103	1,090
Gender				
Female	6,036	1,954	2,524	1,558
Male	7,019	2,465	1,874	2,680
Underrepresented minorities (URM)				
URM	1,710	580	655	475
Non-URM	11,345	3,839	3,743	3,763
		Response Rate		
Total	78.1%	78.1%	80.2%	75.8%
Cohort				
Cohort 1	69.9%	68.1%	72.3%	69.1%
Cohort 2	76.8%	77.4%	79.0%	74.0%
Cohort 3	80.5%	80.7%	81.7%	78.9%
Cohort 4	84.5%	85.0%	87.3%	81.2%
Gender				
Female	80.9%	80.9%	80.7%	81.1%
Male	75.6%	75.8%	79.5%	72.8%

	Total	QG1 Fellows	QG2 Fellows	QG2 Honorable Mention Designees
Underrepresented minorities (URM)				
URM	74.7%	75.5%	74.5%	73.9%
Non-URM	78.6%	78.5%	81.2%	76.1%

Supplementation with Application Data. If survey respondents refused to answer basic demographic questions, their survey data was supplemented with data from the application files used as the sampling frame if the application files contained the missing data. The variables that were supplemented include gender (4.05 percent supplemented; 0 percent missing after supplementation), race (4.13 percent supplemented; 2.44 percent missing after supplementation), ethnicity (3.00 percent supplemented; 1.46 percent missing after supplementation), and disability status (0.96 percent supplemented; 3.33 percent missing after supplementation), as well as the day, month, and year of birth (between 9 and 14 percent supplemented; less than 0.1 percent missing after supplementation). Additionally, the start year of the reference graduate program was supplemented with the award year for the 0.88 percent of cases with a missing start year, and the start month was supplemented with the modal value for start month reported by other respondents for the 1.01 percent of cases with a missing start month.

Site Visits to Institutions

The institutional site visit sample consisted of six institutions that participated in a site visit in 2012 or early 2013 during which the NORC team conducted in-depth, in-person interviews with up to 10 administrators, faculty, and staff members, focusing on their perceptions of the effect of the GRFP on the institution and students as well as implementation of the GRFP and recommended changes. The interviews focused primarily on current (2012) GRFP policies and procedures, with some retrospective questions.

Selection of Sample. The sample of institutions was selected by NORC in consultation with GRFP program staff. In order to include the institutions likely to be most affected by the presence of Fellows, selections were primarily based on the number of current Fellows attending the institution, while balancing other criteria including institutional sector (public or private), geographical region, and size as measured by the number of graduate students enrolled (total enrollment, as enrollment in STEM fields was not available). The sample consisted of the following institutions: Georgia Institute of Technology, Massachusetts Institute of Technology (MIT), Princeton University, Stanford University, University of California-Berkeley, and University of Michigan Ann Arbor. Exhibit 2.3 presents the characteristics of the sample along the various dimensions used in the selection process. The University of California-Berkeley had the highest number of Fellows enrolled in 2012 (519) while Georgia Tech had the smallest number of Fellows (98) in this sample. The six institutions were evenly split between public and private

and offered geographical diversity at both the region and census division levels. Stanford University, University of California-Berkeley and University of Michigan are all large schools, with a graduate student body of over 10,000 students. In contrast, Princeton is the smallest with just over 2,500 graduate students. The proportion of Fellows among enrolled graduate students ranged from a low of less than 1 percent at the University of Michigan to a high of 6.3 percent at MIT. The proportion of Fellows among U.S. citizens, nationals, and permanent residents in STEM fields could not be calculated because the number of such students enrolled in each institution was not available.

Each institution's GRFP Coordinating Official (CO) was asked to identify approximately ten interviewees who were involved with the GRFP in different ways, including departmental staff members who work with graduate students, graduate program coordinators, faculty members, and university administrators. The CO was asked to include both him or herself and the institution's GRFP Primary Investigator (PI; typically a Vice Provost or Dean of Graduate Studies or other similar administrator) in this list of interviewees.

At the six institutions, we interviewed a total of 61 administrators, faculty, and staff members who were associated with the GRFP (roughly two administrators, four faculty members, and four staff members per institution) as well as two GRFP Fellows. The site visit team consisted of two to three NORC staff members.

Exhibit 2.3. Site Visit Sample of Institutions, by Selected Characteristics.

Institution	Number of Fellows (2012)	Public/ Private	Census Region	Census Division	Total Graduate Enrollment (2012)
Georgia Institute of Technology	98	Public	South	South Atlantic	7,605
Massachusetts Institute of Technology	422	Private	Northeast	New England	6,618
Princeton University	116	Private	Northeast	Mid-Atlantic	2,505
Stanford University	442	Private	West	Pacific	13,212
University of California-Berkeley	519	Public	West	Pacific	10,713
University of Michigan	163	Public	Midwest	East North Central	16,846

Interview Protocols. We developed semi-structured protocols (presented in full in Appendix D) in consultation with GRFP program staff with potential follow-up questions and probes, with three versions tailored to the three types of interviewees (administrators, faculty, and staff members). Individuals interviewed as part of the institutional data collection were asked for informed oral consent. They were assured that the information they provided would not be attributed to them, all data would be reported in

aggregated form, and direct quotations would not be attributed to any individuals or their institutions. These data were identified only by site and interviewee codes and were kept in locked cabinets or password-protected data files. In addition, any crosswalk between the interviews and identifying information was maintained separately from the actual interview notes and files. Most interviews lasted between 20 and 45 minutes, with an average of 30 minutes. Interviews were shortest for administrators and longest for faculty members. Some interviews were conducted with multiple people including two different types of respondents (usually a faculty and a staff member from the same department).

Faculty members were asked about their general impressions of the GRFP and how it compared with other fellowship programs, how the Fellowship influenced admissions and willingness of faculty members to work with a prospective student, how Fellows and the department benefitted from the Fellowship, whether and how the experiences of Fellows differed from those of other graduate students in terms of socialization, autonomy, service to the department in terms of teaching or being a research assistant, the professional contributions of Fellows to the research activity of the department. They were also asked for any recommendations for changes to the program. University administrators were asked their overall impression of the GRFP compared with other fellowship programs, the impact of the GRFP on recruiting, funding, diversity of the student body, and financial planning, supports and activities provided to Fellows, program administration, adequacy of GRFP funding and cost-of-education allowance, supplemental funding for Fellows, and for their recommendations for changes to the program. Departmental staff were asked for their overall impression of the GRFP, supports offered to Fellows, demographic composition of Fellows relative to that of other graduate students, patterns of use of the Fellowship, supplemental funding, departmental requirements for service (teaching/research) and the extent to which Fellows were able to participate in teaching and research opportunities provided to other graduate students, whether and how the program had changed over time and the impact of those changes on Fellows and the institution, and for their recommendations for changes to the program.

In-person interviews were recorded and transcribed for analysis, with the participants' permission (if participants refused, a team member took detailed notes during the interview in lieu of a recording and transcription).

Telephone Interviews with Institutional Representatives

Selection of Sample. Telephone interviews were conducted with administrators, faculty, and staff from a set of 18 institutions. As with the site visit sample, this sample was selected primarily based on the number of Fellows attending the institution in 2012, with some attempt at balancing the other characteristics (institutional sector, geographical region, and number of graduate students). In addition,

we attempted to accommodate two additional criteria: first, we chose not to include more than three institutions within the University of California system (otherwise several additional campuses would have been included), and second, we included two institutions based on their relatively high percentage of underrepresented minority graduate students (University of Arizona and University of New Mexico) as reported in the Integrated Postsecondary Education Data System (IPEDS). Two institutions that were part of the initial telephone interview sample of 20 institutions did not respond, resulting in a final sample of 18 institutions that participated in the telephone interviews.

Exhibit 2.4 describes the characteristics of the institutions included in the telephone sample. The number of Fellows enrolled in the institution in 2012 ranged from eight (University of New Mexico) to 322 (Harvard University). Apart from these two extremes, ten universities hosted between 30 and 100 Fellows and the remaining six universities had between 100 and 200 Fellows in 2012. The sample was evenly split between public and private institutions and was balanced across regions (5 each in the Midwest and Northeast, and 4 each in the South and West). The universities ranged in size in terms of graduate enrollment. Rice University was the smallest with 2,352 graduate students, and Harvard University and the University of Minnesota—Twin Cities were the largest, with over 20,000 graduate students (20,095 and 21,384, respectively). Nine universities had between 5,000 and 10,000 graduate students and the remaining six had enrollments of between 10,000 and 20,000 graduate students.

Exhibit 2.4. Telephone Interview Sample of Institutions, by Selected Characteristics

Institution	Number of Fellows (2012)	Public/ Private	Census Region	Census Division	Total Graduate Enrollment (2012)
Columbia University	112	Private	Northeast	Mid-Atlantic	18,168
Cornell University	156	Private	Northeast	Mid-Atlantic	6,959
Duke University	86	Private	South	South Atlantic	8,677
Harvard University	322	Private	Northeast	New England	20,095
Northwestern University	97	Private	Midwest	East North Central	12,038
Pennsylvania State Univ-University Park	50	Public	Northeast	Mid-Atlantic	7,738
Rice University	35	Private	South	West South Central	2,352
University of Arizona	42	Public	West	Mountain	9,881
University of California-San Diego	115	Public	West	Pacific	5,571
University of Illinois at Urbana-Champaign	91	Public	Midwest	East North Central	14,574
University of Minnesota-Twin Cities	68	Public	Midwest	West North Central	21,384
University of New Mexico	8	Public	West	Mountain	9,152
University of Texas at Austin	90	Public	South	West South Central	13,652
University of Washington	185	Public	West	Pacific	14,202
University of Wisconsin-Madison	108	Public	Midwest	East North Central	12,787

Institution	Number of Fellows (2012)	Public/ Private	Census Region	Census Division	Total Graduate Enrollment (2012)
Vanderbilt University	33	Private	South	East South Central	6,371
Washington University	43	Private	Midwest	West North Central	6,834
Yale University	106	Private	Northeast	New England	6,406

Across the 18 universities, we conducted a total of 78 telephone interviews between June and December of 2012.

Interview Protocols. Individuals interviewed by phone as part of the institutional data collection were asked for informed oral consent. As with the site visit sample participants, they were assured that the information they provided would not be attributed to them, all data would be reported in aggregated form, and direct quotations would not be attributed to any individuals or their institutions. These data were identified only by site and interviewee codes and were kept in locked cabinets or password-protected data files. In addition, any crosswalk between the interviews and identifying information was maintained separately from the actual interview notes and files.

NORC developed one semi-structured interview protocol (presented in full in Appendix E) for phone interviews with faculty and administrators at these 18 universities in consultation with GRFP program staff. The phone interview protocol was similar to the protocols used for the site visits, but shorter and with a greater emphasis on program implementation. Most interviews lasted 30 minutes or less. The primary focus of the phone interviews was on the current (2012) program structure and requirements (for example, goals of the program, patterns of use of the Fellowship, adequacy of GRFP funding and cost-of-education allowance, how program guidelines regarding service to the department while on the Fellowship affected Fellows' ability to act as teaching or research assistants, "Tenure" or "Reserve" status being decided on an annual basis, requirement that Fellows be affiliated with a U.S. institution). We also asked about whether and how the experiences of the Fellows differed from those of other graduate students and whether and what kinds of additional funding and/or supports were provided to the Fellows. The interviews ended with a question soliciting recommendations for changes to the program that would benefit the Fellows or the institution.

Telephone interviews were recorded and transcribed for analysis, with the participants' permission (if participants refused, a team member took detailed notes during the interview in lieu of a recording and transcription).

Comparisons with National Data Sources

Secondary (existing) data sources were obtained from NSF NCSES and were used to benchmark characteristics of the GRFP Fellow and HM designee population from 1994 through 2011 against comparable national populations.

Survey of Earned Doctorates. The Survey of Earned Doctorates (SED) is an NSF survey that gathers information about graduates' educational histories, funding sources, and postdoctoral plans from all recipients of a research doctorate earned from any degree-granting institution in the United States. Institutional contacts collect the SED survey forms when they collect other final dissertation forms and send them to NORC along with an official listing of graduates. We used SED data to benchmark the GRFP Fellow and HM designee Ph.D. recipients against a comparable national sample of Ph.D. recipients on degree characteristics, graduate school experiences, and demographic characteristics. The benchmark sample from the SED was restricted to U.S. citizens and permanent residents who received their first Ph.D. between 1996 and 2011 (inclusive) in a field of study that matched the list of current fields eligible for the GRFP.

Survey of Doctorate Recipients. The Survey of Doctorate Recipients (SDR) is one of three surveys that the National Center for Science and Engineering Statistics (NCSES) uses to track the U.S. science and engineering workforce. The SDR sample is composed of 44,000 individuals under the age of 76 who received their research doctorate in the U.S. in a science, engineering, or health-related field. Conducted every two years since 1973, the SDR tracks the employment history and research productivity of members of the science, engineering, and health doctoral labor force as they move through their careers in research and practice. We used 2010 SDR data to benchmark the GRFP Fellow and HM designee Ph.D. recipients against a comparable sample on demographic characteristics and work outcomes. The benchmark sample from the SDR was restricted to U.S. citizens and permanent residents who received their first Ph.D. between 1996 and 2009 (inclusive) in a field of study that matched the list of current fields eligible for the GRFP.

National Survey of College Graduates and National Survey of Recent College Graduates. The National Survey of College Graduates (NSCG) and the National Survey of Recent College Graduates (NSRCG) are NSF longitudinal surveys designed to collect data on the characteristics of U.S. college graduates. These surveys provide information on the work experiences of college graduates. While the NSCG collects data from a selection of all bachelor's degree holders living in the U.S., the NSRCG focuses exclusively on individuals who recently obtained bachelor's or master's degrees in a science, engineering, or health field. For the purposes of our study, we used NSCG and NSRCG to benchmark

GRFP Fellows and HM designees who completed a terminal master's degree against a comparable national sample on selected degree characteristics, graduate school experiences, work outcomes, and demographic characteristics. The benchmark samples were restricted to U.S. citizens and permanent residents who received their first master's degree between 1996 and 2009 (inclusive) in a field of study that matched the list of current fields eligible for the GRFP.

Comparisons Between National Data Sources and GRFP Follow-up Survey Data. Data from the SED and SDR only contain Ph.D. completers; data from the NSCG and NSRGC contain data on master's degree completers. Thus, we constructed subsets of GRFP Fellows to match: (a) Ph.D. completers who were compared with data from SED and SDR; and (b) Fellows holding a master's degree as their highest degree to be compared with data from NSCG and NSRCG. The subsets of GRFP Fellows were further limited to include only those Fellows receiving degrees between 1996 and 2009 to match the years represented in the national data sources. The subsets therefore contained 7,459 Fellows (weighted) who completed a Ph.D. within this year range and 1,121 Fellows (weighted) who completed a master's degree within this year range and who held no higher degree.

To provide a national comparison group to GRFP Fellow Ph.D. completers, we selected from the 2010 SDR and the 1996–2010 SED data sets all U.S. citizens and permanent residents who received their first Ph.D. between 1996 and 2009 in a field of study that matched the list of current fields eligible for the GRFP.[8] The SED and SDR include only degrees earned at U.S. institutions, matching GRFP's current eligibility criteria (although the GRFP allowed Fellows to enroll abroad until 2010, only a small number did so).

The comparison group for GRFP Fellows who hold a master's degree as their highest degree and were not pursuing a Ph.D. (referred to hereafter as terminal master's completers) was selected from the 2010 Scientists and Engineers Statistical Data System (SESTAT) file containing data from the NSCG and NSRCG, and included all U.S. citizens and permanent residents who received their first master's degree (and held no higher degree) at a U.S. institution between 1996 and 2009 (inclusive) in a field of study that matched the list of current fields eligible for the GRFP.[9]

[8] There were some instances in which a STEM field reported in SED or SDR did not exactly match a field of study as we have defined it in this evaluation; please see Exhibit A.7 for a crosswalk of SED/SDR fields of study to GRFP fields of study.

[9] There were some instances in which a STEM field reported in NSCG or NSRCG did not exactly match a field of study as we have defined it in this evaluation; please see Exhibit A.8 for a crosswalk of NSCG/NSRCG fields of study to GRFP fields of study.

In comparing the different groups across several dimensions, we used Student's t-statistics to test for statistical significance. To account for the multiple hypothesis tests, we adjusted the criterion for statistical significance using a false discovery rate procedure (Benjamini & Hochberg, 1995).

We turn now to a description of the methods used to analyze the data and address the major research questions guiding the study. Exhibit 2.5 maps the research questions to the data and methods used to address them.

Exhibit 2.5. Mapping Research Questions to Data and Methods

Research Questions	Data	Methods
RQ1. *What is the impact of the GRFP Fellowship on the graduate school experience?*	Data from the Follow-up Survey of Fellows and HM designees Data from the SED and SDR on U.S. citizens and permanent residents who received their first Ph.D. between 1996 and 2009 in a field of study that matched the list of current fields eligible for the GRFP Data from the NSCG and NSRCG on U.S. citizens and permanent residents who received their first master's degree between 1996 and 2010 (inclusive) in a field of study that matched the list of current field eligible for the GRFP	Propensity score weighting comparing the quality group 2 (QG2) Fellows to the QG2 HM designees Additional regression analyses including demographic factors and graduate field of study as covariates and accounting for institutional random effects Cross-tabulations of weighted survey data and statistical tests for differences in means and proportions both among GRFP respondent groups and matched counterparts in national data
RQ2. *What is the impact of the GRFP Fellowship on career outcomes?*	Data from the Follow-up Survey of Fellows and HM designees restricted to respondents who reported having either completed or dropped out of their program Data from the SED and SDR on U.S. citizens and permanent residents who received their first Ph.D. between 1996 and 2009 in a field of study that matched the list of current fields eligible for the GRFP Data from the NSCG and NSRCG on U.S. citizens and permanent residents who received their first master's degree between 1996 and 2010 (inclusive) in a field of study that matched the list of current field eligible for the GRFP	Propensity score weighting comparing the quality group 2 (QG2) Fellows to the QG2 HM designees Statistical modeling, adjusting for covariates (population average models) as well as for institutional random effects (mixed models) Cross-tabulations of weighted survey data and statistical tests for differences in means and proportions between GRFP Fellows and matched counterparts in national data
RQ3. *What are the effects of the GRFP on institutions?*	Data from the telephone interviews with administrators and faculty members from 18 GRFP institutions Data from the site visit interviews with administrators, faculty, and staff members from six GRFP institutions	Qualitative research methods (coding of interview data) Inductive identification of themes and trends; rough frequencies
RQ4. *Is the program design effective in meeting program goals?*	Follow-Up Survey of Fellows and HM designees Data from the telephone interviews with administrators and faculty members from 18 GRFP institutions Data from the site visit interviews with administrators, faculty, and staff members from six GRFP institutions	Descriptive statistics of Fellows to examine trends in the participation of underrepresented groups, including women, underrepresented minorities, and students with disabilities, in science and engineering fields Cross-tabulations of weighted survey data comparing GRFP Fellows and matched counterparts in national data Qualitative research methods (coding of interviews)

Methods

This section provides a brief overview of the methods we used to analyze the impact of the GRFP on Fellowship recipients along several dimensions and to examine program implementation and the effect of the program on institutions.

Analysis of Impact of GRFP

The first two research questions regarding the impact of the GRFP on graduate school experiences and career outcomes are addressed through a variety of descriptive analyses and statistical modeling.

Impact Estimates. Estimating the impacts of the GRFP on Fellows requires comparison of outcomes among GRFP Fellows to the counterfactual: the outcomes associated with the same students had they not participated in the GRFP. We used quasi-experimental methods to approximate this theoretical standard, comparing the outcomes of Fellows with outcomes of a control group of HM designees, additionally using statistical adjustments to control for measured differences between these similar groups. Such an approach is widely accepted as the best method to infer program effects in the absence of a randomized experiment, when it is not feasible to randomly assign applicants to participate in the GRFP (the treatment) or not to participate in the GRFP (control). The purpose of identifying a comparison group plausibly similar to GRFP Fellows is to minimize group differences prior to GRFP participation so that observed differences between GRFP participants and non-participants may be attributed to the GRFP rather than other, non-GRFP, factors such as background characteristics that could influence *both* receipt of the GRFP Fellowship as well as graduate school experiences and career outcomes. To reduce the selection bias introduced by non-random assignment, two steps were taken in the impact analyses.

First, we restricted comparisons to Fellows and non-Fellows who were the most similar. When estimating GRFP impacts, background differences were mitigated by limiting the analyses to Fellows and HM designees who received the same application quality grouping (i.e., QG2 Fellows and QG2 HM designees).

Second, preexisting differences between QG2 Fellows and QG2 HM designees were further controlled for by matching applicants based on the predicted probability that they would receive the treatment (the Fellowship) instead of the control (the Honorable Mention designation), based on all available background (i.e., pre-GRFP award) information. The estimated probabilities, or propensity scores, were estimated using a logistic regression with a set of individual and institutional background measures as covariates. After estimating the propensity scores, we applied model-specific inverse probability weights (IPW) to achieve balance. For each outcome measure, an IPW was generated and applied to the cases in

the analytic sample. This weight was equal to the reciprocal of the estimated probability of award for the treatment group, and the reciprocal of the probability of no award for the control group (Austin, 2011).

The impact of the GRFP Fellowship on the outcomes was then calculated as the difference between the average outcomes of the QG2 GRFP Fellows and HM designees, where the cases were weighted by the product of the population weights that adjust for non-response and the IPW that adjusts for differences in individual likelihoods of being in the treatment (Fellow) or control (HM designee) groups.

To account for the multiple hypothesis tests, we adjusted the criterion for statistical significance using a false discovery rate procedure (Benjamini & Hochberg, 1995). A false discovery rate (FDR) is the expected proportion of rejected null hypothesis tests that are truly null (i.e., the expected proportion of statistical tests that report significant relationships when no relationships actually exist). Using this adjustment procedure, we indicate when results met the criteria for significance at a FDR of 5 percent or 1 percent.

The outcome variables for the impact analyses include measures of graduate school experiences, professional productivity during graduate school (presentations, publications, grants, etc.), graduate degree completion, time to doctoral degree completion, employment status, job field, relatedness of job to graduate field of study, and professional productivity following graduate school. Several of the measures of graduate school experiences are composite scale scores constructed from two or more conceptually related survey items that were found through factor analysis to represent a common underlying factor (see Exhibits A.3 through A.6 for a summary of composite scale measures).

The propensity-weighted differences were subjected to a series of additional analyses designed to assess possible differences in the impacts between different demographic groups, graduate fields of study, and graduate institutions; these are described in Appendix B.

Descriptive Analysis. We used descriptive methods to compare the survey responses across the three groups of respondents. Descriptive statistics, including means and percentages, were calculated for QG1 Fellows, QG2 Fellows, and QG2 HM designees. The descriptive statistics presented in this report are weighted values that are adjusted for non-response among the survey sample. Applying data weights reduces bias introduced by non-response and allows the descriptive statistics and parameter estimates to be generalizable to all QG1 and QG2 GRFP applicants across sample years 1994–2011.

The descriptive comparisons discussed in this report were tested for statistical significance with a two-sided Student's *t*-test for large, randomly selected, and independent samples, calculated as the difference

in the means for the two groups divided by the pooled standard error of the difference between the means. To account for the multiple hypothesis tests, we adjusted the criterion for statistical significance using a false discovery rate procedure (Benjamini & Hochberg, 1995).

Comparative Benchmarking. The 2010 SED, SDR, NSCG and NSRCG were used to provide a context for understanding the educational and career outcomes of GRFP Fellows relative to nationally-representative samples of graduate degree completers. SED and SDR data were used for comparisons of doctoral recipients in Science and Engineering (S&E) fields, and NSCG and NSRCG data were used for comparisons of master's degree completers in S&E fields. The analyses compared Fellows who completed graduate degrees to nationally-representative samples of degree completers across demographic characteristics, educational background factors, field of graduate study, sources of financial support in graduate school, time to degree, characteristics of graduate institutions attended, and post-degree job characteristics. As above, t-tests with p-values adjusted for multiple comparisons were used to test for statistical significance.

Analysis of Effect of GRFP on Institutions

Using the qualitative interview data, we examined the possible current effects of the GRFP on graduate institutions along a number of dimensions including financial aspects of the Fellowship such as adequacy of the cost-of-education allowance and ability to free up resources to provide funding to other students, the extent to which Fellows participate in departmental teaching and research ("service to the department"), effects on student diversity and (to the extent feasible) student quality, and effects, if any, on scholarly productivity and research.

The site visit and telephone interview data were analyzed using qualitative methods. In the first round of coding, the NORC team focused on topics that corresponded to one of (or part of one of) the questions in the interview protocol. After the transcripts were coded, the team added the coded sections into topic files. For the second-level coding process, NORC staff inductively identified the themes within each topic, major trends, and the frequency with which a topic or opinion was mentioned. These were used to draw broad conclusions regarding perceived program effects on the institution and perceived benefits to the department of hosting GRFP Fellows.

Analysis of Effectiveness of GRFP in Meeting Program Goals

The analysis of whether the program is meeting program goals draws on a variety of sources. Using the weighted survey data, we examined trends in the demographic composition of the Fellows to measure the extent to which women, URMs, and students with disabilities are represented among the Fellows and how

this has changed over time. We also compared the Fellows to national comparison groups from secondary data sources along a variety of dimensions to see to what extent Fellows resembled the national population of Ph.D. and master's degree recipients, including demographics and career outcomes. Data from the qualitative interviews (phone interviews and site visit interviews) were analyzed to understand how the program is currently working, how the different program elements are being implemented, and respondents' recommendations on how the program can be improved. The qualitative data were analyzed using the methods described above.

Chapter 3: Impacts on Graduate School Experiences and Degree Attainment

This chapter focuses on the impact of the program on graduate school experiences and degree attainment (addressing RQ1: *What is the impact of the GRFP Fellowship on the graduate school experience?*), while the next chapter focuses on program impacts on experiences after graduate school, including career outcomes and professional development. Impact estimates compare QG2 Fellows with QG2 HM designees and are calculated as group mean differences using propensity score weighting of the cases to balance these two groups with respect to pre-award factors (please refer to Appendix B for the details of the methodology). All impact estimates presented in these two chapters are based on comparisons of QG2 Fellows and HM designees.

We ran several different versions of the model to examine the impact of the program in different ways. This section focuses on our baseline models that examine the overall impact of the GRFP. In addition, we summarize findings from various models that examined whether the program has a differential impact on women and URMs. The results presented here were supplemented by a number of additional analyses to test for robustness to alternative model specifications as well as to assess possible differences in the impacts between different demographic groups, graduate fields of study, and graduate institutions; Appendix B provides more details on the models and tabulations of supplemental findings. The results of these supplemental models are reported in this chapter when they provide additional information not already captured by the baseline models.

We adjusted significance tests to account for multiple hypothesis tests, and the adjusted standards were applied to the impact estimates discussed in the remainder of this chapter (for more detail, refer to Chapter 2: *Data and Methods*).

In addition to reporting statistical significance, we report standardized group differences, which are equivalent to effect sizes (Bowman, 2012). The effect size is the standardized mean difference between the two groups (i.e., the difference between the means of the two groups, divided by the standard deviation, generally estimated as the 'pooled' standard deviation of the two groups). Effect sizes give an indication of the extent of the difference between the distributions of GRFP Fellows and the HM designees, with larger effect sizes denoting larger mean differences and less overlap between distributions. For example, an effect size of 0 indicates that the average Fellow would score higher than

50 percent of the HM designees (Coe, 2002). For an effect size of 0.10, the average Fellow would score higher than 54 percent of the HM designees. Effect sizes of 0.20 and 0.30 mean that the average Fellow would score higher than 58 percent and 62 percent of HM designees, respectively. These effect sizes provide context for the magnitude of differences that we discuss below. In conventional qualitative terms, an effect size of 0.20 is considered small, 0.50 is considered medium, and 0.80 is considered large (Cohen, 1988).

To provide context on how the outcome measures may have changed over time, we present alongside each impact table a second table showing the outcome measure for all Fellows (including both QG1 and QG2 Fellows) in each of the four cohorts included in this evaluation. However, please note that differences between cohorts do not necessarily represent changes over time, as different program policies were in effect, and different amounts of time have passed, for different cohorts.

Evidence of GRFP Impact on Fellows

The following subsections discuss the findings related to the impact of the program on QG2 Fellows with respect to various outcome measures related to graduate school experiences and degree attainment.

Perceptions of Graduate School Quality

We asked survey respondents about their perceptions of the quality of the graduate school experience, specifically: (a) guidance, support, and professional development; (b) reputation of the program, university, faculty, and peers; (c) curriculum, instruction, and research training; (d) climate for women and minorities; and (e) tuition and financial support. The results for the combined sample from all four cohorts, shown in Exhibit 3.1, indicated no impact on QG2 Fellows' and HM designees' perceptions of the quality of their graduate school on these measures. (None of the effect sizes were statistically significant at the $p<.05$ level, and they are additionally very small effect sizes.)

Exhibit 3.1. Estimated Impact of the GRFP Fellowship on Reported Quality of Graduate School Experiences

Outcome	Impact
Guidance, support, and professional development	0.031
Reputation (program, university, faculty, and peers)	0.063
Curriculum, instruction, and research training	0.070
Climate for women and minorities	-0.033
Tuition and financial support	-0.036

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted.

Exhibit 3.2 shows Fellows' (including both QG1 and QG2 Fellows) reports on the same aspects of the quality of their graduate school experiences by cohort; these estimates exclude the HM designees and, unlike the impact estimates, are not weighted to adjust for differences in pre-award characteristics. Fellows' responses to related survey items were combined into scaled measures as described in Exhibits A.3 through A.6 and are presented as z-scores in order to examine potential differences between cohorts. While the GRFP did not have an observed impact on these five composite measures (as shown in Exhibit 3.1), Fellows' self-reports on all five changed between Cohort 1 and Cohort 4. Cohort 4 Fellows reported higher satisfaction than Cohort 1 Fellows with two of these aspects: guidance, support, and professional development; and the climate for women and minorities. Cohort 4 Fellows reported lower satisfaction than Cohort 1 Fellows with the other three aspects: reputation (of the program, university, faculty, and peers); curriculum, instruction, and research training; and tuition and financial support.

Exhibit 3.2. Reported Quality of Graduate School Experiences Among Fellows by Cohort, Z-scores

Outcome	Cohort 1 (*N*=4,025)	Cohort 2 (*N*=4,988)	Cohort 3 (*N*=3,717)	Cohort 4 (*N*=5,171)
Guidance, support, and professional development	-0.03	0.02	-0.01	0.09***
Reputation (program, university, faculty, and peers)	0.17	0.08	0.04	-0.10***
Curriculum, instruction, and research training	0.27	0.11	-0.12	-0.14***
Climate for women and minorities	-0.06	0.01	-0.02	0.05**
Tuition and financial support	0.06	0.06	-0.05	-0.07***

NOTES: Z-scores are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). The following variables have missing values (numbers reflect weighted missing values): Guidance, support, and professional development (398 missing), Reputation (122 missing), Curriculum, instruction, and research training (160 missing), Climate for women and minorities (1,859 missing), and Tuition and financial support (371 missing).

** Difference between Cohort 1 and Cohort 4 was statistically significant at .01 level (adjusted).

*** Difference between Cohort 1 and Cohort 4 was statistically significant at .001 level (adjusted).

Research Activities, Training, and Choice

We also examined respondents' perceptions about the frequency of research activities, interdisciplinary research, collaboration, and professional conversations during graduate school. As shown in Exhibit 3.3, the GRFP did not have any impact on these outcome measures between QG2 Fellows and HM designees. However, both additional models in Exhibit B.2 (the rationales for and details of these additional models are in Appendix B) show small positive moderating effects on respondents' perceptions about the frequency of research activities (.135 in the "population average" model and .136 in the "institutional average" model), suggesting that, once other factors are controlled for, the GRFP may positively affect respondents' perceptions about the frequency of research activities.

Exhibit 3.3. Estimated Impact of the GRFP Fellowship on Reported Frequency of Research Activities and Collaboration During Graduate School

Outcome	Impact
Research activities	0.024
Collaboration	0.000
Professional conversations and discussions	0.024
Interdisciplinary research	-0.012

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted.

Although we did not observe any impact of the GRFP on the reported frequency of research activities and collaboration during graduate school in Exhibit 3.3, Exhibit 3.4 shows that Fellows in Cohort 4 reported three of the four activities more frequently than Fellows in Cohort 1: research activities, collaboration, and interdisciplinary research.

Exhibit 3.4. Reported Frequency of Research Activities and Collaboration During Graduate School Among Fellows by Cohort, Z-scores

Outcome	Cohort 1 (*N*=4,025)	Cohort 2 (*N*=4,988)	Cohort 3 (*N*=3,717)	Cohort 4 (*N*=5,171)
Research activities	-0.22	0.05	0.14	0.03***
Collaboration	-0.16	0.03	0.07	0.11***
Professional conversations and discussions	-0.02	0.04	-0.01	0.02
Interdisciplinary research	-0.16	-0.01	0.08	0.13***

NOTES: Z-scores are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). The following variables have missing values (numbers reflect weighted missing values): Research activities (109 missing), Collaboration (139 missing), Professional conversations and discussions (93 missing), and Interdisciplinary research (123 missing).

*** Difference between Cohort 1 and Cohort 4 was statistically significant at .001 level (adjusted).

As shown in Exhibit 3.5, the GRFP did appear to impact experiences related to graduate school training and instruction, with small negative impacts on perceptions of the amount of training or instruction received in research, teaching, industry, and policy and opportunities to engage in research activities through training.

Exhibit 3.5. Estimated Impact of the GRFP Fellowship on Graduate School Training and Instruction

Outcome	Impact
Received training or instruction in research, teaching, industry, and policy	-0.100*
Opportunities to engage in research activities through training	-0.102**
Opportunities to learn and develop career and professional skills	-0.075

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted.

* Difference between the indicated group and HM designees was statistically significant at .05 level (adjusted). [10]

** Difference between the indicated group and HM designees was statistically significant at .01 level (adjusted).

Exhibit 3.6 shows that, while the GRFP had a negative impact on two of the three measures shown in Exhibit 3.5, and no impact on the third, Fellows' reports about their experiences related to graduate school training and instruction became more positive between Cohort 1 and Cohort 4 on all three measures.

Exhibit 3.6. Graduate School Training and Instruction Among Fellows by Cohort, Z-scores

Outcome	Cohort 1 (*N*=4,025)	Cohort 2 (*N*=4,988)	Cohort 3 (*N*=3,717)	Cohort 4 (*N*=5,171)
Received training or instruction in research, teaching, industry, and policy	-0.29	-0.13	0.06	0.23***
Opportunities to engage in research activities through training	-0.27	-0.10	0.04	0.21***
Opportunities to learn and develop career and professional skills	-0.36	-0.06	0.11	0.23***

NOTES: Z-scores are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). The following variables have missing values (numbers reflect weighted missing values): Received training or instruction (334 missing), Opportunities to engage in research activities (334 missing), and Opportunities to learn and develop career and professional skills (160 missing).

*** Difference between Cohort 1 and Cohort 4 was statistically significant at .001 level (adjusted).

The survey included questions about the extent to which respondents could choose their own research projects and had flexibility to change their departments, advisors, or field of study. The GRFP had a mixed impact on these outcomes, shown in Exhibit 3.7. The program had no impact on perceptions of the ease with which respondents believed they could change departments or their advisors, or whether or not

[10] The term "adjusted" refers to the Benjamini-Hochberg adjustment described in Chapter 2: Data and Methods.

they changed fields of study during graduate school. However, the program had a small positive impact on perceptions of the extent to which they could choose their own research projects.

The additional model that includes institutional effects as well as moderating effects of demographic variables ("institutional average" in Exhibit B.4; the rationales for and details of these additional models are in Appendix B) shows a small positive effect size (.131) of the GRFP on perceptions of the ease with which respondents believed they could change advisors, suggesting that, once other factors are controlled for, the GRFP may positively affect respondents' perceptions of the ease of changing advisors.

Exhibit 3.7. Estimated Impact of the GRFP Fellowship on Flexibility and Choice During Graduate School

Outcome	Impact
Opportunities to choose research projects	0.102**
Ease changing departments	-0.054
Ease changing advisors	0.021
Changed field of study	-0.057

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted.

** Difference between the indicated group and HM designees was statistically significant at .01 level (adjusted).

Exhibit 3.8 provides context for Exhibit 3.7 in several ways. First, in addition to the GRFP having a positive impact on perceptions of opportunities to choose research projects, Cohort 4 Fellows expressed increased perceptions of such opportunities compared to Cohort 1 Fellows. Although the GRFP had no impact on perceptions of the ease of changing departments or whether or not students actually changed fields of study during graduate school, Cohort 4 Fellows had more positive perceptions of the ease of changing departments, yet changed fields of study less frequently compared to Cohort 1 Fellows.

Exhibit 3.8. Flexibility and Choice During Graduate School Among Fellows by Cohort

Outcome	Cohort 1 (*N*=4,025)	Cohort 2 (*N*=4,988)	Cohort 3 (*N*=3,717)	Cohort 4 (*N*=5,171)
Opportunities to choose research projects (Z-score)	-0.08	0.07	0.04	0.10***
Ease changing departments (Z-score)	-0.05	-0.02	-0.01	0.04*
Ease changing advisors (Z-score)	0.05	0.05	-0.07	0.01
Changed field of study (percentage)	7.8%	7.8%	4.7%	4.6%***

NOTES: Z-scores and table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). The following variables have missing values (numbers reflect weighted missing values): Opportunities to choose research projects (163 missing), Ease changing departments (301 missing), Ease changing advisors (271 missing), and Changed field of study (59 missing).

* Difference between Cohort 1 and Cohort 4 was statistically significant at .05 level (adjusted).

*** Difference between Cohort 1 and Cohort 4 was statistically significant at .001 level (adjusted).

As shown in Exhibit 3.9, the program had no impact on attitudes toward the faculty and their peers. However, both additional models in Exhibit B.5 show small positive moderating effects on positive attitudes toward faculty among students studying Geosciences (.251 in the "population average" model and .256 in the "institutional average" model), indicating that the GRFP may more positively impact the attitudes of Fellows studying Geosciences toward their peers compared to Fellows studying other fields.

Exhibit 3.9. Estimated Impact of the GRFP Fellowship on Positive Attitude Towards Graduate School Faculty and Peers

Outcome	Impact
Positive attitude towards faculty	0.018
Positive attitude towards peers	-0.016

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted.

Exhibit 3.10 shows that, although the GRFP did not impact positive attitudes towards faculty members, Cohort 4 Fellows had more positive attitudes about faculty members compared to Cohort 1 Fellows.

Exhibit 3.10. Positive Attitude Towards Graduate School Faculty and Peers Among Fellows by Cohort, Z-scores

Outcome	Cohort 1 (*N*=4,025)	Cohort 2 (*N*=4,988)	Cohort 3 (*N*=3,717)	Cohort 4 (*N*=5,171)
Positive attitude towards faculty	-0.04	0.04	-0.02	0.08**
Positive attitude towards peers	0.02	0.08	-0.06	-0.02

NOTES: Z-scores are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). The following variables have missing values (numbers reflect weighted missing values): Positive attitude towards faculty (270 missing), and Positive attitude towards peers (150 missing).

** Difference between Cohort 1 and Cohort 4 was statistically significant at .01 level (adjusted).

Research Productivity during Graduate School

To examine the impact of the GRFP Fellowship on participants' working patterns during graduate school, we asked respondents whether they worked for pay during graduate school, and if so, the average number of hours they worked per week, and whether they had an internship. As shown in Exhibit 3.11, the GRFP did not have an impact on the number of hours worked or on the likelihood of awardees obtaining an internship, but had a medium-sized negative impact on the likelihood of working for pay. Additionally, both additional models in Exhibit B.6 show a large negative moderating effect on the average hours working per week among students studying Psychology (-.719 in the population average model and -.798 in the institutional average model), indicating that the GRFP may reduce the number of hours worked by Fellows studying Psychology to a greater degree than Fellows studying other fields.

Exhibit 3.11. Estimated Impact of the GRFP Fellowship on Working and Internships During Graduate School

Outcome	Impact
Worked for pay	-0.320**
Average hours working per week	-0.022
Had an internship	-0.149

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted.

** Difference between the indicated group and HM designees was statistically significant at .01 level (adjusted).

In addition to the medium-sized negative impact on working for pay during graduate school, Exhibit 3.12 shows that Cohort 4 Fellows were less likely to have worked for pay compared to Cohort 1 Fellows. In

addition, although the GRFP had no impact on having had an internship during graduate schools, Cohort 4 Fellows were less likely to have had an internship during graduate school compared to Cohort 1 Fellows (although it should be noted that Cohort 4 Fellows may still have been enrolled in graduate school at the time of the survey).

Exhibit 3.12. Working and Internships During Graduate School Among Fellows by Cohort

Outcome	Cohort 1 (*N*=4,025)	Cohort 2 (*N*=4,988)	Cohort 3 (*N*=3,717)	Cohort 4 (*N*=5,171)
Worked for pay	21.4%	16.3%	18.4%	11.9%***
Average hours working per week	11.78	10.54	9.65	10.25
Had an internship	14.7%	13.2%	17.7%	9.6%***

NOTES: Table means and percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). The following variables have missing values (numbers reflect weighted missing values): Worked for pay (412 missing), Average hours working per week (25 missing), and Had an internship (419 missing).

*** Difference between Cohort 1 and Cohort 4 was statistically significant at .001 level (adjusted).

We also asked respondents about their research productivity while in graduate school, defined as the number of papers presented at national conferences, the number of papers presented at international conferences, the number of refereed journal articles published as the primary author or co-author, the number of patents applied for, and the number of grants and contracts applied for as the Primary Investigator (PI) or co-PI. While there was no impact on the number of papers presented at national meetings or the number of refereed journal articles, the program had a small positive impact on the number of papers presented at international meetings (Exhibit 3.13).

The additional models in Exhibit B.7 show two small to medium sized positive moderating effects for Fellows studying Geosciences: in the "institutional average" model on the number of papers presented at national meetings (.300) and in the "population average" model on the number of papers presented at international meetings (.423). These results may indicate that the GRFP more positively impacts Fellows studying Geosciences compared to other fields of study on the number of papers presented at both types of meetings.

Exhibit 3.13. Estimated Impact of the GRFP Fellowship on Presentations and Publications During Graduate School

Outcome	Impact
Number of papers presented at national meetings	0.064
Number of papers presented at international meetings	0.125**
Number of refereed journal articles published as primary or co-author	0.063

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted.

** Difference between the indicated group and HM designees was statistically significant at .01 level (adjusted).

Exhibit 3.14 shows that Fellows in Cohorts 1, 2, and 3 presented similar numbers of papers at both national (between 2.19 and 2.31 by cohort) and international meetings (between 1.52 and 1.66 by cohort), and published similar numbers of refereed journal articles (between 3.46 and 4.16 by cohort). Although Fellows in Cohort 4 participated in all three activities at a lower level than members of the other three cohorts, many members of Cohort 4 were still enrolled in graduate school at the time of the survey.

Exhibit 3.14. Presentations and Publications During Graduate School Among Fellows by Cohort

Outcome	Cohort 1 (*N*=4,025)	Cohort 2 (*N*=4,988)	Cohort 3 (*N*=3,717)	Cohort 4 (*N*=5,171)
Number of papers presented at national meetings	2.19	2.31	2.28	1.70***
Number of papers presented at international meetings	1.52	1.64	1.66	1.34***
Number of refereed journal articles published as primary or co-author	3.46	4.16	3.87	1.53***

NOTES: Table means are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). The following variables have missing values (numbers reflect weighted missing values): Number of papers presented at national meetings (445 missing), Number of papers presented at international meetings (445 missing), and Number of refereed journal articles published as primary or co-author (750 missing).

*** Difference between Cohort 1 and Cohort 4 was statistically significant at .001 level (adjusted).

As shown in Exhibit 3.15, the GRFP had no impact on the number of patents applied for but decreased the likelihood that QG2 Fellows applied for a grant or contract as the PI or co-PI during graduate school[11]. The effect size indicates that this difference between QG2 Fellows and HM designees was medium-sized.

[11] The survey did not define grants or contracts, and asked respondents: "Did you apply to any of the following types of grants/contracts as a Principal Investigator (PI) or Co-PI while in graduate school?" The respondent was asked to identify which of the following types of grants/contracts he or she had applied for: Federal government, state government, local government, foundation, business/industry, employing organization, not-for-profit agency, and professional society or association.

The additional models in Exhibit B.8 show several moderating effects on the number of patents applied for during graduate school. The population average model shows a large positive moderating effect on Fellows studying Mathematical Sciences (13.294) and a large negative moderating effect on Fellows studying Social Sciences (-11.544), and the institutional average model shows a large positive moderating effect on female Fellows (.719). Together, these results suggest that the GRFP more positively impacts women and Fellows studying Mathematical Sciences, and more negatively impacts Fellows studying Social Sciences, compared to other fields of study or male students, in terms of the number of patents applied for during graduate school. However, as Exhibit 3.16 shows, applying for patents during graduate school is a relatively uncommon activity, so these results could be unduly influenced by outliers.

Exhibit 3.15. Estimated Impact of the GRFP Fellowship on Grant and Patent Applications During Graduate School

Outcome	Impact
Number of patents applied for	-0.198
Applied to at least one grant/contract as PI or Co-PI	-0.342**

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted.

** Difference between the indicated group and HM designees was statistically significant at .01 level (adjusted).

Exhibit 3.16 shows that the mean number of patents applied for was less than one-quarter per Fellow in all cohorts, and that between 24.2 percent and 33.7 percent of Fellows in each cohort reported applying for at least one grant or contract as PI or co-PI during graduate school. Furthermore, the proportion of Cohort 4 Fellows who reported applying for at least one grant or contract as PI or co-PI during graduate school was greater than that of Cohort 1 Fellows.

Exhibit 3.16. Grant and Patent Applications During Graduate School Among Fellows by Cohort

Outcome	Cohort 1 (*N*=4,025)	Cohort 2 (*N*=4,988)	Cohort 3 (*N*=3,717)	Cohort 4 (*N*=5,171)
Number of patents applied for	0.14	0.18	0.21	0.11
Applied to at least one grant/contract as PI or Co-PI	29.2%	33.2%	33.7%	24.2%*

NOTES: Table means and percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). The following variables have missing values (numbers reflect weighted missing values): Number of patents applied for (634 missing), and Applied to at least one grant/contract as PI or Co-PI (611 missing).

* Difference between Cohort 1 and Cohort 4 was statistically significant at .05 level (adjusted).

Degree Attainment and Time to Degree

The GRFP had a medium-sized positive impact on doctoral degree attainment (Exhibit 3.17), with QG2 Fellows being more likely than HM designees to have earned a doctorate degree within 10 years of starting the program, but about equally likely to have earned a master's degree within 5 years of starting the program.

Exhibit 3.17. Estimated Impact of the GRFP Fellowship on Graduate Degree Attainment

Outcome	Impact
Earned a master's degree within 5 years	0.040
Earned a Ph.D. within 10 years	0.440**

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted.

** Difference between the indicated group and HM designees was statistically significant at .01 level (adjusted).

Exhibit 3.18 shows the percentage of Fellows in each cohort who earned a master's degree within five years of enrollment and who earned a Ph.D. within ten years of enrollment. Note that this table is not limited to Fellows who enrolled at least five or at least ten years before the time of the survey; therefore the percentages who completed either degree in Cohort 4, or the Ph.D. in Cohort 3, are lower than they will be after all Cohort members have been enrolled for at least five years (for master's degree completion) or at least ten years (for Ph.D. completion). Because of this difference, significance tests were not run between Cohorts 1 and 4 in this exhibit.

Exhibit 3.18. Graduate Degree Attainment Among Fellows by Cohort

Outcome	Cohort 1 (*N*=4,025)	Cohort 2 (*N*=4,988)	Cohort 3 (*N*=3,717)	Cohort 4 (*N*=5,171)
Earned a master's degree within 5 years	44.0%	39.3%	36.3%	18.8%
Earned a Ph.D. within 10 years	78.1%	86.7%	47.8%	0.6%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses).

As shown in Exhibit 3.19, among those who completed either their masters or doctorate degrees, there was no difference between QG2 Fellows and HM designees with respect to number of years they took to obtain their degrees. It appears as if the impact of the program is in preventing attrition from the program rather than in reducing the actual time to complete the degree.

Exhibit 3.19. Estimated Impact of the GRFP Fellowship on Time to Degree Completion

Outcome	Impact
Years taken to complete master's degree	-0.003
Years taken to complete Ph.D.	-0.001

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted.

* Difference between the indicated group and HM designees was statistically significant at .05 level (adjusted).

** Difference between the indicated group and HM designees was statistically significant at .01 level (adjusted).

Exhibit 3.20 shows the mean number of years taken to complete the master's degree and the Ph.D. among Fellows, by cohort. Note that, because members of each cohort enrolled in graduate school at different times, this measure encompasses different time frames for each cohort. For example, only 27 members of Cohort 4 reported completing a Ph.D. at the time of the survey, and these 27 Fellows completed the Ph.D. relatively quickly (4.37 years). However, this exhibit does not capture time to degree for the thousands of Cohort 4 Fellows who will presumably complete a Ph.D. in the future, whose inclusion would increase the mean time to degree for the group. Because of this difference in time frame for each cohort, and the fact that the table excludes Fellows who will complete a master's degree or Ph.D. in the future, the majority of whom are in later cohorts, significance tests were not run between Cohorts 1 and 4 in this exhibit, and observed differences should be understood as possible directions for future study rather than conclusions to be drawn from this evaluation.

Exhibit 3.20. Time to Degree Completion Among Fellows by Cohort

Outcome	Cohort 1	Cohort 2	Cohort 3	Cohort 4
Years taken to complete master's degree	(*N*=1,839)	(*N*=2,039)	(*N*=1,377)	(*N*=1,007)
	2.31	2.34	2.27	2.00
Years taken to complete Ph.D.	(*N*=3,288)	(*N*=4,397)	(*N*=1,786)	(*N*=29)
	6.35	6.02	5.57	4.37

NOTES: Table means are based on weighted, non-missing data. Individual cell Ns represent the weighted number of respondents who reported completing the indicated degree (including those missing information on the years taken to complete the degree). The following variables have missing values (numbers reflect weighted missing values): Years taken to complete master's degree (109 missing), and Years taken to complete Ph.D. (15 missing).

Summary of Program Impacts on Graduate School Experiences and Attainment

Our analyses indicate that the GRFP affected Fellows' graduate school experiences in several ways. First and foremost, the program had a medium-sized positive impact on the likelihood of completion of a Ph.D. within ten years, indicating that QG2 Fellows are more likely to complete their degree program than non-Fellow HM designees, although the program did not appear to affect actual time to degree. QG2 Fellows also reported more flexibility in choosing their own research project and presented more papers at international meetings compared to HM designees (with a small effect indicated by the impact analysis).

Some of the findings with respect to working for pay and applying for external funding (grants or contracts as a PI or co-PI) reflect current program policies and practices. For example, the program places restrictions on work for pay and also offers three years of full funding, which reduces the need to find sources of financial support. The impact analysis indicates that the GRFP program has a medium-sized negative impact on working for pay and applying for grants or contracts during graduate school. In addition, QG2 Fellows reported (by a small margin) fewer opportunities to receive training or instruction on research, teaching, industry, or policy and to engage in research activities through training compared to HM designees, which may also reflect program restrictions on paid opportunities.

Differential Impacts of the GRFP on Women and URMs

While we focused on overall effects of the GRFP on graduate school experiences in this chapter, we also investigated whether GRFP participation had different effects for different subpopulations, particularly women and URMs. Additional regression analyses (described in Appendix B) found differential effects of GRFP participation for some subpopulations on some of the outcomes, which are described above, including one differential effect on women (positive impact on the number of patents applied for during graduate school; Exhibit B.8). The GRFP program had no differential impacts on URMs or students with disabilities on the graduate school experiences examined above.

Chapter 4: Impacts on Careers and Professional Development

This chapter focuses on program impacts on experiences after graduate school, including career outcomes and professional development (addressing RQ2: *What is the impact of the GRFP Fellowship on career outcomes?*) using the same approach described in the previous section. As before, all results of the impact analyses reported here are based on comparisons of QG2 Fellows and HM designees, although here the analyses include the results from only those respondents who were no longer enrolled in graduate school at the time of the survey. The analyses in this chapter included as covariates the respondents' highest degree attained and broad job field in addition to the covariates included in the analyses in the preceding chapter. Impact estimates for work activities, productivity, and service also include whether respondents were currently employed in an academic job within the education sector as an additional covariate. The full set of results is presented in Appendix B.

To provide context on how the outcome measures may have changed over time, we present alongside each impact table a second table showing the outcome measure for all Fellows (including both QG1 and QG2 Fellows) in each of the four cohorts included in this evaluation. However, please note that differences between cohorts do not necessarily represent changes over time, as different program policies were in effect, and different amounts of time have passed, for different cohorts.

As described in Chapter 2*: Data and Methods*, we adjusted significance tests to account for multiple hypothesis tests, and the adjusted standards were applied to the impact estimates discussed in the remainder of this chapter.

Evidence of GRFP Impact on Fellows

The following subsections discuss evidence of program impact on Fellows on various outcome measures related to post-graduate experiences, including careers and professional development.

Employment Status and Jobs

As shown in Exhibit 4.1, there was no impact of the GRFP on employment status. QG2 Fellows and HM designees were equally likely to be currently employed rather than not currently working for pay. However, the population average model in Exhibit B.16 shows a large positive effect size for current employment (1.978), suggesting that when other moderating factors are accounted for (particularly field

of graduate study) the GRFP has a net positive impact on current employment. The population average model in Exhibit B.16 also shows several large moderating effects on current employment by field of graduate study: a positive moderating effect for Fellows studying Computer and Information Sciences and Engineering (11.991) and negative moderating effects for Fellows studying Engineering (-2.169), Life Sciences (-2.081), Mathematical Sciences (-2.332), Physics and Astronomy (-2.753), and Social Sciences (-2.116). However, as Exhibit 4.2 shows, nearly all Fellows are employed, so these results could be unduly influenced by outliers.

Exhibit 4.1. Estimated Impact of the GRFP Fellowship on Employment Status

Outcome	Impact
Currently employed	-0.033

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted.

Exhibit 4.2 demonstrates that Fellows are highly likely to be currently employed, with rates ranging from 93.9 percent to 95.0 percent currently employed in Cohorts 1, 2, and 3. Many members of Cohort 4 were still enrolled in graduate school at the time of the survey (resulting in a very small *N* of 152 members of Cohort 4 included in this measure); therefore, the lower rate of current employment among Cohort 4 Fellows (62.6 percent) should not be taken as evidence of a trend. No significance tests were run between Cohort 1 and Cohort 4 Fellows because of this limitation.

Exhibit 4.2. Employment Status Among Fellows by Cohort

Outcome	Cohort 1 (*N*=3,998)	Cohort 2 (*N*=4,900)	Cohort 3 (*N*=2,063)	Cohort 4 (*N*=152)
Currently employed	95.0%	94.9%	93.9%	62.6%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). The following variable has missing values (number reflects weighted missing values): Currently employed (302 missing).

In addition to having no impact on current employment status, being awarded a GRFP Fellowship did not have an impact on type of employment, as both QG2 Fellows and HM designees were equally likely to be employed in a field related to their graduate studies, both immediately after graduation as well as in their current position (Exhibit 4.3).

Exhibit 4.3. Estimated Impact of the GRFP Fellowship on Employment in Field Related to Field of Graduate Studies

Outcome	Impact
Current or most recent job related to field of graduate studies	-0.038
First job after graduate school was related to field of graduate studies	-0.034

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted.

Exhibit 4.4 shows that Fellows in Cohorts 1, 2, and 3 were roughly equally likely to have a current or most recent job that is related to their field of graduate study (between 88.2 percent and 93.4 percent by cohort). Similarly, the first job held by Fellows in Cohorts 1, 2, and 3 was equally likely to be related to their field of graduate study (between 91.0 and 93.5 percent by cohort). Although the rates of both measures are lower for members of Cohort 4, the relatively small number of Cohort 4 Fellows who are no longer enrolled in graduate school (and hence eligible for employment-related questions in the survey) prevents any concrete conclusions from being drawn about the employment status of members of Cohort 4. No significance tests were run between Cohort 1 and Cohort 4 Fellows because of this limitation.

Exhibit 4.4. Employment in Field Related to Field of Graduate Studies Among Fellows by Cohort

Outcome	Cohort 1 (*N*=3,998)	Cohort 2 (*N*=4,900)	Cohort 3 (*N*=2,063)	Cohort 4 (*N*=152)
Current or most recent job related to field of graduate studies	88.2%	92.8%	93.4%	73.3%
First job after graduate school was related to field of graduate studies	91.0%	93.2%	93.5%	67.2%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). The following variables have missing values (numbers reflect weighted missing values): Current or most recent job related to field of graduate studies (342 missing), and First job after graduate school was related to field of graduate studies (86 missing).

Work Activities, Research Productivity, and Service

We also examined respondents' primary work activities after graduation, such as activities related to professional services, teaching, management and administration, and research and development. Exhibit 4.5 shows that the GRFP had no impact on the likelihood of reporting research and development, teaching, management or administration, or professional services as primary work activities.

The additional models in Exhibit B.11 show several moderating effects on respondents' primary work activities after graduation. Both additional models show a large positive moderating effect (.915 in the

population average model and .916 in the institutional average model) on the likelihood of Fellows studying Physics and Astronomy reporting teaching as a primary work activity. The institutional average model shows medium-sized negative moderating effects on the likelihood of Fellows studying Engineering (-.555) and Life Sciences (-.567), and a large positive moderating effect on the likelihood of Fellows studying Mathematical Sciences (1.387), reporting management or administration as a primary work activity. The population average model shows a medium-sized positive moderating effect (.594) on the likelihood of Fellows studying Engineering reporting professional services as a primary work activity.

Exhibit 4.5. Estimated Impact of the GRFP Fellowship on Primary Work Activities Since Graduate School

Outcome	Impact
Research and development	0.188
Teaching	0.200
Management or administration	-0.169
Professional services	-0.179

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted.

Exhibit 4.6 shows Fellows' reports of their primary work activities at their current or most recent job by cohort. Because this exhibit presents Fellows' primary work activities at different points in their career, no significance tests were run on the exhibit.

Exhibit 4.6. Primary Work Activities Since Graduate School Among Fellows by Cohort

Outcome	Cohort 1 (*N*=3,998)	Cohort 2 (*N*=4,900)	Cohort 3 (*N*=2,063)	Cohort 4 (*N*=152)
Research and development	62.0%	70.4%	78.2%	53.7%
Teaching	33.2%	30.9%	15.1%	9.2%
Management or administration	22.2%	13.7%	10.1%	12.1%
Professional services	11.8%	11.3%	10.7%	37.9%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). The following variables have missing values (numbers reflect weighted missing values): Research and development (413 missing), Teaching (413 missing), Management or administration (413 missing), and Professional services (413 missing).

As shown in Exhibit 4.7, the GRFP had small to medium-sized impacts on the number of research products produced after graduation, including papers presented at national or international conferences,

refereed journal articles, and the total number of publications. Additionally, the population average model in Exhibit B.12 shows a small-to-medium-sized negative moderating effect (-.266) on the total number of publications (any source) among students studying Social Sciences, indicating that the GRFP has a less positive effect on this outcome measure for Fellows studying Social Sciences compared to other fields of study.

Exhibit 4.7. Estimated Impact of the GRFP Fellowship on Presentations and Publications After Graduate School

Outcome	Impact
Number of papers presented at national or international meetings	0.254**
Publications: any source, as primary- or co-author	0.213*
Publications: refereed journal articles, as primary- or co-author	0.254**

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted.

* Difference between the indicated group and HM designees was statistically significant at .05 level (adjusted).

** Difference between the indicated group and HM designees was statistically significant at .01 level (adjusted).

Exhibit 4.8 displays the mean number of presentations and publications reported by Fellows in each cohort. Because this exhibit presents data over a different amount of time for each cohort (i.e., Cohort 1 Fellows have generally been working for much longer than Cohort 3 or 4 Fellows), no significance tests were run on the exhibit.

Exhibit 4.8. Presentations and Publications After Graduate School Among Fellows by Cohort

Outcome	Cohort 1 (*N*=3,998)	Cohort 2 (*N*=4,900)	Cohort 3 (*N*=2,063)	Cohort 4 (*N*=152)
Number of papers presented at national or international meetings	13.95	7.09	2.02	0.58
Publications: any source, as primary- or co-author	14.84	7.65	2.09	0.52
Publications: refereed journal articles, as primary- or co-author	10.50	5.36	1.55	0.45

NOTES: Table means are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). The following variables have missing values (numbers reflect weighted missing values): Number of papers presented at national or international meetings (616 missing), Publications: any source (1,044 missing), and Publications: refereed journal articles (1044 missing).

Compared to the data on presentations and publications in Exhibit 4.7, the pattern of results was more mixed with respect to patents and grants (Exhibit 4.9). The GRFP had a small to medium-sized impact on

the likelihood of being awarded grants and contracts as a PI after graduate school, but no impact on the number of patents sought and awarded.

The additional models in Exhibit B.13 show several moderating effects on the number of patents awarded and the number of grants and contracts awarded as PI after graduate school. First, the population average model shows a large negative effect size on the number of patents sought and awarded after graduate school (-1.432), indicating that when other factors (particularly field of study) are controlled for, the GRFP may negatively impact the number of patents applied for after graduate school (although this analysis does not control for the type of job held). Furthermore, the population average model showed the following large moderating effects on the number of patents sought and awarded after graduate school by field of study: positive effects on Fellows studying Chemistry (1.978), Computer and Information Sciences and Engineering (1.731), Engineering (1.431), and Physics and Astronomy (2.012) and a negative effect on Fellows studying Geosciences (-9.591). Note that the institutional average model for this outcome measure did not run, possibly indicating insufficient numbers of Fellows awarded patents within certain fields of study, which may imply that caution is warranted when interpreting the results of the population average model for this outcome measure.

The institutional average model shows two negative moderating effects on the number of grants and contracts awarded as a PI after graduate school: a small-to-medium-sized negative moderating effect for Fellows studying Chemistry (-.328) and a medium-sized negative moderating effect for URMs (-.646).

Exhibit 4.9. Estimated Impact of the GRFP Fellowship on Patents, Grants, and Contracts After Graduate School

Outcome	Impact
Patents sought and awarded	0.049
Number of grants and contracts awarded as PI	0.250*

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted.

* Difference between the indicated group and HM designees was statistically significant at .05 level (adjusted).

Exhibit 4.10 displays the mean number of patents sought and awarded and grants and contracts awarded as PI as reported by Fellows in each cohort. Because this exhibit presents data over a different amount of time for each cohort (i.e., Cohort 1 Fellows have generally been working for much longer than Cohort 3 or 4 Fellows), no significance tests were run on the exhibit.

Exhibit 4.10. Patents, Grants, and Contracts After Graduate School Among Fellows by Cohort

Outcome	Cohort 1 (*N*=3,998)	Cohort 2 (*N*=4,900)	Cohort 3 (*N*=2,063)	Cohort 4 (*N*=152)
Patents sought and awarded	0.82	0.18	0.05	0.00
Number of grants and contracts awarded as PI	2.76	1.54	0.35	0.00

NOTES: Table means are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). The following variables have missing values (numbers reflect weighted missing values): Patents sought and awarded (1,281 missing), and Number of grants and contracts awarded as PI (996 missing).

In terms of professional service activities since graduation, we observed a mixture of null and positive impacts. The GRFP did not impact the likelihood of providing service to the K–12 system or providing editorial services, but had medium-sized positive impacts on the likelihood of serving on a committee or panel and providing review services, as shown in Exhibit 4.11.

Exhibit 4.11. Estimated Impact of the GRFP Fellowship on Professional Service Activities Since Graduate School

Outcome	Impact
Service to K–12 system, students, and professionals	0.161
Editorial services	0.277
Committee or panel participation	0.354**
Review services	0.273**

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted.

** Difference between the indicated group and HM designees was statistically significant at .01 level (adjusted).

Exhibit 4.12 presents data on the participation of Fellows in each cohort in the professional service activities examined in Exhibit 4.11. Because this exhibit presents Fellows' professional service activities at different points in their career, no significance tests were run on the exhibit.

Exhibit 4.12. Professional Service Activities Since Graduate School Among Fellows by Cohort

Outcome	Cohort 1 (*N*=3,998)	Cohort 2 (*N*=4,900)	Cohort 3 (*N*=2,063)	Cohort 4 (*N*=152)
Service to K–12 system, students, and professionals	21.0%	18.1%	11.6%	12.1%
Editorial services	19.2%	8.5%	2.7%	2.2%
Committee or panel participation	63.3%	52.8%	25.6%	6.4%
Review services	67.7%	65.7%	51.0%	12.6%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). The following variables have missing values (numbers reflect weighted missing values): Service to K–12 system (441 missing), Editorial services (441 missing), Committee or panel participation (441 missing), and Review services (441 missing).

As Exhibit 4.13 shows, the GRFP had no impact on the likelihood of engaging in teaching activities after graduation.

Exhibit 4.13. Estimated Impact of the GRFP Fellowship on Teaching Activities Since Graduate School

Outcome	Impact
Participated in any teaching activities	0.197

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted.

Exhibit 4.14 presents data on the participation of Fellows in each cohort in teaching activities. Because this exhibit presents Fellows' teaching activities at different points in their career, no significance tests were run on the exhibit.

Exhibit 4.14. Teaching Activities Since Graduate School Among Fellows by Cohort

Outcome	Cohort 1 (*N*=3,998)	Cohort 2 (*N*=4,900)	Cohort 3 (*N*=2,063)	Cohort 4 (*N*=152)
Participated in any teaching activities	82.7%	78.9%	63.3%	45.0%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). The following variable has missing values (number reflects weighted missing values): Participated in any teaching activities (659 missing).

Summary of Program Impacts on Careers and Professional Development

Our analyses indicate that, in addition to the GRFP's positive impacts on Fellows' graduate school experiences reported earlier, the program also had several clearly positive impacts on Fellows' post-graduate careers and experiences.

The GRFP had small to medium-sized impacts on the number of papers presented at national or international meetings, the number of papers published (both in refereed journals and overall), and the number of grants and contracts awarded as a PI after graduate school. Additionally, the analysis indicated no negative impacts of being a Fellowship participant on post-graduate careers and experiences. These results suggest that the program is succeeding in its goal of developing high-achieving scientists and engineers. Similarly, the program had medium-sized positive impacts on the likelihood of serving on a committee or panel and providing review services, both activities related to successful STEM-related careers.

Differential Impacts of the GRFP on Women and URMs

While we focused on overall effects of the GRFP on career and professional development outcome measures in this chapter, we also investigated whether GRFP participation had different effects for different subpopulations, particularly women and URMs. Additional regression analyses (described in Appendix B) found differential effects of GRFP participation for some subpopulations on some of the outcomes, which are described above, including one differential effect on URMs (negative impact on the number of patents applied for after graduate school; Exhibit B.13). The GRFP program had no differential impacts on women or students with disabilities on the career and professional development outcome measures examined above.

Chapter 5: Selected Characteristics of GRFP Fellows and Honorable Mention Designees

This chapter describes the demographic and educational backgrounds of GRFP Fellows and QG2 HM designees, disaggregated by gender, URM status, and disability status, including changes over time, in order to provide context for the results presented in Chapters 3 and 4, address the first goal of the evaluation (to provide descriptive information related to the GRFP goals on the demographics, educational decisions, career preparation, aspirations and progress, as well as professional productivity, of GRFP Fellows and comparable non-recipient applicants and national populations of graduate students and doctorate recipients), and also partially address RQ4 (*Is the program design effective in meeting program goals?*).

Characteristics of the GRFP Survey Population

Exhibit 5.1 presents the characteristics of the overall survey population of GRFP Fellows and HM designees from 1994–2011. Overall, women accounted for a little over half of all Fellows during this time period (50.5 percent) but less than 40 percent (39.5 percent) of HM designees. Among Fellows, women tended to be underrepresented in QG1 (44.4 percent) compared with QG2 (57.4 percent).

About 8 percent of Fellows (7.9 percent) were Hispanic compared with 6.6 percent of HM designees. Whites accounted for 79.9 percent of the Fellows and 83.3 percent of HM designees, and Asians accounted for 10.7 percent of Fellows and 8.9 percent of HM designees. Just over 4 percent of Fellows were black (4.2 percent) compared with 2.5 percent of HM designees. Overall, URMs accounted for 14.2 percent of all Fellows and 11.1 percent of HM designees. Students with disabilities represented about 3 percent of each group.

Overall, a little over 40 percent of Fellows and HM designees had mothers with graduate degrees (master's, doctoral, or professional degree) and close to 60 percent had fathers with graduate degrees, with fairly similar distributions between Fellows and HM designees.

Exhibit 5.1. Demographic Characteristics of the Survey Population of GRFP Fellows and Honorable Mention Designees, 1994–2011

	QG1 Fellows (*N*=9,417)	QG2 Fellows (*N*=8,484)	All Fellows (*N*=17,901)	QG2 Honorable Mention Designees (*N*=9,302)
Gender				
Female	44.4%	57.4%	50.5%	39.6%
Male	55.6%	42.6%	49.5%	60.4%
Ethnicity				
Hispanic	7.5%	8.3%	7.9%	6.6%
Non-Hispanic	92.5%	91.7%	92.1%	93.4%
Race				
White	80.4%	79.4%	79.9%	83.3%
Asian	10.7%	10.7%	10.7%	8.9%
Black or African American	3.7%	4.9%	4.2%	2.5%
Native Hawaiian or Other Pacific Islander	0.1%	0.2%	0.2%	0.4%
American Indian or Alaska Native	0.8%	0.7%	0.8%	0.7%
Multiracial (two or more)	4.3%	4.1%	4.2%	4.2%
Underrepresented Minority (URM)				
URM	13.3%	15.3%	14.2%	11.1%
Non-URM	86.7%	84.7%	85.8%	88.9%
Disability Status				
With disabilities	3.2%	3.0%	3.1%	2.9%
Highest degree completed by Mother				
Less than a Bachelor's degree	23.1%	26.8%	24.9%	27.1%
Bachelor's degree	31.8%	32.1%	31.9%	31.2%
Master's degree (M.A., M.S., M.B.A., etc.)	30.1%	28.9%	29.5%	27.9%
Professional degree (M.D., D.D.S., J.D., Psy.D., etc.)	6.1%	5.2%	5.7%	7.2%
Research doctoral degree or Ph.D.	8.7%	6.9%	7.9%	6.4%
Highest degree completed by Father				
Less than a Bachelor's degree	19.0%	21.3%	20.1%	22.3%
Bachelor's degree	21.8%	22.4%	22.1%	23.2%
Master's degree (M.A., M.S., M.B.A., etc.)	23.0%	23.8%	23.4%	23.1%
Professional degree (M.D., D.D.S., J.D., Psy.D., etc.)	13.6%	11.9%	12.8%	13.4%
Research doctoral degree or Ph.D.	22.1%	19.8%	21.0%	17.4%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses).The following variables have missing values (numbers reflect weighted missing values): Ethnicity (409 missing), Race (694 missing), URM Status (228 missing), Disability Status (859 missing), Highest Degree completed by Mother (1136 missing), and Highest Degree completed by Father (1159 missing).

Exhibit 5.2 shows trends in the composition of the survey population of GRFP Fellows and HM designees across time for the four cohorts in our study (1994–1998, 1999–2004, 2005–2008, and 2009–2011). The percentage of women increased over time from 45.7 percent of Fellows and 23.0 percent of HM designees

in Cohort 1 (1994–1998) to 50.8 percent and 46.6 percent respectively in Cohort 4 (2009–2011), continuing the trend noted in the previous GRFP evaluation, which found that the proportion of female Fellows increased from 29 percent in 1979 to 43 percent in 1993 (Goldsmith, Presley, & Cooley, 2002). In contrast, the percentage of URMs declined slightly over time and markedly so in Cohort 2 (1999–2004). Overall, 18.1 percent of Fellows and 18.3 percent of HM designees in Cohort 1 were URMs compared with 16.7 percent of Fellows and 11.3 percent of HM designees in Cohort 4. The numbers dropped in Cohort 2, when URMs accounted for only 8.7 percent of Fellows and 6.4 percent of HM designees. We note that this drop coincides with the consolidation of the Minority Graduate Fellowship (MGF) Program (which began in 1978) into the GRFP in 1999 (MGF Fellows were considered part of the GRFP before this consolidation, and are included in the GRFP totals during the program's existence). The percentage of students with disabilities increased over time. In Cohort 1, they comprised 2.4 percent of Fellows and 2.3 percent of HM designees. By Cohort 4, this had increased to 4.4 percent of Fellows and 3.9 percent of HM designees.

Exhibit 5.2. Gender, URM, and Disability Status of the Survey Population of GRFP Fellows and Honorable Mention Designees by Award Status and Cohort

	Cohort 1 (1994–1998) (*N*=5,467)	Cohort 2 (1999–2004) (*N*=6,980)	Cohort 3 (2005–2008) (*N*=5,794)	Cohort 4 (2009–2011) (*N*=8,961)
Female				
QG1 Fellows	34.0%	43.1%	51.7%	48.5%
QG2 Fellows	59.5%	60.4%	57.0%	53.2%
All Fellows	45.7%	51.5%	54.1%	50.8%
QG2 HM designees	23.0%	36.2%	41.4%	46.6%
Male				
QG1 Fellows	66.0%	56.9%	48.3%	51.5%
QG2 Fellows	40.5%	39.6%	43.0%	46.8%
All Fellows	54.3%	48.5%	45.9%	49.2%
QG2 HM designees	77.0%	63.8%	58.6%	53.4%
URM				
QG1 Fellows	17.7%	7.3%	14.5%	14.5%
QG2 Fellows	18.6%	10.2%	13.2%	19.0%
All Fellows	18.1%	8.7%	13.9%	16.7%
QG2 HM designees	18.3%	6.4%	9.8%	11.3%
Non-URM				
QG1 Fellows	82.3%	92.7%	85.5%	85.5%
QG2 Fellows	81.4%	89.8%	86.8%	81.0%
All Fellows	81.9%	91.3%	86.1%	83.3%
QG2 HM designees	81.7%	93.6%	90.2%	88.7%
With disabilities				
QG1 Fellows	2.3%	3.1%	2.7%	4.2%

	Cohort 1 (1994–1998) (*N*=5,467)	Cohort 2 (1999–2004) (*N*=6,980)	Cohort 3 (2005–2008) (*N*=5,794)	Cohort 4 (2009–2011) (*N*=8,961)
QG2 Fellows	2.5%	1.6%	3.2%	4.5%
All Fellows	2.4%	2.4%	2.9%	4.4%
QG2 HM designees	2.3%	1.3%	2.8%	3.9%
Without disabilities				
QG1 Fellows	97.7%	96.9%	97.3%	95.8%
QG2 Fellows	97.5%	98.4%	96.8%	95.5%
All Fellows	97.6%	97.6%	97.1%	95.6%
QG2 HM designees	97.7%	98.7%	97.2%	96.1%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses).The following variables have missing values (numbers reflect weighted missing values): URM Status (228 missing) and Disability Status (859 missing).

Educational Backgrounds

Exhibit 5.3 presents selected data on the prior educational background and experiences of the three groups of applicants that were part of the evaluation (QG1 and QG2 Fellows and QG2 HM designees) aggregated across the cohorts. The majority of all three groups attended traditional four-year colleges as undergraduates. Less than one in ten (8.9 percent) Fellows and just over one in ten (10.2 percent) HM designees attended a community college at any point during their undergraduate education. A sizable number (27.3 percent of Fellows and 25.3 percent of HM designees) had participated in an NSF-sponsored program as an undergraduate. Students may apply for the GRFP either during their senior undergraduate year or during one of their first two years in graduate school; the majority reported that they received the Fellowship or Honorable Mention designation during graduate school (57.7 percent of Fellows and 72.0 percent of HM designees). Only 28.0 percent of the HM designees reported that they were designated with an Honorable Mention during their senior undergraduate year compared with 42.3 percent of the Fellows who received the award during their senior undergraduate year.

Exhibit 5.4 shows changes in educational backgrounds and experiences of Fellows across the four cohorts. The percentage of Fellows who had attended a community college at any point in their undergraduate career increased from 7.7 percent in Cohort 1 to 11.1 percent in Cohort 4 as did the percentage who had participated in an NSF-sponsored program undergraduate educational programs (from 22.1 percent to 30.5 percent). Over time, there has been a shift away from applying and receiving the award as an undergraduate. For example, while 56.4 percent of Cohort 1 Fellows were undergraduates at the time of the award, this was true of only 32.9 percent of Cohort 4 Fellows.

Exhibits 5.5 and 5.6 show the most commonly reported NSF-sponsored undergraduate programs in which GRFP applicants participated, and for Fellows, whether this changed over time. Research Experiences for Undergraduates was by far the most common NSF-sponsored undergraduate program reported by Fellows (20.2 percent) and HM designees (17.5 percent). Among Fellows, participation in this program increased over time, with 24.1 percent of Cohort 4 Fellows reporting that they3` had participated compared with 15.4 percent of Cohort 1 Fellows.

Exhibit 5.3. Educational Backgrounds and Experiences of GRFP Fellows and Honorable Mention Designees

	QG1 Fellows (*N*=9,417)	QG2 Fellows (*N*=8,484)	All Fellows (*N*=17,901)	QG2 Honorable Mention Designees (*N*=9,302)
Attended a community college as undergraduate	8.4%*	9.4%	8.9%	10.2%
Participated in a NSF-sponsored program as an undergraduate	27.1%	27.4%	27.3%	25.3%
Education level at time of Fellowship award or Honorable Mention designation				
Undergraduate student	43.3%***	41.2%***	42.3%***	28.0%
Graduate student	56.7%***	58.8%***	57.7%***	72.0%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses).The following variables have missing values (numbers reflect weighted missing values): Attended a community college (1046 missing), and Participated in a NSF-sponsored program as an undergraduate (946 missing)

* Difference between the indicated group and HM designees was statistically significant at .05 level (adjusted).

*** Difference between the indicated group and HM designees was statistically significant at .001 level (adjusted).

Exhibit 5.4. Educational Backgrounds and Experiences of GRFP Fellows, by Cohort

	Cohort 1 (1994–1998) (*N*=5,467)	Cohort 2 (1999–2004) (*N*=6,980)	Cohort 3 (2005–2008) (*N*=5,794)	Cohort 4 (2009–2011) (*N*=8,961)
Attended a community college as an undergraduate	7.7%	8.0%	8.8%	11.1%***
Participated in a NSF-sponsored program as an undergraduate	22.1%	24.9%	27.5%	30.5%***
Education Level when Awarded				
Undergraduate Student	56.4%	45.9%	35.3%	32.9%***
Graduate Student	43.6%	54.1%	64.7%	67.1%***

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses).The following variables have missing values (numbers reflect weighted missing values): Attended a community college (1046 missing), and Participated in a NSF-sponsored program as an undergraduate (946 missing).

*** Difference between Cohort 1 and Cohort 4 was statistically significant at .001 level (adjusted).

Exhibit 5.5. Undergraduate NSF Program Participation by GRFP Fellows and Honorable Mention Designees

	All Fellows (*N*=17,901)	QG2 Honorable Mention Designees (*N*=9,302)
Research Experiences for Undergraduates	20.2%	17.5%
Other NSF-sponsored undergraduate programs	2.5%	2.4%
Research in Undergraduate Institutions	2.1%	2.5%
NSF Scholarships in Science, Technology, Engineering, and Mathematics	1.1%	1.1%
Louis Stokes Alliance for Minority Participation (LSAMP)	0.9%	0.9%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). Row variables have 946 weighted missing values.

Exhibit 5.6. Undergraduate NSF Program Participation by GRFP Fellows, by Cohort

	Cohort 1 (1994–1998) (*N*=5,467)	Cohort 2 (1999–2004) (*N*=6,980)	Cohort 3 (2005–2008) (*N*=5,794)	Cohort 4 (2009–2011) (*N*=8,961)
Research Experiences for Undergraduates	15.4%	18.4%	22.1%	24.1%
Other NSF-sponsored undergraduate programs	1.1%	2.2%	2.9%	3.4%
Research in Undergraduate Institutions	1.6%	2.1%	1.8%	2.6%
NSF Scholarships in Science, Technology, Engineering, and Mathematics	1.7%	1.0%	0.5%	1.2%
Louis Stokes Alliance for Minority Participation (LSAMP)	0.4%	0.1%	0.9%	2.0%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). Row variables have 946 weighted missing values.

Overview of Primary Institution Attended

During the Follow-up Survey, respondents were asked to identify the institution attended using their GRFP support (for HM designees, the institution attended after receiving the Honorable Mention recognition), which we refer to as the respondent's "primary" institution. If a Fellow used their GRFP funding at more than one institution, they were asked to identify the institution at which they spent most of their time as a GRFP Fellow. Exhibit 5.7 presents selected characteristics of the primary institution attended by Fellows and HM designees (using data from the 2010 Integrated Postsecondary Education Data System; note that this represents institutional characteristics as of 2010 regardless of when each respondent was enrolled in graduate school). The overwhelming majority of Fellows (94.5 percent) and

HM designees (94.1 percent) attended a research university with a very high level of research activity according to the Carnegie Classification of Institutions of Higher Education[12]. The institutions they attended were about evenly split between public and private, tilted slightly in favor of public universities, although QG1 Fellows were more likely to attend private universities (49.6 percent) than were HM designees (43.9 percent). There were some differences in the geographic distribution of the graduate institutions attended by the three types of applicants, with QG1 Fellows more likely to attend universities located in the Northeast or West, and less likely to attend universities located in the South or Midwest, compared with HM designees. The geographic distribution of institutions attended by QG2 Fellows, on the other hand, was similar to that of the HM designees.

The sizes of the institutions selected by the three groups were generally similar, with median full-time graduate enrollments between 7,000 and 7,700 across groups. In terms of representation of women in the graduate student body, the institutions were similar across all three groups, with women accounting for between 45.8 and 47.2 percent of total full-time graduate enrollment. The institutions also appeared to have similar racial/ethnic distributions among graduate student bodies.

White (non-Hispanic) students accounted for between 45.1 and 46.6 percent of the average full-time graduate student body of institutions attended by Fellows and HM designees, Asians for between 10.0 and 10.7 percent, and URMs (including the Black, Hispanic/Latino, and Two or more races categories in Exhibit 5.7) for between 10.0 and 10.1 percent. On average, the institutions enrolled between 25.4 and 26.2 percent international students among full-time graduate students.

In terms of graduate degrees awarded, the universities attended by QG1 and QG2 Fellows and HM designees appeared to be similarly distributed. The median number of graduate degrees awarded in 2010 by the institutions attended by Fellows and HM designees was approximately 3,000.

Exhibit 5.8 shows changes in the characteristics of the institutions attended by Fellows by cohort. The overwhelming majority of Fellows (between 93.3 percent and 95.2 percent by cohort) attended a research university with a very high level of research activity according to the Carnegie Classification of Institutions of Higher Education, with no significant variation by cohort. However, there has been a shift towards enrolling in public institutions, with the percentage of Fellows attending such institutions increasing from 50.3 percent in Cohort 1 to 55.8 percent in Cohort 4. There have been no significant changes in the geographic location or other characteristics of institutions attended by Fellows between Cohort 1 and Cohort 4.

[12] For more information, please see http://classifications.carnegiefoundation.org/.

Exhibit 5.7. Selected Characteristics of the Primary Graduate Institutions Attended by GRFP Fellows and Honorable Mention Designees

	QG1 Fellows (*N*=9,181)	QG2 Fellows (*N*=8,354)	All Fellows (*N*=17,535)	QG2 Honorable Mention Designees (*N*=9,078)
Carnegie Classification				
Research Universities: very high research activity	94.8%	94.1%	94.5%	94.1%
Research Universities: high research activity	2.1%	2.8%	2.4%	3.1%
Doctoral Research Universities	0.1%	0.4%	0.3%	0.2%
Master's Colleges and Universities	0.2%	0.2%	0.2%	0.5%
Other	2.8%	2.6%	2.7%	2.2%
Control				
Public	50.4%***	54.0%	52.1%	56.1%
Private	49.6%***	46.0%	47.9%	43.9%
Geographic Region				
Northeast	32.7%***	28.6%	30.8%	28.1%
South	10.8%***	16.7%	13.6%	15.7%
Midwest	14.7%**	16.4%	15.5%	17.8%
West	41.8%*	38.3%	40.1%	38.4%
Full-time graduate enrollment				
25th percentile	5,412	5,262	5,309	5,129
50th percentile (median)	7,683	7,087	7,234	7,032
75th percentile	9,338	9,294	9,300	9,301
Percent women full-time graduate students	44.9%*	45.0%*	44.9%	45.9%
Percent full-time graduate enrollment by race/ethnicity				
American Indian or Alaska Native	0.5%	0.4%	0.5%	0.5%
Asian/Native Hawaiian/Pacific Islander	10.7%***	10.0%	10.4%	10.0%
Black or African American	3.3%***	3.4%	3.3%	3.5%
Hispanic/Latino	5.3%	5.2%	5.2%	5.2%
White	45.1%***	46.0%	45.5%	46.6%
Two or more races	1.5%	1.5%	1.5%	1.4%
Race/Ethnicity unknown	7.6%	7.2%*	7.4%	7.5%
International students	26.2%**	26.1%**	26.2%	25.4%
Graduate degrees awarded (master's, doctorates, and first professional degrees)				
25th percentile	2,151	2,132	2,144	1,922
50th percentile (median)	2,996	2,842	2,978	2,914
75th percentile	4,044	3,295	3,875	3,894

SOURCE: 2010 Integrated Postsecondary Education Data System (IPEDS)

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents who attended a reference program at a U.S. educational institution with an IPEDS ID number.

* Difference between the indicated group and HM designees was statistically significant at .05 level (adjusted).

** Difference between the indicated group and HM designees was statistically significant at .01 level (adjusted).

*** Difference between the indicated group and HM designees was statistically significant at .001 level (adjusted).

Exhibit 5.8. Selected Characteristics of the Primary Graduate Institutions Attended by GRFP Fellows, by Cohort

	Cohort 1 (1994–1998) (*N*=5,369)	Cohort 2 (1999–2004) (*N*=6,817)	Cohort 3 (2005–2008) (*N*=5,654)	Cohort 4 (2009–2011) (*N*=8,773)
Carnegie Classification				
Research Universities: very high research activity	94.2%	95.2%	93.3%	94.8%
Research Universities: high research activity	2.7%	1.9%	2.7%	2.5%
Doctoral Research Universities	0.4%	0.2%	0.2%	0.3%
Master's Colleges and Universities	0.1%	0.1%	0.1%	0.3%
Other	2.6%	2.5%	3.7%	2.2%
Control				
Public	50.3%	51.0%	50.5%	55.8%**
Private	49.7%	49.0%	49.5%	44.2%*
Geographic Region				
Northeast	31.2%	33.3%	30.8%	27.9%
South	12.7%	14.0%	12.2%	14.9%
Midwest	15.5%	14.7%	14.9%	16.8%
West	40.6%	38.0%	42.1%	40.4%
Full-time graduate enrollment				
25th percentile	5,451	5,309	5,304	5,271
50th percentile (median)	7,279	6,924	7,650	7,289
75th percentile	9,295	9,296	9,300	9,631
Percent of full-time graduate enrollment of women	44.5%	44.7%	44.9%	45.5%
Percent of full-time graduate enrollment by race/ethnicity				
American Indian or Alaska Native	0.5%	0.5%	0.4%	0.5%
Asian/Native Hawaiian/Pacific Islander	10.3%	10.4%	10.5%	10.0%
Black or African American	3.3%	3.3%	3.4%	3.5%
Hispanic/Latino	5.3%	5.2%	5.3%	5.2%
White	45.5%	45.3%	45.5%	46.8%
Two or more races	1.5%	1.5%	1.5%	1.4%
Race/Ethnicity unknown	7.3%	7.5%	7.5%	7.4%
International students	26.4%	26.3%	25.9%	25.3%
Graduate degrees awarded (master's, doctorates, and first professional degrees)				
25th percentile	2,149	2,148	2,149	2,064
50th percentile (median)	2,996	2,725	2,997	2,985
75th percentile	3,507	3,633	3,654	4,051

SOURCE: 2010 Integrated Postsecondary Education Data System (IPEDS)

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents who attended a reference program at a U.S. educational institution with an IPEDS ID number.

* Difference between the indicated group and HM designees was statistically significant at .05 level (adjusted).

** Difference between the indicated group and HM designees was statistically significant at .01 level (adjusted).

Factors Important in the Decision to Attend a Specific Program/Institution

Respondents to the Follow-up Survey were asked about the factors that were important in their decision to attend a specific program/institution. Exhibit 5.9 shows the percentage of respondents who agreed or strongly agreed that a particular factor was important in this decision. An overwhelming majority of the respondents agreed or strongly agreed that they wanted "to attend an institution that was academically desirable," including a higher proportion of QG1 Fellows (92.7 percent) compared to HM designees (90.8 percent). QG1 Fellows were also more likely than HM designees to report the second most common factor, "to improve [their] employment opportunities in academia" (76.4 percent compared to 73.2 percent), as well as "to work with a specific faculty member" (67.1 percent compared to 64.0 percent). On the other hand, HM designees were more likely than QG1 Fellows to report that they chose their graduate program "to improve [their] employment opportunities in industry" (40.2 percent compared to 36.5 percent) and more likely than both groups of Fellows to report that they chose their graduate program "because it provided [them] with opportunities to teach" (26.2 percent compared to 19.8 percent of QG1 Fellows and 18.6 percent of QG2 Fellows).

Of the factors selected equally often by Fellows and HM designees, between 64.6 percent and 65.0 percent chose their graduate program "to attend an institution that was desirable due to its geographic location," between 59.6 percent and 62.5 percent chose their graduate program "to attend an institution that provided a good fit for [them] personally (e.g., in terms of family or health circumstances)," and between 45.7 percent and 45.9 percent chose their graduate program "to attend an institution that was socially desirable."

Exhibit 5.10 presents data on the extent to which the factors affecting decisions to enroll in a graduate program changed between Cohort 1 and Cohort 4 among Fellows. Five factors were reported more frequently among Cohort 4 Fellows than Cohort 1 Fellows: "to work with a specific faculty member" (from 59.0 percent in Cohort 1 to 72.2 percent in Cohort 4), "to attend an institution that provided a good fit for [them] personally (e.g., in terms of family or health circumstances)" (from 55.0 percent to 66.9 percent), "to attend an institution that was socially desirable" (from 38.5 percent to 53.0 percent), "to improve [their] employment opportunities in industry" (from 35.9 percent to 43.7 percent), and "because it provided [them] with opportunities to teach" (from 14.1 percent to 27.5 percent). No factors were reported less frequently among Cohort 4 Fellows than Cohort 1 Fellows.

Exhibit 5.9. Factors Influencing Decision to Enroll in Graduate Program by Fellowship Award Status

	QG1 Fellows (*N*=9,417)	QG2 Fellows (*N*=8,484)	All Fellows (*N*=17,901)	QG2 Honorable Mention Designees (*N*=9,302)
Opportunities to teach	19.8%***	18.6%***	19.2%	26.2%
To work with a specific faculty member	67.1%**	65.5%	66.4%	64.0%
To improve my employment opportunities in industry	36.5%*	40.4%	38.3%	40.2%
To improve my employment opportunities in academia	76.4%***	71.7%	74.2%	73.2%
To attend an institution that was socially desirable	45.9%	45.9%	45.9%	45.7%
To attend an institution that was academically desirable	92.7%***	91.0%	91.9%	90.8%
To attend an institution that was desirable due to its geographic location	64.6%	65.0%	64.8%	65.0%
To attend an institution that provided a good fit for me personally (e.g., in terms of family or health circumstances)	59.6%	63.3%	61.4%	62.5%

NOTES: Table shows the percentage of respondents who reported that they Agreed or Strongly Agreed with each statement. Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). Row variables have between 716 and 839 weighted missing values.

* Difference between the indicated group and HM designees was statistically significant at .05 level (adjusted).

** Difference between the indicated group and HM designees was statistically significant at .01 level (adjusted).

*** Difference between the indicated group and HM designees was statistically significant at .001 level (adjusted).

Exhibit 5.10. Factors Influencing Fellows' Decision to Enroll in Graduate Program by Cohort

	Cohort 1 (1994–1998) (*N*=5,467)	Cohort 2 (1999–2004) (*N*=6,980)	Cohort 3 (2005–2008) (*N*=5,794)	Cohort 4 (2009–2011) (*N*=8,961)
Opportunities to teach	14.1%	14.8%	19.1%	27.5%***
To work with a specific faculty member	59.0%	66.3%	66.2%	72.2%***
To improve my employment opportunities in industry	35.9%	34.8%	38.2%	43.7%***
To improve my employment opportunities in academia	72.0%	76.9%	74.0%	73.4%
To attend an institution that was socially desirable	38.5%	42.5%	48.4%	53.0%***
To attend an institution that was academically desirable	93.0%	91.8%	91.9%	91.1%
To attend an institution that was desirable due to its geographic location	63.9%	64.1%	65.9%	65.4%
To attend an institution that provided a good fit for me personally (e.g., in terms of family or health circumstances)	55.0%	59.1%	63.7%	66.9%***

NOTES: Table shows the percentage of respondents who reported that they Agreed or Strongly Agreed with each statement. Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). Row variables have between 716 and 839 weighted missing values.

*** Difference between the indicated group and HM designees was statistically significant at .001 level (adjusted).

Perceptions of the GRFP Fellowship

Fellows were asked whether there were other fellowships in their field that were considered more desirable and a little over one quarter (25.8 percent) of Fellows responded that there were (Exhibits 5.11 and 5.12). However, this has increased over time, as Exhibit 5.12 shows, from 21.9 percent in Cohort 1 to 32.1 percent in Cohort 4.

The Fellows who responded in the affirmative were asked about the elements that made these fellowships more desirable. Of these, the majority pointed to a larger stipend (72.5 percent); 69.6 percent mentioned higher prestige; and a little over one third (34.4 percent) noted that the more desirable fellowships were of longer duration. Three of the reasons why another fellowship was considered more desirable became more common between Cohort 1 and Cohort 4: because of a larger stipend (from 70.3 to 81.3 percent), because of more prestige (from 62.7 to 71.0 percent), and for other reasons (from 6.6 to 12.6 percent).

Exhibit 5.11. Percentage of Fellows Reporting That Other Fellowships in Their Field Were More Desirable and Reasons Why

	QG1 Fellows (*N*=9,417)	QG2 Fellows (*N*=8,484)	All Fellows (*N*=17,901)
Other fellowship in field more desirable	26.6%	25.0%	25.8%
Reasons why more desirable:			
Larger stipend	73.7%	71.1%	72.5%
Longer duration	37.3%	30.9%	34.4%
More prestige	70.8%	68.2%	69.6%
Other reason	10.4%	11.3%	10.8%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses).The following variables have missing values (numbers reflect weighted missing values): Other fellowship in field more desirable (122 missing), and Reasons why more desirable (460 missing).

Exhibit 5.12. Percentage of Fellows Reporting That Other Fellowships in Their Field Were More Desirable and Reasons Why, by Cohort

	Cohort 1 (1994–1998) (*N*=4,025)	Cohort 2 (1999–2004) (*N*=4,988)	Cohort 3 (2005–2008) (*N*=3,717)	Cohort 4 (2009–2011) (*N*=5,171)
Other fellowship in field more desirable	21.9%	23.3%	24.6%	32.1%***
Reasons why more desirable:				
Larger stipend	70.3%	64.8%	68.4%	81.3%**
Longer duration	28.8%	34.6%	36.4%	35.9%
More prestige	62.7%	71.8%	70.5%	71.0%*
Other reason	6.6%	7.7%	15.0%	12.6%*

NOTES: Table Ns reflect Fellows who accepted the award. Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses).The following variables have missing values (numbers reflect weighted missing values): Other fellowship in field more desirable (122 missing), and Reasons why more desirable (460 missing).

* Difference between Cohort 1 and Cohort 4 was statistically significant at .05 level (adjusted).

** Difference between Cohort 1 and Cohort 4 was statistically significant at .01 level (adjusted).

*** Difference between Cohort 1 and Cohort 4 was statistically significant at .001 level (adjusted).

Exhibit 5.13 shows Fellows' responses to whether there were other fellowships in their field that were considered more desirable, and if so, for what reasons, broken out by cohort and field of graduate study. Looking at Cohort 4 to assess the most recent Fellows' perceptions of the desirability of the GRFP program shows that this perception varies by field of graduate study. Roughly one-half of Fellows in most physical science and engineering fields (including Chemistry, Computer and Information Sciences and Engineering, Engineering, Mathematical Sciences, and Physics and Astronomy) felt that other fellowships in their field were more desirable. Furthermore, Cohort 4 Fellows who studied Engineering or Computer and Information Sciences and Engineering were more likely to perceive another fellowship in their field as more desirable than Cohort 1 Fellows in the same field.

The fields of study in which Fellows were least likely to perceive another fellowship in their field as more desirable were Psychology (8.7 percent) and Social Sciences (5.1 percent). Intermediate proportions of Fellows in Geosciences (20.1 percent), Life Sciences (21.9 percent), and Other fields of study (29.7 percent) perceived another fellowship in their field as more desirable.

Fellows' perceptions about what made other fellowships in their field more desirable also varied by field of study, although the number of Fellows involved in this analysis was fairly small (particularly within Geosciences, Psychology, Social Sciences, and Other fields of study), so observed trends should be understood as suggestions for further study.

Exhibit 5.13. Percentage of Fellows Reporting That Other Fellowships in Their Field Were More Desirable and Reasons Why, by Cohort and Field of Graduate Study

	Cohort 1 (1994–1998)	Cohort 2 (1999–2004)	Cohort 3 (2005–2008)	Cohort 4 (2009–2011)
Other fellowship in field more desirable	(*N*=4,025)	(*N*=4,988)	(*N*=3,717)	(*N*=5,171)
Chemistry (*N*=1,188)	31.3%	40.6%	49.9%	45.2%
Computer and Information Sciences and Engineering (*N*=1,076)	27.2%	35.6%	34.9%	51.9%**
Engineering (*N*=4,882)	24.9%	32.2%	33.5%	47.0%**
Geosciences (*N*=692)	13.9%	16.1%	15.5%	20.1%
Life Sciences (*N*=4,849)	25.3%	18.9%	14.6%	21.9%
Mathematical Sciences (*N*=706)	31.2%	19.8%	45.1%	45.4%
Physics and Astronomy (*N*=1,024)	41.2%	36.3%	49.4%	53.9%
Psychology (*N*=1,150)	1.9%	7.3%	8.7%	8.7%
Social Sciences (*N*=2,238)	5.5%	3.7%	4.0%	5.1%
Other Field of Study (*N*=72)	25.5%	30.3%	0.0%	29.7%
Reasons why more desirable:	(*N*=869)	(*N*=1,158)	(*N*=912)	(*N*=1,653)
Larger stipend				
Chemistry (*N*=497)	66.2%	58.2%	75.8%	86.4%
Computer and Information Sciences and Engineering (*N*=397)	87.1%	75.2%	62.8%	89.1%
Engineering (*N*=1,711)	66.2%	63.0%	69.8%	82.1%
Geosciences (*N*=117)	100.0%	89.5%	58.8%	87.4%
Life Sciences (*N*=969)	66.1%	63.7%	65.2%	73.3%
Mathematical Sciences (*N*=236)	75.2%	45.4%	81.4%	85.6%
Physics and Astronomy (*N*=460)	84.7%	71.2%	69.1%	93.8%
Psychology (*N*=77)	50.0%	68.2%	52.0%	43.1%
Social Sciences (*N*=103)	41.8%	67.2%	34.3%	40.2%
Other Field of Study (*N*=17)	100.0%	100.0%	0.0%	100.0%
Longer duration				
Chemistry (*N*=497)	25.9%	44.6%	45.1%	35.1%
Computer and Information Sciences and Engineering (*N*=397)	28.2%	53.2%	42.3%	42.1%
Engineering (*N*=1,711)	28.4%	35.1%	33.1%	40.7%
Geosciences (*N*=117)	26.8%	0.0%	10.6%	0.0%
Life Sciences (*N*=969)	21.8%	26.9%	33.2%	26.5%
Mathematical Sciences (*N*=236)	40.5%	30.4%	39.8%	31.2%
Physics and Astronomy (*N*=460)	49.2%	30.3%	43.3%	44.6%
Psychology (*N*=77)	0.0%	31.8%	34.2%	11.9%**
Social Sciences (*N*=103)	12.0%	32.8%	50.9%	48.9%
Other Field of Study (*N*=17)	0.0%	0.0%	0.0%	100.0%
More prestige				
Chemistry (*N*=497)	64.3%	90.9%	88.4%	76.6%
Computer and Information Sciences and Engineering (*N*=397)	58.2%	75.2%	74.9%	73.2%
Engineering (*N*=1,711)	60.9%	79.3%	67.9%	75.2%
Geosciences (*N*=117)	63.4%	28.9%	63.0%	44.0%

	Cohort 1 (1994–1998)	Cohort 2 (1999–2004)	Cohort 3 (2005–2008)	Cohort 4 (2009–2011)
Life Sciences (*N*=969)	64.1%	65.0%	61.8%	63.2%
Mathematical Sciences (*N*=236)	75.3%	69.6%	68.0%	62.4%
Physics and Astronomy (*N*=460)	59.2%	54.9%	83.2%	82.1%
Psychology (*N*=77)	100.0%	47.3%	31.9%	44.5%
Social Sciences (*N*=103)	67.4%	32.8%	50.5%	49.6%
Other Field of Study (*N*=17)	0.0%	0.0%	0.0%	100.0%
Other reason				
Chemistry (*N*=497)	10.1%	4.9%	12.1%	13.5%
Computer and Information Sciences and Engineering (*N*=397)	7.9%	6.2%	14.9%	11.5%
Engineering (*N*=1,711)	5.4%	7.0%	14.6%	13.5%
Geosciences (*N*=117)	0.0%	9.0%	27.9%	6.4%
Life Sciences (*N*=969)	9.0%	14.6%	20.6%	13.8%
Mathematical Sciences (*N*=236)	8.7%	8.1%	8.3%	7.1%
Physics and Astronomy (*N*=460)	0.0%	0.0%	6.9%	8.6%
Psychology (*N*=77)	0.0%	0.0%	16.1%	22.9%
Social Sciences (*N*=103)	10.3%	17.3%	49.1%	0.0%
Other Field of Study (*N*=17)	0.0%	0.0%	0.0%	100.0%

NOTES: Table Ns reflect Fellows who accepted the award. Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses).The following variables have missing values (numbers reflect weighted missing values): Other fellowship in field more desirable (122 missing), and Reasons why more desirable (460 missing).

** Difference between Cohort 1 and Cohort 4 was statistically significant at .01 level (adjusted).

Fellows who said that there were other fellowships in their field that were more desirable were also asked to identify these more desirable fellowships. Because the types and nature of fellowships change over time, we focused on the responses of Cohort 4 Fellows regarding which fellowships were more desirable. Among the most commonly mentioned fellowships were the Hertz Fellowship (60 percent), the Department of Defense National Defense Science and Engineering Graduate (NDSEG) Fellowship (40 percent), the Department of Energy Fellowship (22 percent), and the Rhodes Scholarship (13 percent).

Respondents were also asked whether they had accepted their GRFP award. Overall, 5.7 percent of survey respondents indicated that they had not accepted the GRFP award, but as Exhibit 5.14 shows, the declination rate decreased markedly between Cohorts 1 and 4, from 12.1 percent of Cohort 1 to 2.6 percent of Cohort 4 awardees.

In order to provide the information most relevant to understanding the effects of current program policies, we examined the reasons for declining the award among the most recent cohort (Cohort 4) of awardees only (Exhibit 5.15). Receiving a fellowship with a higher stipend was the primary reason for 71.4 percent of Cohort 4 respondents who declined the GRFP, followed by receiving another fellowship that offered

better non-stipend support (expenses for research, travel, etc.), as mentioned by 53.1 percent of such respondents. The 12.2 percent who indicated "other" reasons provided these reasons in a text field in the survey. Their reasons included because their preferred field of study was not funded by the GRFP and because of other specific program restrictions (discussed below) of the GRFP award.

Exhibit 5.14. Percentage of Awardees Who Declined the GRFP Award by Cohort

	Total (*N*=7,014)	Cohort 1 (1994–1998) (*N*=1,575)	Cohort 2 (1999–2004) (*N*=1,735)	Cohort 3 (2005–2008) (*N*=1,799)	Cohort 4 (2009–2011) (*N*=1,905)
Did not accept GRFP award	5.7%	12.1%	8.3%	0.8%	2.6%

NOTES: Because responses to this question determine survey eligibility (respondents who did not accept the GRFP award have a weight of zero), table percentages and Ns are unweighted.

Exhibit 5.15. Reasons for Declining the GRFP Award, Cohort 4 Awardees Who Did Not Accept the GRFP Award

	Cohort 4 (2009–2011) (*N*=50)
Received another fellowship that offered a higher stipend	71.4%
Received another fellowship that offered better non-stipend support (expenses for research, travel, etc.)	53.1%
Received another financial award (e.g., scholarship, grant, etc.) that offered a higher stipend	2.0%
Received another financial award (e.g., scholarship, grant, etc.) that offered better non-stipend support (expenses for research, travel, etc.)	0.0%
Accepted a research assistantship instead of the GRFP award	0.0%
Accepted a teaching assistantship instead of the GRFP award	0.0%
Decided not to pursue my graduate studies at that time	12.2%
Other	14.3%

NOTES: Because responses to this question determine survey eligibility (respondents who did not accept the GRFP award have a weight of zero), table percentages and Ns are unweighted. One respondent who was asked this question did not provide an answer. Table percentages are based on non-missing data.

Respondents who reported that they declined the award were asked whether the requirements of the GRFP award influenced their decision to not accept the award; Exhibit 5.16 shows the results of this question for respondents in Cohort 4. Twelve respondents out of 50 in Cohort 4 who reported that they had declined the award indicated that their decision to decline the award was influenced by the award requirements (two of the 50 respondents did not answer this question either way). Of these 12 respondents, two (16.7 percent) reported that their declination of the GRFP award was influenced by the program requirement that they attend a graduate program at a U.S. institution, six (50.0 percent) reported that their declination was influenced by the program requirement that they not accept another federal

fellowship, and eight (66.7 percent) reported that their declination was influenced by other program requirements. None of these respondents reported that the three-year length of the GRFP influenced their decision.

Of the eight respondents who reported being influenced by other program requirements, several noted that they could not pursue the specific degree program they wanted because it was not eligible for support (non-research-based Ph.D., dual degree, clinical degree, etc.); one respondent declined the GRFP in favor of another fellowship that does not restrict teaching assistantships; another noted the restriction on paid service while on the Fellowship; and another declined because of a university policy that requires a Fellow's dissertation advisor to use discretionary funds to supplement the GRFP cost-of-education allowance.

Exhibit 5.16. Whether Specific GRFP Requirements Influenced the Decision to Decline the GRFP Award, Cohort 4 Awardees Who Declined the Award

	Cohort 4 (2009–2011)
GRFP requirements influenced decision to decline the award (*N*=50)	25.0%
Program requirement that discouraged awardees from accepting GRFP (*N*=12)	
Attend a graduate program at a U.S. institution	16.7%
Three-year duration of the award	0.0%
Not being allowed to accept another federal fellowship	50.0%
Other	66.7%

NOTES: Because responses to this question determine survey eligibility (respondents who did not accept the GRFP award have a weight of zero), table percentages and Ns are unweighted. Two respondents who were asked the question in the first row did not provide an answer. Table percentages are based on non-missing data.

Degree Completion

The descriptive analysis also looked at degree completion rates of the three groups, as shown in Exhibit 5.17, including completion of a master's degree within five years of enrollment and completion of a Ph.D. within ten years of enrollment. These analyses measure from respondents' initial enrollment in their reference program, but include degrees completed at other institutions if the respondent left their reference program and completed a degree at another institution during the stated time period. Respondents who received both a master's degree within five years and a Ph.D. within ten years count positively toward both rows in the exhibit.

Within five years of enrollment in their reference program, 39.5 percent of Fellows and 38.2 percent of HM designees completed a master's degree at any graduate institution. QG2 Fellows (42.2 percent) completed master's degrees at a higher rate than HM designees.

Within ten years of enrollment in their reference program, 82.7 percent of Fellows and 77.9 percent of HM designees completed a Ph.D. at any graduate institution. QG1 Fellows (83.8 percent) completed master's degrees at a higher rate than HM designees. The Ph.D. completion rates of Fellows and HM designees are extraordinarily high in light of recent evidence from the Ph.D. Completion Project showing that the national 10 year completion rate was 54.7 percent in mathematics and physical sciences, 55.9 percent in social sciences, 62.9 percent in life sciences, and 63.6 percent in engineering (Sowell, Zhang, Redd, & King, 2008).

Exhibit 5.17. Percentage Completing Master's and Ph.D. Within Specified Time Period by Fellowship Award Status

	QG1 Fellows	QG2 Fellows	All Fellows	QG2 Honorable Mention Designees
Master's completion within 5 years of enrollment	(*N*=6,741)	(*N*=6,027)	(*N*=12,769)	(*N*=5,872)
	37.0%	42.2%*	39.5%	38.2%
Ph.D. completion within 10 years of enrollment	(*N*=3,372)	(*N*=3,067)	(*N*=7,784)	(*N*=2,844)
	83.8%**	81.6%	82.7%	77.9%

NOTES: Table percentages are based on weighted, non-missing data. Individual cell Ns represent the weighted number of respondents who enrolled in their reference graduate program at least 5 years (for master's completion) or at least 10 years (for Ph.D. completion) prior to 2012.

* Difference between the indicated group and HM designees was statistically significant at .05 level (adjusted).

** Difference between the indicated group and HM designees was statistically significant at .01 level (adjusted).

Degree completion varied by field of graduate study, as shown in Exhibit 5.18. The highest rates of master's degree completion within five years of enrollment were in Engineering (59.5 percent of all Fellows), Computer and Information Sciences and Engineering (56.3 percent of all Fellows), and Other fields of study (55.0 percent of all Fellows). The lowest rates of master's degree completion within five years of enrollment were in Life Sciences (15.1 percent of all Fellows) and Chemistry (20.6 percent of all Fellows). Within Engineering, QG1 Fellows were less likely than HM designees to complete a master's degree within five years of enrollment, and QG2 Fellows were more likely than HM designees to complete a master's degree within five years of enrollment.

The highest rates of Ph.D. completion within ten years of enrollment were in Chemistry (93.6 percent of all Fellows) and Psychology (92.2 percent of all Fellows), and the lowest rates of Ph.D. completion within ten years of enrollment were in Other fields of study (55.6 percent of all Fellows), Computer and

Information Sciences and Engineering (74.3 percent of all Fellows), Engineering (74.5 percent of all Fellows), and Social Sciences (79.2 percent of all Fellows).

These differential rates of degree completion by field of graduate study may reflect field-specific conditions, including how common it is to pursue a Ph.D. compared to a terminal master's degree, how common it is to receive a master's degree in the course of a Ph.D. program, and typical completion rates and time to degree within each field. They do not necessarily reflect differential influence of the GRFP by field of graduate study.

Exhibit 5.18. Percentage Completing Master's and Ph.D. Within Specified Time Period by Fellowship Award Status and Field of Graduate Study

	QG1 Fellows	QG2 Fellows	All Fellows	QG2 Honorable Mention Designees
Master's completion within 5 years of enrollment	(*N*=6,741)	(*N*=6,027)	(*N*=12,769)	(*N*=5,872)
Chemistry (*N*=1,234)	21.8%	19.2%	20.6%	17.0%
Computer and Information Sciences and Engineering (*N*=1,115)	53.9%	58.9%	56.3%	53.2%
Engineering (*N*=4,544)	57.3%**	61.2%*	59.5%	59.7%
Geosciences (*N*=697)	32.2%	47.1%	38.7%	46.7%
Life Sciences (*N*=5,211)	15.5%	14.6%	15.1%	16.4%
Mathematical Sciences (*N*=694)	33.6%	47.5%	40.1%	39.9%
Physics and Astronomy (*N*=1,135)	42.5%	41.6%	42.1%	48.7%
Psychology (*N*=1,287)	40.2%	39.7%	40.0%	40.6%
Social Sciences (*N*=2,582)	47.5%	48.5%	47.9%	48.8%
Other Field Of Study (*N*=132)	48.4%	59.2%	55.0%	56.5%
Ph.D. completion within 10 years of enrollment	(*N*=4,026)	(*N*=3,758)	(*N*=7,784)	(*N*=2,844)
Chemistry (*N*=717)	94.8%	92.2%	93.6%	93.2%
Computer and Information Sciences and Engineering (*N*=659)	71.0%	77.7%	74.3%	61.6%
Engineering (*N*=2,506)	77.1%	72.6%	74.5%	61.2%
Geosciences (*N*=416)	87.8%	82.9%	85.6%	72.0%
Life Sciences (*N*=2,859)	86.8%	88.7%	87.7%	89.1%
Mathematical Sciences (*N*=442)	91.7%	83.0%	87.4%	82.3%
Physics and Astronomy (*N*=663)	88.7%	86.0%	87.6%	84.5%
Psychology (*N*=728)	92.0%	92.5%	92.2%	86.7%
Social Sciences (*N*=1,568)	80.1%	77.9%	79.2%	73.4%
Other Field Of Study (*N*=70)	38.9%	70.3%	55.6%	29.5%

NOTES: Table percentages are based on weighted, non-missing data. Individual cell Ns represent the weighted number of respondents who enrolled in their reference graduate program at least 5 years (for master's completion) or at least 10 years (for Ph.D. completion) prior to 2012.

* Difference between the indicated group and HM designees was statistically significant at .05 level (adjusted).

** Difference between the indicated group and HM designees was statistically significant at .01 level (adjusted).

Exhibit 5.19 examines degree completion among various demographic subgroups. Female QG2 Fellows were more likely to complete a master's degree within five years of enrollment compared to female HM designees (43.1 percent compared to 33.1 percent), as were QG1 Fellows with disabilities compared to HM designees with disabilities (36.2 percent compared to 34.9 percent).

Fellows within several demographic subgroups completed a Ph.D. within ten years of enrollment at higher rates than their HM designee counterparts, including men (84.0 percent of male QG1 Fellows and 84.7 percent of male QG2 Fellows, compared to 77.6 percent of male HM designees), URMs (80.5 percent of URM QG1 Fellows and 72.1 percent of URM QG2 Fellows, compared to 63.9 percent of URM HM designees), non-URMs (84.2 percent of non-URM QG1 Fellows compared to 79.8 percent of non-URM HM designees), and students without disabilities (84.0 percent of QG1 Fellows without disabilities compared to 78.2 percent of HM designees without disabilities). There were no differences in Ph.D. completion rate within ten years between female Fellows and HM designees or between Fellows and HM designees with disabilities.

Exhibit 5.19. Percentage Completing Master's and Ph.D. Within Specified Time Period by Demographic Characteristics and Fellowship Award Status

	QG1 Fellows	QG2 Fellows	All Fellows	QG2 Honorable Mention Designees
Master's completion within 5 years of enrollment	(*N*=6,741)	(*N*=6,027)	(*N*=12,769)	(*N*=5,872)
Men (*N*=10,036)	37.6%	40.9%	38.9%	41.2%
Women (*N*=8,605)	36.2%	43.1%**	40.0%	33.1%
URM (*N*=2,343)	33.6%	46.1%	39.7%	42.7%
Non-URM (*N*=16,102)	37.6%	41.4%	39.4%	37.8%
With disabilities (*N*=447)	36.2%**	39.0%	37.4%	34.9%
Without disabilities (*N*=17,356)	37.3%	41.9%	39.5%	38.6%
Ph.D. completion within 10 years of enrollment	(*N*=4,026)	(*N*=3,758)	(*N*=7,784)	(*N*=2,844)
Men (*N*=6,014)	84.0%**	84.7%**	84.3%	77.6%
Women (*N*=4,614)	83.4%	79.6%	81.1%	78.6%
URM (*N*=1,416)	80.5%**	72.1%*	76.2%	63.9%
Non-URM (*N*=9,110)	84.2%*	83.2%	83.7%	79.8%
With disabilities (*N*=211)	75.8%	70.3%	73.4%	74.9%
Without disabilities (*N*=9,875)	84.0%**	82.2%	83.1%	78.2%

NOTES: Table percentages are based on weighted, non-missing data. Row and column Ns represent the weighted number of respondents who enrolled in their reference graduate program at least 5 years (for master's completion) or at least 10 years (for Ph.D. completion) prior to 2012. For Ph.D. completion, the following variables have missing values (numbers reflect weighted missing values): URM status (102 missing), and Disability status (542 missing). For Master's degree completion, the following variables have missing values (numbers reflect weighted missing values): URM status (196 missing) and Disability status (837 missing).

* Difference between the indicated group and HM designees was statistically significant at .05 level (adjusted).

** Difference between the indicated group and HM designees was statistically significant at .01 level (adjusted).

Exhibit 5.20 presents overall degree completion among master's and doctoral students broken out by cohort. The master's completion portion of the exhibit includes only Fellows and HM designees who enrolled in their reference graduate program at least five years before 2012 (which excludes Cohort 4), and the Ph.D. completion portion of the exhibit includes only Fellows and HM designees who enrolled in their reference graduate program at least ten years before 2012 (which excludes Cohorts 3 and 4).

In order to determine if completion rates for each of the four award status groups displayed in Exhibit 5.18 – QG1 Fellows, QG2 Fellows, all Fellows, and HM designees – have changed, we compared completion rates for the most recent cohort (Cohort 3 for master's degree completion and Cohort 2 for Ph.D. completion) against completion rates for Cohort 1.

Members of Cohort 3 exhibited lower master's degree completion rates across all four award status groups compared to Cohort 1. For example, 36.2 percent of Cohort 3 Fellows (QG1 and QG2 combined) completed a master's degree within five years of enrollment, compared to 44.0 percent of Cohort 1 Fellows.

Ph.D. completion rates exhibited the opposite pattern; members of Cohort 2 across all four award status groups completed a Ph.D. within ten years of enrollment at a higher rate than their counterparts in Cohort 1. For example, 86.7 percent of Cohort 2 Fellows completed a Ph.D. within ten years of enrollment compared to 78.1 percent of Cohort 1 Fellows.

Exhibit 5.20. Percentage Completing Master's and Ph.D. Within Specified Time Period by Cohort and Fellowship Award Status

	QG1 Fellows	QG2 Fellows	All Fellows	QG2 Honorable Mention Designees
Master's completion within 5 years of enrollment	(*N*=6,563)	(*N*=5,824)	(*N*=12,387)	(*N*=5,398)
Cohort 1 (*N*=5,465)	42.3%	45.9%	44.0%	42.8%
Cohort 2 (*N*=6,980)	35.9%	42.8%	39.3%	40.7%
Cohort 3 (*N*=5,339)	34.3%**	38.5%**	36.2%***	35.6%**
Ph.D. completion within 10 years of enrollment	(*N*=4,026)	(*N*=3,751)	(*N*=7,777)	(*N*=2,826)
Cohort 1 (*N*=5,462)	79.2%	76.9%	78.1%	73.2%
Cohort 2 (*N*=5,140)	89.1%***	86.2%***	87.6%***	83.1%***

NOTES: Table percentages are based on weighted, non-missing data. Row and column Ns represent the weighted number of respondents who enrolled in their reference graduate program at least 5 years (for master's completion) or at least 10 years (for Ph.D. completion) prior to 2012.

* Difference between the indicated cohort and Cohort 1 was statistically significant at .05 level (adjusted).

** Difference between the indicated cohort and Cohort 1 was statistically significant at .01 level (adjusted).

*** Difference between the indicated cohort and Cohort 1 was statistically significant at .001 level (adjusted).

Exhibit 5.21 shows degree completion rates by cohort among demographic subgroups. As in the previous exhibit, the master's completion portion includes only Fellows and HM designees who enrolled in their reference graduate program at least five years before 2012 (which excludes Cohort 4), and the Ph.D. completion portion of the exhibit includes only Fellows and HM designees who enrolled in their reference graduate program at least ten years before 2012 (which excludes Cohorts 3 and 4).

The patterns of changes in degree completion shown in Exhibit 5.20 are present for some, but not all, of the demographic subgroups in Exhibit 5.21. Cohort 3 members in the following demographic subgroups were less likely to complete a master's degree within five years of enrollment compared to Cohort 1 members in the same demographic subgroups: women (including QG1 Fellows, QG2 Fellows, all Fellows, and HM designees), URMs (including QG2 Fellows, all Fellows, and HM designees), non-URMs (including QG1 Fellows and all Fellows), and students without disabilities (including QG1 Fellows, QG2 Fellows, all Fellows, and HM designees).

Cohort 2 members in all of the demographic subgroups included in Exhibit 3.21 were more likely to complete a Ph.D. within ten years of enrollment compared to Cohort 1 members in the same demographic subgroups (across QG1 Fellows, QG2 Fellows, all Fellows, and HM designees): men, women, URMs, non-URMs, students with disabilities, and students without disabilities.

Exhibit 5.21. Percentage Completing Master's and Ph.D. Within Specified Time Period by Demographic Characteristics, Cohort, and Fellowship Award Status

	QG1 Fellows	QG2 Fellows	All Fellows	QG2 Honorable Mention Designees
Master's completion within 5 years of enrollment	(*N*=6,563)	(*N*=5,824)	(*N*=12,387)	(*N*=5,398)
Men				
Cohort 1 (*N*=3,294)	41.8%	45.6%	43.1%	43.8%
Cohort 2 (*N*=3,689)	34.3%	39.8%	36.5%	43.5%
Cohort 3 (*N*=2,667)	37.6%	38.2%	37.8%	40.5%
Women				
Cohort 1 (*N*=2,174)	43.4%	46.1%	45.0%	39.7%
Cohort 2 (*N*=3,291)	38.1%	44.8%	41.9%	35.8%
Cohort 3 (*N*=2,672)	31.2%**	38.7%*	34.8%***	29.1%*
URM				
Cohort 1 (*N*=993)	39.1%	58.6%	48.3%	53.7%
Cohort 2 (*N*=549)	28.2%	39.4%	34.6%	38.0%
Cohort 3 (*N*=669)	28.5%	34.1%***	30.9%***	33.6%**
Non-URM				
Cohort 1 (*N*=4,470)	43.0%	43.0%	43.0%	40.5%

	QG1 Fellows	QG2 Fellows	All Fellows	QG2 Honorable Mention Designees
Cohort 2 (*N*=6,263)	36.5%	42.8%	39.5%	40.9%
Cohort 3 (*N*=4,644)	35.4%*	39.1%	37.1%**	36.2%
With disabilities				
Cohort 1 (*N*=121)	42.8%	42.8%	42.8%	38.1%
Cohort 2 (*N*=140)	34.8%	46.5%	38.7%	33.2%
Cohort 3 (*N*=146)	38.6%	40.3%	39.4%	37.8%
Without disabilities				
Cohort 1 (*N*=5,026)	43.0%	45.6%	44.2%	43.1%
Cohort 2 (*N*=6,538)	36.0%	42.3%	39.1%	41.2%
Cohort 3 (*N*=4,976)	34.4%**	38.2%**	36.2%***	36.0%*
Ph.D. completion within 10 years of enrollment	(*N*=4,026)	(*N*=3,751)	(*N*=7,777)	(*N*=2,826)
Men				
Cohort 1 (*N*=3,292)	79.4%	79.9%	79.6%	74.7%
Cohort 2 (*N*=2,704)	90.1%***	89.4%**	89.8%***	81.8%*
Women				
Cohort 1 (*N*=2,170)	78.8%	74.8%	76.4%	67.8%
Cohort 2 (*N*=2,436)	87.7%*	84.0%**	85.5%***	85.4%***
URM				
Cohort 1 (*N*=993)	74.9%	62.5%	69.1%	57.7%
Cohort 2 (*N*=418)	95.3%***	89.1%***	91.7%***	82.4%**
Non-URM				
Cohort 1 (*N*=4,466)	80.1%	80.2%	80.2%	76.6%
Cohort 2 (*N*=4,623)	88.6%***	85.8%*	87.2%***	83.2%*
With disabilities				
Cohort 1 (*N*=121)	65.7%	50.3%	58.3%	64.1%
Cohort 2 (*N*=90)	85.8%***	100.0%**	91.2%**	100.0%**
Without disabilities				
Cohort 1 (*N*=5,025)	79.3%	77.8%	78.6%	73.6%
Cohort 2 (*N*=4,827)	89.3%***	86.4%***	87.8%***	83.0%***

NOTES: Table percentages are based on weighted, non-missing data. Row and column Ns represent the weighted number of respondents who enrolled in their reference graduate program at least 5 years (for master's completion) or at least 10 years (for Ph.D. completion) prior to 2012. For Ph.D. completion, the following variables have missing values (numbers reflect weighted missing values): URM status (102 missing), and Disability status (542 missing). For Master's degree completion, the following variables have missing values (numbers reflect weighted missing values): URM status (196 missing) and Disability status (837 missing).

* Difference between the indicated cohort and Cohort 1 was statistically significant at .05 level (adjusted).

** Difference between the indicated cohort and Cohort 1 was statistically significant at .01 level (adjusted).

*** Difference between the indicated cohort and Cohort 1 was statistically significant at .001 level (adjusted).

Time to Degree

Exhibit 5.22 presents data on time to degree (TTD) for Ph.D. graduates. Overall, among all doctoral students who completed their degree program in any amount of time (i.e., not limited to those who completed the degree within ten years), the average TTD was just over six years, and did not differ by

cohort or award status. While Exhibit 5.22 shows a shorter TTD for members of Cohort 2 compared to Cohort 1, these differences may be due to two factors that cannot be controlled for. Members of Cohort 1 enrolled in graduate school several years earlier than members of Cohort 1. Similarly, a higher proportion of the members of Cohort 2 are currently enrolled in graduate school compared to Cohort 1. The data collected at the time of the survey (in 2012) therefore encompass a longer period of time for Cohort 1 than for Cohort 2, which results in a shorter cutoff for Cohort 2 members who may complete a Ph.D. but take longer than average to do so. Students who complete a Ph.D. later than 2012 will raise the mean TTD for their cohort, and there are many more members of Cohort 2 who are likely to do so than members of Cohort 1. Changes in TTD over time may be an area for further study, but care must be taken to examine TTD over an appropriate span of time in order to account for students who take longer to complete a Ph.D.

Exhibit 5.22. Mean Time to Degree (in Years) for the Doctoral Degree by Fellowship Award Status and Cohort

	QG1 Fellows (*N*=4,129)	QG2 Fellows (*N*=3,556)	All Fellows (*N*=7,685)	QG2 Honorable Mention Designees (*N*=2,712)
Cohort 1 (*N*=4,380)	6.32	6.38	6.35	6.36
Cohort 2 (*N*=6,018)	6.04	5.99	6.01	6.05

NOTES: Means and Ns are based on weighted, non-missing data. Row and column Ns represent the weighted number of respondents who reported completing a Ph.D. The following variable has missing values (number reflects weighted missing values): time to complete degree (22 missing). Significance tests between Cohort 1 and Cohort 2 were not run because members of Cohort 1 enrolled in graduate school earlier than members of Cohort 2, and Cohort 2 has a higher proportion of students who are currently enrolled in Ph.D. programs. Both of these factors are likely to decrease the observed TTD for members of Cohort 2 as measured in 2012.

Exhibit 5.23 shows the mean TTD by field of graduate study, as well as by award status and cohort. Mean TTD varies by field of study. For example, the shortest TTD were observed among Fellows who studied Chemistry (5.54 years in Cohort 1), Mathematical Sciences (5.54 years in Cohort 1), Psychology (5.91 years in Cohort 1) and Engineering (5.96 years in Cohort 1), and the longest TTD were observed among Fellows who studied Social Sciences (7.57 years in Cohort 1) and Geosciences (7.02 years in Cohort 1). These differences in TTD by field of graduate study may reflect field-specific conditions, including cultural and funding-related factors, rather than differential influence of the GRFP by field of graduate study.

Exhibit 5.23. Mean Time to Degree (in Years) for the Doctoral Degree by Fellowship Award Status, Cohort, and Field of Graduate Study

	QG1 Fellows	QG2 Fellows	All Fellows	QG2 Honorable Mention Designees
Cohort 1	(*N*=1,813)	(*N*=1,475)	(*N*=3,288)	(*N*=1,091)
Chemistry (*N*=311)	5.54	5.54	5.54	5.35
Computer and Information Sciences and Engineering (*N*=221)	6.42	6.34	6.38	7.01
Engineering (*N*=913)	5.87	6.06	5.96	6.12
Geosciences (*N*=136)	6.84	7.29	7.02	6.71
Life Sciences (*N*=1,178)	6.29	6.44	6.36	6.27
Mathematical Sciences (*N*=192)	5.44	5.64	5.54	6.20
Physics and Astronomy (*N*=343)	5.99	6.01	6.00	6.66
Psychology (*N*=338)	6.06	5.70	5.91	6.09
Social Sciences (*N*=720)	7.47	7.72	7.57	7.17
Other Field Of Study (*N*=24)	12.01	5.82	7.07	6.98
Cohort 2	(*N*=2,315)	(*N*=2,081)	(*N*=4,396)	(*N*=1,621)
Chemistry (*N*=466)	5.29	5.49	5.38	5.51
Computer and Information Sciences and Engineering (*N*=374)	6.29	6.21	6.25	5.72
Engineering (*N*=1,318)	5.77	5.75	5.76	5.72
Geosciences (*N*=266)	6.07	6.34	6.17	6.33
Life Sciences (*N*=1,723)	6.08	6.11	6.09	6.07
Mathematical Sciences (*N*=281)	5.49	5.24	5.38	5.48
Physics and Astronomy (*N*=354)	5.96	5.64	5.84	6.28
Psychology (*N*=417)	5.92	5.93	5.92	5.93
Social Sciences (*N*=789)	6.90	7.11	6.98	6.74
Other Field Of Study (*N*=12)	5.54	n/a	5.54	5.50

NOTES: Means and Ns are based on weighted, non-missing data. Row and column Ns represent the weighted number of respondents who reported completing a Ph.D. The following variables have missing values (numbers reflect weighted missing values): time to complete degree (22 missing), and field of graduate study (3 missing).

Summary

The percentage of Fellows who had attended a community college at any point in their undergraduate career increased between Cohort 1 and Cohort 4 from 7.7 percent to 11.1 percent. Over one-quarter of respondents across all cohorts had participated in an NSF-sponsored program as undergraduates and this increased from 22.1 percent in Cohort 1 to 30.5 percent in Cohort 4.

The overwhelming majority of Fellows and HM designees (94 to 95 percent across groups) attended a research university with a very high level of research activity and there has been a small shift over time towards public institutions among Fellows.

Among the list of reasons for choosing to enroll in a particular graduate program, the most common factors cited by both Fellows and HM designees were the institution's academic desirability, the desire to improve employment opportunities in academia, the ability to work with a specific faculty member, and the institution's desirable geographic location. Compared with Cohort 1 Fellows, Fellows in Cohort 4 more frequently cited the following factors as influencing their choice of graduate program: to work with a specific faculty member, to attend an institution that provided a good fit for [them] personally, to attend an institution that was socially desirable, to improve [their] employment opportunities in industry, and because it provided [them] with opportunities to teach.

About one-quarter of the Fellows reported that there were other fellowships in their fields that were more desirable, primarily because of a larger stipend or higher prestige and, to a lesser extent, because the fellowship offered more years of support. This proportion varied by cohort, and the proportion of Fellows reporting that there were other fellowships in their fields that were more desirable increased from 21.9 percent in Cohort 1 to 32.1 percent in Cohort 4. Most of the reasons why other fellowships were more desirable were cited more frequently in Cohort 4 compared to Cohort 1 by similar proportions.

The perception that other fellowships in their fields were more desirable varied by field of graduate study with roughly half of the Cohort 4 Fellows in most physical science and engineering fields (including Chemistry, Computer and Information Sciences and Engineering, Engineering, Mathematical Sciences, and Physics and Astronomy) reporting that other fellowships in their field were more desirable. Intermediate proportions of Fellows (between 20 and 30 percent) in Geosciences, Life Sciences, and Other fields of study, and less than ten percent of Fellows in Psychology and Social Sciences, perceived another fellowship in their field as more desirable.

A small percentage of awardees did not accept the GRFP award; this percentage declined from 12.1 percent in Cohort 1 to 2.6 percent in Cohort 4. Receiving other fellowships that offered higher stipends and/or better non-stipend support appeared to be the primary reasons for declining the GRFP award among potential Cohort 4 Fellows. One quarter of the potential Cohort 4 Fellows who declined the award reported that GRFP requirements influenced their decision to decline the award.

There were some differences in the percentage of Fellows and HM designees completing their master's or doctoral programs. QG2 Fellows were more likely than HM designees to have completed a master's degree within five years of enrollment, and QG1 Fellows were more likely than HM designees to have completed a Ph.D. within ten years of enrollment. Overall the rates of completion were high, with 82.7

percent of Fellows and 77.9 percent of HM designees completing a Ph.D. within ten years of enrollment (this calculation includes students who initially enrolled in a terminal master's program).

Degree completion rates varied by field of graduate study. More than half of the Fellows studying Engineering, Computer and Information Sciences and Engineering, or Other fields of study completed a master's degree within five years of enrollment, compared to roughly fifteen to twenty percent of the Fellows studying Chemistry or Life Sciences. In terms of Ph.D. completion within ten years of enrollment, more than 90 percent of the Fellows studying Chemistry and Psychology did so, along with more than 80 percent of the Fellows studying Life Sciences, Physics and Astronomy, Mathematical Sciences, and Geosciences, compared to just under 80 percent of the Fellows studying Social Sciences and roughly 75 percent of the Fellows studying Engineering and Computer and Information Sciences and Engineering. Because these calculations include all Fellows regardless of whether they initially enrolled in a Ph.D. program or a terminal master's program, these differences are likely to reflect field-specific conditions, including how common it is to pursue a Ph.D. compared to a terminal master's degree, how common it is to receive a master's degree in the course of a Ph.D. program, and typical completion rates and time to degree within each field. They do not necessarily reflect differential influence of the GRFP by field of graduate study; in fact, the differences in completion rates between Fellows and HM designees were minimal. By comparison, note that the impact analysis in Exhibit 3.17 that includes propensity weighting techniques indicates that the GRFP has a medium-size impact on Ph.D. completion rates within ten years of enrollment, but the additional impact analyses in Exhibit B.9 indicate no differential impact by field of graduate study.

There were some differences in degree completion between Fellows and HM designees among demographic subgroups. Female QG2 Fellows were more likely to complete a master's degree within five years of enrollment compared to female HM designees, as were QG1 Fellows with disabilities compared to HM designees with disabilities. Fellows within several demographic subgroups completed a Ph.D. within ten years of enrollment at higher rates than their HM designee counterparts, including men (both QG1 and QG2 Fellows), URMs (both QG1 and QG2 Fellows), non-URMs (QG1 Fellows), and students without disabilities (QG1 Fellows). There were no differences in Ph.D. completion rate within ten years between female Fellows and HM designees or between Fellows and HM designees with disabilities.

The survey data suggest that Fellows have become more likely to complete a Ph.D. within ten years of enrollment and less likely to complete a master's degree within five years of enrollment. Fellows and HM designees in Cohort 3 are less likely than Fellows and HM designees in Cohort 1 to have completed a master's degree within five years of enrollment (Cohort 4 Fellows were excluded from this analysis

because they had not enrolled at least five years before 2012). Ph.D. completion rates exhibited the opposite pattern; Fellows and HM designees in Cohort 2 completed a Ph.D. within ten years of enrollment at a higher rate than Fellows and HM designees in Cohort 1 (Cohort 3 and 4 Fellows were excluded from this analysis because they had not enrolled at least ten years before 2012). Because these analyses excluded the most recent cohorts of Fellows, these changes may not reflect current program policies and future study to determine if these trends persist is recommended.

Similar to degree completion rates, time to complete the Ph.D. also varied by field of graduate study, although mean degree completion times should be assessed over a long time frame to account for students who take longer (in many cases, more than ten years) to complete a Ph.D. Among Cohort 1 Fellows, the fields of study with the shortest mean time to complete the Ph.D. (less than six years) were Chemistry, Mathematical Sciences, Psychology, and Engineering, and the fields of study with the longest mean time to complete the Ph.D. (more than seven years) were Social Sciences and Geosciences. While the survey data indicate that Cohort 2 Fellows currently have a shorter mean time to complete the Ph.D. than Cohort 1 Fellows, because care must be taken to examine TTD over an appropriate span of time in order to account for students who take longer to complete a Ph.D., future study over a longer time frame is recommended. Furthermore, the impact analysis in Exhibit 3.19 that includes propensity weighting techniques indicates that the GRFP no impact on the time to complete the Ph.D.

Chapter 6: Selected Characteristics of GRFP Fellows and National Comparison Groups

The comparisons in this chapter address the first purpose of the study: to provide descriptive information related to the GRFP goals on the demographics, educational decisions, career preparation, aspirations and progress, as well as professional productivity, of GRFP Fellows and comparable non-recipient applicants and national populations of graduate students and doctorate recipients. Additionally, these comparisons provide important context for interpreting the impact of the Fellowship of graduate school experiences and career outcomes (as described in Chapters 3 and 4) by describing how Fellows are similar to and differ from a national population of graduate students, and partially address RQ4 (*Is the program design effective in meeting program goals?*).

Demographic Characteristics

Exhibit 6.1 presents selected demographic characteristics of two subsets of GRFP Fellows, Ph.D. completers and terminal master's completers, alongside their national comparison groups. No data on students with and without disabilities are presented in this exhibit because neither the SDR nor the NSCG contains a measure comparable to the GRFP measure of disability status. Citizenship status is presented at time of survey rather than when entering graduate school because the latter measure was not available in the SDR or NSCG data.

Women accounted for a higher proportion of GRFP Fellows with degrees than among national samples of degree completers (47.9 percent of GRFP Fellow Ph.D. completers compared to 43.9 percent nationally, and 57.1 percent of GRFP Fellow terminal master's completers compared to 49.1 percent nationally). Similarly, a higher proportion of GRFP Fellow Ph.D. completers were URMs compared with the national samples (12.2 percent compared to 10.6 percent nationally), although a lower proportion of GRFP Fellow terminal master's completers were URMs compared with the national samples (14.8 percent compared to 16.3 percent nationally).

Within the race and ethnicity categories, GRFP Fellow Ph.D. completers were slightly more likely than the national sample to be Hispanic or multi-racial (6.9 percent compared to 4.7 percent, and 3.4 percent compared to 1.8 percent, respectively), and slightly less likely than the national sample to be Asian or Black (9.2 percent compared to 10.5 percent, and 3.7 percent compared to 4.6 percent, respectively). GRFP Fellow terminal master's completers were more likely than the national sample to by White (78.6

percent compared to 74.4 percent) and less likely to be Black or Native Hawaiian or Other Pacific Islander (5.4 percent compared to 8.7 percent, and 0.0 percent compared to 0.2 percent, respectively).

GRFP Fellow degree completers were more likely to be U.S. citizens at the time of the survey compared to the relevant national samples (99.4 percent versus 96.4 percent for Ph.D. completers and 99.6 percent versus 94.0 percent for terminal master's completers), which is not surprising given the GRFP's requirement that applicants be U.S. citizens, nationals, or permanent residents.

GRFP Fellow degree completers were more likely than the national comparison groups to have parents with advanced degrees. Among Ph.D. completers, 8.3 percent of GRFP Fellows had mothers with a Ph.D., and 23.6 percent of Fellows had fathers with a Ph.D., compared to 3.9 percent and 14.0 percent respectively nationally. Among terminal master's completers, 3.9 percent of Fellows had mothers and 17.5 percent of Fellows had fathers with doctoral degrees, compared to 1.3 percent and 5.8 percent respectively nationally.

Conversely, GRFP Fellow degree completers were less likely than their counterparts to have parents with a Bachelor's degree or less. Among Ph.D. completers, 57.1 percent of GRFP Fellows had mothers who had completed a Bachelor's degree or less, and 38.7 percent of Fellows had fathers who had completed a Bachelor's degree or less, compared to 73.1 percent and 58.7 percent respectively nationally. Among terminal master's completers, 68.6 percent of GRFP Fellows had mothers with a Bachelor's degree or less, and 46.7 percent of Fellows had fathers with a Bachelor's degree or less, compared to 82.5 percent and 74.6 percent respectively nationally.

Exhibit 6.1. Demographic Characteristics of GRFP Degree Completers and National Comparison Groups

	GRFP Fellows: Ph.D. Completers (*N*=7,459)	SDR: Ph.D. Completers (*N*=229,297)	GRFP Fellows: Terminal Master's Completers (*N*=1,121)	NSCG/ NSRCG: Terminal Master's Completers (*N*=969,872)
Gender				
Female	47.9%***	43.9%	57.1%***	49.1%
Male	52.1%***	56.1%	42.9%***	50.9%
Ethnicity				
Hispanic	6.9%***	4.7%	7.7%	6.6%
Non-Hispanic	93.1%***	95.3%	92.3%	93.4%
Race				
White	83.2%	82.5%	78.6%*	74.4
Asian	9.2%**	10.5%	13.0%	14.3%

	GRFP Fellows: Ph.D. Completers (*N*=7,459)	SDR: Ph.D. Completers (*N*=229,297)	GRFP Fellows: Terminal Master's Completers (*N*=1,121)	NSCG/ NSRCG: Terminal Master's Completers (*N*=969,872)
Black or African American	3.7%***	4.6%	5.4%*	8.7%
Native Hawaiian or Other Pacific Islander	0.1%	0.2%	0.0%***	0.2%
American Indian or Alaska Native	0.5%	0.4%	0.6%	0.3%
Multiracial (two or more)	3.4%***	1.8%	2.4%	2.1%
Underrepresented Minority (URM)				
URM	12.2%***	10.6%	14.8%***	16.3%
Non-URM	87.8%***	89.4%	85.2%***	83.7%
Citizenship status at time of survey				
U.S. citizen	99.4%***	96.4%	99.6%***	94.0%
Highest degree completed by mother				
Less than a Bachelor's degree	24.3%***	47.7%	32.4%***	58.4%
Bachelor's degree	32.8%***	25.4%	36.2%***	24.1%
Master's degree (M.A., M.S., M.B.A., etc.)	30.6%***	19.3%	23.7%***	14.8%
Professional degree (M.D., D.D.S., J.D., Psy.D., etc.)	3.8%	3.7%	3.8%***	1.4%
Research doctoral degree or Ph.D.	8.3%***	3.9%	3.9%***	1.3%
Highest degree completed by father				
Less than a Bachelor's degree	17.9%***	35.9%	21.4%***	50.6%
Bachelor's degree	20.8%**	22.8%	25.3%	24.0%
Master's degree (M.A., M.S., M.B.A., etc.)	24.3%***	18.5%	23.5%***	14.3%
Professional degree (M.D., D.D.S., J.D., Psy.D., etc.)	12.9%***	8.8%	12.3%***	5.3%
Research doctoral degree or Ph.D.	23.6%***	14.0%	17.5%***	5.8%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). For GRFP Ph.D. completers, the following variables have missing values (numbers reflect weighted missing values): Ethnicity (154 missing), Race (160 missing), URM status (48 missing), Citizenship status at time of survey (315 missing), Highest degree completed by mother (322 missing), and Highest degree completed by father (325 missing). For GRFP terminal master's completers, the following variables have missing values (numbers reflect weighted missing values): Ethnicity (44 missing), Race (41 missing), URM status (20 missing), Citizenship status at time of survey (75 missing), Highest degree completed by mother (80 missing), and Highest degree completed by father (82 missing). For NSCG/NSRCG terminal master's completers the following variables have missing values (numbers reflect weighted missing values): Highest degree completed by mother (6,517 missing),and Highest degree completed by father (8,576 missing).

GRFP Fellow Ph.D. completers are compared to SDR Ph.D. completers, and GRFP Fellow terminal master's completers are compared to NSCG/NSRCG terminal master's completers. Significance test indicators are placed next to the GRFP Fellow percentage and indicate a significant difference between that group of GRFP Fellows and the noted comparison group.

*p<0.05 (adjusted)

**p<0.01 (adjusted)

***p<0.001 (adjusted)

Educational Backgrounds

As shown in Exhibit 6.2, GRFP Fellow degree completers were less likely than the national comparison groups to have attended community college as an undergraduate (7.2 percent compared to 13.0 percent

among Ph.D. completers and 9.9 percent compared to 45.9 percent among terminal master's completers). However, the question related to community college attendance was phrased differently in the three surveys[13] and the differences in the way the question was worded could have contributed to the differences between groups.

Exhibit 6.2. Community College Attendance of GRFP Degree Completers and National Comparison Groups

Educational background	GRFP Fellows: Ph.D. Completers (*N*=7,459)	SED: Ph.D. Completers (*N*=241,479)	GRFP Fellows: Terminal Master's Completers (*N*=1,121)	NSCG/ NSRCG: Terminal Master's Completers (*N*=969,872)
Attended a community college as undergraduate	7.2%***	13.0%	9.9%***	45.9%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). For GRFP Ph.D. completers, the following variable has missing values (number reflects weighted missing values): Attended a community college as undergraduate (307 missing). For GRFP terminal master's completers, the following variable has missing values (number reflects weighted missing values): Attended a community college as undergraduate (72 missing). For SED Ph.D. completers, there are 10,391 weighted missing values for the community college attendance variable.

GRFP Fellow Ph.D. completers are compared to SED Ph.D. completers, and GRFP Fellow terminal master's completers are compared to NSCG/NSRCG terminal master's completers. Significance test indicators are placed next to the GRFP Fellow percentage and indicate a significant difference between that group of GRFP Fellows and the noted comparison group.

***p<0.001 (adjusted)

Selected Characteristics of Graduate Institutions Attended

Exhibit 6.3 presents data from the Integrated Postsecondary Education Data System (IPEDS) about the primary graduate institution attended by GRFP Fellow Ph.D. completers and terminal master's completers and the national comparison groups. Among Ph.D. completers, GRFP Fellows were more likely than their counterparts to attend an institution categorized in the Carnegie Classification system as having very high research activity (94.6 percent compared to 73.5 percent), and more likely to attend a private university (50.3 percent compared to 31.9 percent). GRFP Fellows were also more likely to attend an institution located in the Northeast (33.4 percent compared to 23.8 percent) or West (38.6 percent compared to 24.6 percent) and less likely to attend an institution located in the South (12.7 percent compared to 28.8 percent) or Midwest (15.3 percent compared to 22.5 percent).

[13] In the GRFP survey, the question is "Did you attend community college at any point during your undergraduate education?" The SED asks "Did you earn college credit from a community or two-year college?" The NSRCG asks "Have you ever taken courses at a community college?" The GRFP version of this question makes clear that the question is relevant to undergraduate education, which the SED version implies but does not state. The NSRCG version, on the other hand, could apply to courses taken at any time, including after receiving a Ph.D., and may not have been related to a degree program.

Among terminal master's completers, GRFP Fellows were much more likely than the national comparison group to attend an institution categorized in the Carnegie Classification system as having very high research activity (94.8 percent compared to 23.9 percent), and more likely to attend a private university (42.4 percent compared to 20.6 percent).[14]

Exhibit 6.3. Selected Characteristics of the Primary Graduate Institution Attended of GRFP Degree Completers and National Comparison Groups

	GRFP Fellows: Ph.D. Completers (*N*=7,459)	SDR: Ph.D. Completers (*N*=229,297)	GRFP Fellows: Terminal Master's Completers (*N*=1,121)	NSCG/ NSRCG: Terminal Master's Completers (*N*=969,872)
Carnegie Classification				
Research Universities: very high research activity	94.6%***	73.5%	94.8%***	23.9%
Research Universities: high research activity	2.3%***	17.7%	3.1%***	14.4%
Doctoral Research Universities	0.3%***	3.9%	0.3%***	3.2%
Master's Colleges and Universities	0.0%***	0.9%	0.7%***	18.5%
Other	2.8%***	4.0%	1.1%***	40.1%
Control				
Public	49.7%***	68.1%	57.6%***	79.4%
Private	50.3%***	31.9%	42.4%***	20.6%
Census Region				
Northeast	33.4%***	23.8%	25.4%	--
South	12.7%***	28.8%	19.1%	--
Midwest	15.3%***	22.5%	15.4%	--
West	38.6%***	24.6%	40.1%	--

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). Among SDR Ph.D. completers, there are 8,953 weighted missing values for Carnegie Classification and Control. Among NSCG/NSRCG terminal master's completers, there are 696,099 weighted missing values for Carnegie Classification due to data suppression.

GRFP Fellow Ph.D. completers are compared to SDR Ph.D. completers, and GRFP Fellow terminal master's completers are compared to NSCG/NSRCG terminal master's completers. Significance test indicators are placed next to the GRFP Fellow percentage and indicate a significant difference between that group of GRFP Fellows and the noted comparison group.

***p<0.001 (adjusted)

Graduate Fields of Study

Exhibit 6.4 presents data on the graduate field of study pursued by GRFP Fellow Ph.D. completers and terminal master's completers and their national comparison counterparts. GRFP Follow-up Survey respondents reported their primary field of study at their primary institution, while SED and

[14] Approximately 30 percent of the IPEDS data in the NSCG and NSRCG data sets were suppressed. However, the differences noted in Exhibit 4.3 are so large that it is unlikely that the suppressed data would change the findings markedly.

NSCG/NSRCG respondents reported the field of study in which they received the reported degree. GRFP respondents may have changed fields before completing the reported degree.

Among Ph.D. completers, GRFP Fellows were more likely than the national comparison group to be in Computer and Information Sciences and Engineering (5.7 percent compared to 3.5 percent), Engineering (23.4 percent compared to 15.6 percent), Geosciences (4.1 percent compared to 2.5 percent), Mathematical Sciences (4.7 percent compared to 3.7 percent), or Physics and Astronomy (6.5 percent compared to 4.7 percent). On the other hand, GRFP Fellows were less likely than the national comparison group to have studied Life Sciences (26.7 percent compared to 30.2 percent), Psychology (7.5 percent compared to 16.6 percent), or Social Sciences (13.2 percent compared to 15.8 percent). Roughly equal proportions of GRFP Fellows and the national comparison group were studying Chemistry (7.5 percent compared to 7.2 percent).

Among terminal master's completers, GRFP Fellows were more likely than the national comparison group to have graduated with degrees in Chemistry (2.5 percent compared to 1.0 percent), Engineering (55.0 percent compared to 22.5 percent), Geosciences (3.6 percent compared to 1.6 percent), and Physics and Astronomy (3.5 percent compared to 0.8 percent). GRFP Fellows were less likely than the national comparison group to have degrees in Computer and Information Sciences and Engineering (8.2 percent compared to 19.4 percent), Mathematical Sciences (2.9 percent compared to 6.5 percent), Psychology (1.7 percent compared to 18.0 percent), or Social Sciences (6.6 percent compared to 15.1 percent). Roughly equal proportions of GRFP Fellows and the national comparison group were studying Life Sciences (12.8 percent compared to 11.1 percent).

Exhibit 6.4. Field of Graduate Study of GRFP Degree Completers and National Comparison Groups

	GRFP Fellows: Ph.D. Completers (*N*=7,459)	SED: Ph.D. Completers (*N*=241,479)	GRFP Fellows: Terminal Master's Completers (*N*=1,121)	NSCG/ NSRCG: Terminal Master's Completers (*N*=969,872)
Chemistry	7.5%	7.2%	2.5%***	1.0%
Computer and Information Sciences and Engineering	5.7%***	3.5%	8.2%***	19.4%
Engineering	23.4%***	15.6%	55.0%***	22.5%
Geosciences	4.1%***	2.5%	3.6%***	1.6%
Life Sciences	26.7%***	30.2%	12.8%	11.4%
Mathematical Sciences	4.7%	3.7%	2.9%**	6.5%
Physics and Astronomy	6.5%**	4.7%	3.5%***	0.8%
Psychology	7.5%***	16.6%	1.7%***	18.0%
Social Sciences	13.2%***	15.8%	6.6%***	15.1%
Other	0.6%	N/A	3.2%	3.8%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). For GRFP Ph.D. completers, the following variable has missing values (number reflects weighted missing values): Field of Graduate Study (3 missing).

GRFP Fellow Ph.D. completers are compared to SED Ph.D. completers, and GRFP Fellow terminal master's completers are compared to NSCG/NSRCG terminal master's completers. Significance test indicators are placed next to the GRFP Fellow percentage and indicate a significant difference between that group of GRFP Fellows and the noted comparison group.

**p<0.01 (adjusted)

***p<0.001 (adjusted)

Sources of Financial Support

We next examine sources of financial support for GRFP Fellow Ph.D. completers and the SDR comparison group (Exhibit 6.5). As expected, virtually all GRFP Fellow Ph.D. completers (99.3 percent) reported receiving financial support via fellowships or scholarships, compared to 55.5 percent of similar Ph.D. completers in the SDR. GRFP Fellows were also more likely than their SDR counterparts to report receiving support from grants (38.8 percent versus 26.7 percent) but less likely to report receiving support from internships (6.1 percent compared to 15.2 percent), loans (13.2 percent compared to 35.0 percent), personal or family sources (40.5 percent compared to 66.9 percent), or employer assistance (1.6 percent compared to 8.6 percent). These differences make sense in light of GRFP Fellows' decreased need for funding (because of the Fellowship). However, similar proportions of GRFP Fellow Ph.D. completers and the national comparison sample from SDR reported receiving financial support through assistantships, including teaching and research (81.7 percent compared to 81.2 percent). The Follow-up Survey did not ask Fellows to specify whether they were on Tenure or Reserve status when they received each type of

support, nor did it specify whether financial support included only salary or stipend support, or supplies and equipment as well.

Exhibit 6.5. Sources of Financial Support for GRFP Ph.D. Completers and National Comparison Groups

	GRFP Fellows: Ph.D. Completers (*N*=7,459)	SDR: Ph.D. Completers (*N*=229,297)
Fellowships or Scholarships	99.3%***	55.5%
Grants	38.8%***	26.7%
Assistantships (teaching, research, other)	81.7%	81.2%
Internship	6.1%***	15.2%
Loans	13.2%***	35.0%
Personal or family sources	40.5%***	66.9%
Employer assistance	1.6%***	8.6%
Foreign (non-U.S.) support	0.9%	1.1%
Other	1.3%**	0.6%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). For GRFP Ph.D. completers, the following variable has missing values (number reflects weighted missing values): sources of financial support (232 missing). For SED Ph.D. completers, the following variable has missing values: sources of financial support (18,703 missing).

GRFP Fellow Ph.D. completers are compared to SDR Ph.D. completers. Significance test indicators are placed next to the GRFP Fellow percentage and indicate a significant difference between the two groups.

**p<0.01 (adjusted)

***p<0.001 (adjusted)

Time to Degree (Ph.D.)

GRFP Fellow Ph.D. completers, on average, received their Ph.D. about nine months more quickly than their SED counterparts: 5.95 years compared to 6.69 years (Exhibit 6.6). Note that the time to degree reported in Exhibit 6.6 for Fellows differs slightly from the time to degree reported in Exhibit 5.22 for Fellows by award status and cohort because the included populations are slightly different. In order to compare GRFP survey data to SED data, the GRFP Fellow population in Exhibit 6.6 is limited to those who completed a Ph.D. between 1996 and 2009, whereas Exhibit 5.22 includes degrees completed through 2012.

Exhibit 6.6. Mean Time to Degree for GRFP Ph.D. Completers and National Comparison Groups

	GRFP Fellows: Ph.D. Completers (*N*=7,459)	SED: Ph.D. Completers (*N*=241,479)
Time to Ph.D. (years)	5.95***	6.69

NOTES: Statistics presented for GRFP Ph.D. completers are based on weighted, non-missing data. For GRFP Ph.D. completers, the following variable has missing values (number reflects weighted missing values): time to degree (18 missing). For SED Ph.D. completers, the following variable has missing values: time to degree (20,596 missing).

GRFP Fellow Ph.D. completers are compared to SED Ph.D. completers. Significance test indicators are placed next to the GRFP Fellow percentage and indicate a significant difference between the two groups.

***p<0.001 (adjusted)

Mean time to degree varied by field of graduate study, and within each of the examined fields of graduate study, GRFP Fellow Ph.D. completers received their Ph.D. more quickly than SED respondents in the same field (Exhibit 6.7). In three fields of study, GRFP Fellow Ph.D. completers received their Ph.D. more than a year earlier than their SED counterparts: Psychology (1.09 years), Mathematical Sciences (1.08 years), and Computer and Information Sciences and Engineering (1.05 years). In three other fields of study, the difference was less than half a year: Life Sciences (0.31 years), Geosciences (0.36 years), and Chemistry (0.37 years).

Time to degree varies by field of study, reflecting cultural, funding-related, and other discipline-specific factors, regardless of GRFP participation, but GRFP participation may affect the time to degree of students in different fields of study differently. For example, in the SED data, the mean time to degree for a Ph.D. in Life Sciences in the SED was 6.32 years, and 6.44 years in Mathematical Sciences. Among GRFP Fellows who completed the Ph.D., the mean time to degree was 6.01 years for Life Sciences and 5.36 years for Mathematical Sciences; decreases of 0.31 years and 1.08 years respectively. Although the impact analysis (Exhibit 3.19) showed no impact of the GRFP on time to degree, overall or by field of study, the sample size within many of the individual fields of study may have been too small to detect any differences. Given the differences observed in Exhibit 6.7 between fields of study and between GRFP Fellows and the larger national population of Ph.D. recipients in the same fields, further study may be warranted.

Among the GRFP Fellow Ph.D. completers, the differences in time to degree by field of graduate study may reflect field-specific conditions, including cultural and funding-related factors, rather than differential influence of the GRFP by field of graduate study.

Exhibit 6.7. Mean Time to Degree for GRFP Ph.D. Completers and National Comparison Groups by Field of Graduate Study

	GRFP Fellows: Ph.D. Completers (*N*=7,459)	SED: Ph.D. Completers (*N*=241,479)
Time to Ph.D. (years)		
Chemistry	5.33***	5.70
Computer and Information Sciences and Engineering	6.13***	7.18
Engineering	5.63***	6.47
Geosciences	6.38*	6.74
Life Sciences	6.01***	6.32
Mathematical Sciences	5.36***	6.44
Physics and Astronomy	5.70***	6.56
Psychology	5.79***	6.88
Social Sciences	6.96***	7.93
Other Field Of Study	6.50	n/a

NOTES: Statistics presented for GRFP Ph.D. completers are based on weighted, non-missing data. For GRFP Ph.D. completers, the following variable has missing values (number reflects weighted missing values): time to degree (18 missing). For SED Ph.D. completers, the following variable has missing values: time to degree (20,596 missing).

GRFP Fellow Ph.D. completers are compared to SED Ph.D. completers. Significance test indicators are placed next to the GRFP Fellow percentage and indicate a significant difference between the two groups.

*p<0.05 (adjusted)

***p<0.001 (adjusted)

Job Congruence with Graduate Field of Study

GRFP Fellow Ph.D. completers reported similar levels of relatedness of their current or most recent job (as of 2012) to graduate field of study compared with the SDR comparison group, as shown in Exhibit 6.8. For example, 69.2 percent reported that the job was "closely related" to the field of study compared with 67.5 percent of the SDR sample. However, GRFP Fellow terminal master's completers reported much lower levels of congruence between their job and field of study compared with the national comparison group. For example, only 35.3 percent reported their job was "closely related" compared with 68.5 percent of the NSCG/NSRCG comparison group while 24.7 percent reported that their job was "not related" to their field compared with only 8.2 percent of the national comparison group.

Exhibit 6.8. Relatedness of Current or Most Recent Job to Graduate Field of Study of GRFP Degree Completers and National Comparison Groups

	GRFP Fellows: Ph.D. Completers (N=7,459)	SDR: Ph.D. Completers (N=216,420)	GRFP Fellows: Terminal Master's Completers (N=1,121)	NSCG/NSRCG: Terminal Master's Completers (N=878,314)
Closely related	69.2%*	67.5%	35.3%***	68.5%
Somewhat related	24.5%	25.8%	40.0%***	23.3%
Not related	6.3%	6.7%	24.7%***	8.2%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). For GRFP Ph.D. completers, the following variable has missing values (number reflects weighted missing values): Relatedness of Current or Most Recent Job to Graduate Field of Study (193 missing). For GRFP terminal master's completers, the following variable has missing values (number reflects weighted missing values): Relatedness of Current or Most Recent Job to Graduate Field of Study (71 missing).

GRFP Fellow Ph.D. completers are compared to SDR Ph.D. completers, and GRFP Fellow terminal master's completers are compared to NSCG/NSRCG terminal master's completers. Significance test indicators are placed next to the GRFP Fellow percentage and indicate a significant difference between that group of GRFP Fellows and the noted comparison group.

*p<0.05 (adjusted)

***p<0.001 (adjusted)

Sector of Employment

As shown in Exhibit 6.9, among Ph.D. completers, GRFP Fellows were more likely than the national comparison sample to be currently employed (as of 2012) in the education sector (59.8 percent versus 49.7 percent), and less likely to be employed by the government (7.2 percent versus 11.2 percent) or the private sector (31.4 percent versus 38.9 percent). The pattern is fairly different among terminal master's completers: GRFP Fellows were more likely than the national comparison group to be employed in the private sector (67.7 percent compared to 59.7 percent), and less likely to be employed in either the education (16.8 percent compared to 24.5 percent) or government sector (10.2 percent compared to 15.6 percent). The differences between GRFP Fellows and their national counterparts with respect to the graduate field of study, particularly among terminal master's completers may account for many of the differences seen here. For example, 55.0 percent of GRFP Fellows with a terminal master's degree studied Engineering, compared to 22.5 percent of the national comparison group.

Exhibit 6.9. Employment Sector of Current Job of GRFP Degree Completers and National Comparison Groups

	GRFP Fellows: Ph.D. Completers (N=7,459)	SDR: Ph.D. Completers (N=216,420)	GRFP Fellows: Terminal Master's Completers (N=1,121)	NSCG/ NSRCG: Terminal Master's Completers (N=878,314)
Education	59.8%***	49.7%	16.8%***	24.5%
Government (U.S. or Foreign)	7.2%***	11.2%	10.2%***	15.6%
Private (Not-for-profit or For-profit)	31.4%***	38.9%	67.7%***	59.7%
Other	1.6%***	0.3%	5.3%***	0.2%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). For GRFP Ph.D. completers, the following variable has missing values (number reflects weighted missing values): Employment Sector of Current Job (187 missing). For GRFP terminal master's completers, the following variable has missing values (number reflects weighted missing values): Employment Sector of Current Job (73 missing).

GRFP Fellow Ph.D. completers are compared to SDR Ph.D. completers, and GRFP Fellow terminal master's completers are compared to NSCG/NSRCG terminal master's completers. Significance test indicators are placed next to the GRFP Fellow percentage and indicate a significant difference between that group of GRFP Fellows and the noted comparison group.

***p<0.001 (adjusted)

Primary Work Activities

Exhibit 6.10 presents data on the primary work activities of currently employed (as of 2012) GRFP Fellow Ph.D. completers and terminal master's completers alongside national comparison groups. Among Ph.D. completers, GRFP Fellows were more likely than the national comparison group to indicate that research and development (81.4 percent compared to 65.9 percent) and teaching (45.1 percent compared to 30.8 percent) were among their most prominent work activities, and less likely to report other primary work activities including management or administration (25.5 percent compared to 32.6 percent), professional service to individuals (9.4 percent compared to 16.1 percent), and other activities (5.8 percent compared to 25.8 percent). Among terminal master's completers, Fellows were more likely to report as primary work activities management or administration (48.1 percent compared to 35.0 percent) or professional service to individuals (35.6 compared to 16.2 percent), and less likely to report teaching (12.8 percent compared to 20.5 percent) or other activities (20.2 percent compared to 54.4 percent).

Exhibit 6.10. Primary Work Activities of GRFP Degree Completers and National Comparison Groups

	GRFP Fellows: Ph.D. Completers (N=7,459)	SDR: Ph.D. Completers (N=216,420)	GRFP Fellows: Terminal Master's Completers (N=1,121)	NSCG/NSRCG: Terminal Master's Completers (N=878,314)
Research and development	81.4%***	64.9%	40.0%	41.3%
Teaching	45.1%***	30.8%	12.8%***	20.5%
Management or administration	25.5%***	32.6%	48.1%***	35.0%
Professional service to individuals	9.4%***	16.1%	35.6%***	16.2%
Other	5.8%***	25.8%	20.2%***	54.4%

NOTES: Table percentages are based on weighted, non-missing data. Column Ns represent the weighted number of respondents eligible to answer the survey item (including missing responses). For GRFP Ph.D. completers, the following variable has missing values (number reflects weighted missing values): Primary work activities (223 missing). For GRFP terminal master's completers, the following variable has missing values (number reflects weighted missing values): Primary work activities (94 missing).

GRFP Fellow Ph.D. completers are compared to SDR Ph.D. completers, and GRFP Fellow terminal master's completers are compared to NSCG/NSRCG terminal master's completers. Significance test indicators are placed next to the GRFP Fellow percentage and indicate a significant difference between that group of GRFP Fellows and the noted comparison group.

***p<0.001 (adjusted)

Summary

Compared with their national comparison groups, GRFP Fellows with completed degrees (both master's and doctorate) included higher proportions of women (differences of between 4 and 8 percentage points). A higher proportion of GRFP Fellow Ph.D. completers were URMs compared with the national SDR sample, although a lower proportion of GRFP Fellow terminal master's degree completers were URMs compared with the national sample.

GRFP Fellow degree completers were much more likely than the national comparison groups to have parents with advanced graduate degrees, and were less likely to have attended community college as an undergraduate. Among degree completers of both types, GRFP Fellows were markedly more likely than their counterparts to attend an institution categorized in the Carnegie Classification system as having very high research activity and to attend a private university; the differences between Fellows and the national comparison group were notably larger among terminal master's degree completers.

There were some notable differences between GRFP degree completers and their national counterparts in terms of field of graduate study. Among Ph.D. completers, GRFP Fellows were more likely than the national comparison group to be in Computer and Information Sciences and Engineering, Engineering, Geosciences, Mathematical Sciences, or Physics and Astronomy, and less likely to be in Life Sciences,

Psychology, or Social Sciences. Among terminal master's completers, GRFP Fellows were twice as likely as the national comparison group to have graduated with degrees in Engineering, more likely to have graduated with degrees in Chemistry, Geosciences, or Physics and Astronomy, and less likely to have degrees in Computer and Information Sciences and Engineering, Mathematical Sciences, Psychology, or Social Sciences. These differences demonstrate how students within different fields of study access the GRFP as a source of support, and the fields of study that are underrepresented within the population of Fellows may be productive targets for outreach from the program to increase awareness of or access to the GRFP.

GRFP Fellows were much less likely than the national comparison group to take out loans, rely on personal or family resources of financial support, take paid internships, or get employer assistance during graduate school. These differences make sense given that GRFP Fellows, by definition, receive three years of stipend and tuition support. Similar proportions of GRFP Fellow Ph.D. completers and the national SED comparison group reported receiving teaching or research assistantships, indicating that Fellows are able to engage in research and teaching opportunities during Reserve years or after completion of the fellowship.

GRFP Fellow Ph.D. completers, on average, received their Ph.D. about nine months more quickly than the SED comparison group: 5.95 years compared to 6.69 years. While time to degree varied by field of graduate study, the mean time to degree was shorter among GRFP Fellow Ph.D. completers within each field of study.

GRFP Fellow Ph.D. completers reported similar levels of relatedness of their job to graduate field of study compared with the national comparison group. This was not true of the master's completers, where Fellows reported much lower levels of congruence between their job and field of study compared with the national comparison group.

Among Ph.D. completers, GRFP Fellows were more likely than the national comparison group to be employed in the education sector and less likely to be employed in the government or the private sector. Among terminal master's completers, GRFP Fellows were more likely than the national comparison group to be employed in the private sector rather than in either the education or the government sector. The differences between GRFP Fellows and the national comparison groups with respect to the graduate field of study, particularly among terminal master's completers, may account for many of the differences seen here. For example, 55.0 percent of GRFP Fellows with a terminal master's degree studied Engineering, compared to 22.5 percent of the national comparison group.

Among Ph.D. completers, GRFP Fellows were more likely than the national comparison group to indicate that research and development and teaching were among their most prominent work activities. Among terminal master's completers, Fellows were more likely than the national comparison group to report management or administration or professional service to individuals and less likely to report teaching as primary work activities.

Chapter 7: Program Effects on Institutions

This section presents the broad conclusions drawn from the site visits and institutional telephone interviews with faculty members, departmental staff members, and administrators at GRFP institutions in order to address RQ3 (*What are the effects of the GRFP on institutions?*) and partially address RQ4 (*Is the program design effective in meeting program goals?*).

These interviews collected information on interviewees' perceptions of the current (2012) GRFP policies and procedures and recent changes. In some cases, interviewees misunderstood GRFP policies in ways that influenced their responses; we note the correct information below where relevant.

Program Influence on Graduate Institutions

Many factors outside of NSF affect how the GRFP influences institutions hosting Fellows, including, but not limited to:

- The number of Fellows and the proportion of Fellows within the institution's graduate student population.
- The availability of other sources of funding for graduate students at the institution.
- Whether the institution seeks to admit as many graduate students as can be successfully supported (financially and otherwise), or limits graduate enrollment based on other factors.

Additionally, there are major differences in organizational structure, with some institutions following a centralized model in which the graduate school administration makes most decisions down to the department level, and other institutions following a fairly decentralized model that grants individual departments or divisions a fair amount of autonomy. We found that the organizational structure of the graduate school affects not only how the GRFP influences individual departments within the graduate school, but also how the GRFP influences the institution as a whole.

We expected to find that institutions with greater numbers of Fellows (and, relatedly, those with a greater proportion of Fellows within the institution's graduate student population) would be most influenced by the GRFP, and therefore selected institutions with greater numbers of Fellows for inclusion in the site visits and telephone interviews. As discussed in Chapter 2*: Data and Methods*, to the extent possible, we took into account other criteria such as geographical region, public versus private status, and percentage of underrepresented minority students, in order to make the sample more representative of the GRFP

institutions. The 24 institutions that participated in the site visits or institutional telephone interviews represent 10.5 percent of the 228 GRFP institutions in 2012; these 24 institutions hosted a total of 3,507 Fellows in 2012, or 62.4 percent of all Fellows (there were 5,621 active Fellows in 2012).

As expected, the influence of GRFP on the institution was indeed related to the number or proportion of Fellows in the graduate student population. However, there were some notable exceptions relating to the availability of other funds, the institution's targets for graduate student enrollment, and administrative decisions to aggressively pursue GRFP funding by recruiting Fellows and/or encouraging graduate students to apply for the Fellowship. Where possible in the following discussion, we have indicated what institutional factors may have affected the ways in which the GRFP affected institutions in general, or a specific institution.

Graduate Student Diversity

Most university administrators and departmental staff members, along with many faculty members, believed that the demographic characteristics of Fellows were similar to those of non-Fellows at the institution. A small number of faculty members (less than five) from several different institutions believed that the Fellowship was more likely to be awarded to women and underrepresented minorities than to white or Asian men; most of these faculty members expressed concern that prioritizing diversity may lead to a decreased emphasis on academic qualifications. We note that, in the past, the GRFP included sub-programs for women, Women in Engineering (WENG) and Women in Computer and Information Science (WICS), which were in effect for Cohorts 1, 2, and 3 in this study, and the Minority Graduate Fellowship Program (MGRF) for underrepresented minorities, which was in effect for only Cohort 1 in this study. When asked to clarify, almost all faculty members who said that the GRFP tends to be preferentially awarded to women and minorities affirmed that they were referring to the current program, and not these discontinued programs.

Several university administrators and faculty members who believed that the demographic characteristics of Fellows generally mirrored those of their general graduate student population noted that the population of *all* qualified applicants to their graduate school also mirrored their general graduate student population. In other words, according to these interviewees, a program that aimed to increase female and underrepresented minority enrollment in graduate STEM programs through preferential application decisions would not be particularly successful because intervention for these populations was needed earlier in their academic careers so they could meet the qualifications to apply to these selective universities.

Most university administrators and almost all departmental staff members did not feel that the GRFP contributed to the diversity of their program in any direct way, although none felt it detracted from it. A small group of university administrators presented a more nuanced assessment of how the presence of Fellows contributed to diversity at their institution in indirect, but not unimportant, ways. The availability of large amounts of additional funding increases the pool of potential applicants (particularly those who may need to weigh finances more heavily in post-graduate decisions than other undergraduates) and increases the size of the incoming cohorts at most institutions. At some institutions, the receipt of GRFP funding frees up other funds that could be used specifically for female and minority graduate students. Furthermore, several university administrators noted that increasing the number of students who attend top-tier schools frees up spaces in the next tier of schools, and so on. In this way, additional funding generally leads to additional opportunities for qualified students to attend graduate school, even if the students who benefit would not be competitive for the GRFP, and that these additional graduate students would contribute to the diversity of the country's graduate student population via increased access to graduate school.

Graduate Student Quality

Most site visit interviewees noted that, because of the nature of their institution, the quality of graduate students was quite high regardless of students' status as GRFP Fellows. Several faculty members noted that they could not often predict which students at their institution would receive the GRFP Fellowship, but did not feel there were any examples of undeserving students being awarded the Fellowship. While these faculty members tended to point to students who they felt were particularly worthy and who were not awarded the Fellowship, they usually conceded that there was such a large pool of qualified candidates that deserving applicants might well be rejected.

In general, interviewees of all types felt that their institutions benefited from hosting Fellows because of the prestige of the Fellowship, the availability of additional funding (which might free up funding for other graduate students), and Fellows' ability to contribute to high-level research. Most interviewees felt that Fellows ended up having similar experiences to non-Fellows in the same department and produced research of a similar quality. This is perhaps not surprising, given the high caliber of the non-Fellows attending these institutions.

While the telephone interview protocol did not include any direct questions on this topic, answers to questions about the experiences of Fellows in graduate school tended to corroborate the site visit findings. Some respondents noted that Fellows either tended to finish their degree more quickly or tended to be

more productive during their graduate career. These differences could be due to the effects of GRFP policies or due to the high quality of Fellows.

Scholarly Productivity and Research

Nearly every respondent indicated that Fellows were important members of the university's research community. Many faculty members were careful to indicate that they felt that the educational and research experiences of Fellows did not and should not differ from those of other students, and that their department worked actively toward this goal. Some faculty members acknowledged that Fellows' experiences would necessarily differ based on university or department policies (for example, requirements about teaching assistantships [TAing] and research assistantships [RAing]) or funding, although the department generally worked to minimize these differences. As described in the previous section, most interviewees felt that Fellows and other students in the same department produced research of a similar quality.

Most interviewees indicated that Fellows were fully integrated into their program. Even if they were exempt from certain requirements (such as TAing) or sources of stress (such as securing funding), Fellows still had to do almost all of the things that non-Fellows had to do. This sentiment was most common in departments in which graduate students were required to join a lab in order to pursue their research. Even though the Fellow's funding came from a different source (from the GRFP rather than the advisor's research grant or other funds), the experience of working in a lab was still fundamentally similar. Some faculty members noted that Fellows had more freedom to select their own research project because they were not limited to what faculty members could fund with their own grant money (or, in some departments, training grants), although this also varied greatly by discipline. In equipment-heavy lab-based departments, however, the Fellow was generally limited to projects similar to faculty members' existing projects because of lack of access to other costly lab equipment or space. Several faculty members noted that some faculty members would view a Fellow as a "free" student (in other words, one who requires minimal support from other sources), and this would likely open up spots in labs that may not otherwise have been available, although some cautioned that other faculty members might be less willing to work with a Fellow because he or she would not be as dependent on that faculty member's resources as other students (although none indicated that they themselves felt this way).

Service to Departments and Graduate Student Financial Support

In many departments, TAing and RAing are not only viewed as service to the department, but are an important means of graduate student financial support, providing tuition remission and a stipend for the graduate student. Based on our interviews, engagement in other types of service to the department were

fairly minimal and did not vary much between Fellows and non-Fellows. This section therefore focuses on graduate school experiences related to TAing, RAing, and other sources of support; conflicts between GRFP and university or departmental guidelines about TAing and RAing are described below under "Implementation".

Graduate student financial support varied substantially among institutions, and often among departments as well. Some institutions (typically private institutions) provided fellowships for some or all graduate students (in some or all departments), some of which were designed based on the GRFP, having similar requirements and providing the same flexibility of independent funding. Other institutions required students to be funded through some combination of research assistantships (ideally related to their own research), training grants, and teaching assistantships. Many institutions and departments employed a combination of these approaches by providing short fellowships for all students, followed by other sources of support.

TAing and RAing can be viewed as serving two separate functions: they can be a valuable part of a graduate student's educational program, and they can also be a critical component of that graduate student's funding package. Fellows have no need for the additional stipend support during their three years of Tenure, but may need to find funding for two or more additional years of graduate education, depending on the typical length of their program and the way their department funds students. Many (but not all) departments view TAing as an essential component of their graduate education program and therefore require between one and three quarters or semesters of TAing. Some programs require more teaching but this is typically due to demand for teaching staff, and not necessarily as a component of the educational program. Fellows have the option of fulfilling teaching requirements during years when they are not on active Tenure with the GRFP, and many do so in order to fund their education during those quarters or semesters.

While many interviewees discussed the importance of TAing, which is allowed while on Tenure (under certain circumstances, if it is a part of the Fellow's educational program), an administrator in charge of fellowship programs at a private university argued for the importance of allowing Fellows to participate in paid internships and other similar opportunities while on Tenure, noting that some paid internships offered valuable educational experiences that Fellows might otherwise be excluded from participating in. Another administrator in charge of graduate school financial matters at a public university argued that, just as TAing is allowed while on Tenure if it is part of the Fellow's educational program, RAing and other paid research opportunities should also be allowed as long as they further Fellows' educational goals. In particular, RAing helps provide valuable working experience that may benefit Fellows when

they enter the job market. Finally, another administrator who would prefer for Fellows to be eligible for all other opportunities, paid or not, summarized her argument by comparing the experiences of Fellows to those of their departmental peers, who gain valuable experience from teaching, developing courses, and working in a lab on a faculty member's research project. She argued that Fellows should not be excluded during Tenure years from these valuable experiences that are not always directly related to their educational program because they are important to their academic growth and development as scientists. While most of the discussions on this topic focused on the educational value of these experiences, she also noted that it would be unfair to expect Fellows to forgo payment for such opportunities if their peers were getting paid for the same work. The exact mechanism for this payment (whether full payment on top of their stipend, or some method of top-up pay) was not discussed.

Implementation of the GRFP at Host Institutions

Several program characteristics and policies have differential effects, or are implemented differently, at different institutions. This subsection discusses the implementation of specific program policies at the institutions included in the site visits and telephone interviews, along with how this implementation interacts with university and departmental management practices and goals.

How the Fellowship Funding is Used (Tenure and Reserve)

Fellows have the flexibility to use their three years of funding at any time within a five-year window, with the restriction that they must declare their Fellowship status (Tenure or Reserve) on a yearly basis. Fellows' decisions about when to use their three years of funding within the five year window were based almost entirely on institutional and departmental funding sources and other conditions. For example, some institutions or departments offer internal fellowships to some or all of their students that may last anywhere from a single semester through five years (but most commonly, among institutions included in this study, a year or two at most). In these cases, Fellows would be motivated to remain on Reserve status as long as possible to maximize the number of years funded across all sources, although some institutions and departments strongly preferred (but did not, as far as we could tell, require) Fellows to be on Tenure status and forgo institutional/departmental funding so that it would be available to support other students.

Many interviewees noted that the GRFP's flexibility in allowing up to two years of Reserve status was greatly beneficial in that it allowed Fellows to tailor their funding to their particular needs, based on these departmental and institutional factors. Some of the factors that were cited as influencing when Fellows typically used their Reserve and Tenure years were:

- the availability and length of departmental or institutional fellowships,
- the flexibility of available departmental or institutional fellowships (specifically, do they allow for the equivalent of Reserve status?),
- the existence of institutional or departmental requirements for TAing (or the Fellow's own desire to TA to obtain teaching experience),
- the institution's tuition structure (students may be charged different levels of tuition at different phases of their graduate school career), and
- the availability of training grant funding for students in specific phases in graduate school.

In the absence of specific institutional and departmental conditions, most Fellows seemed to use their Tenure years early in the five-year window, often without using the optional Reserve status at all. Typically, this allows Fellows to use the Fellowship during the years with the highest tuition rates and to be free from RAing or performing other work that may not be related to their own research while also taking classes. In addition, faculty advisors are more easily able to support students in later years (often because of reduced tuition levels, but also because advanced graduate students can contribute more than beginning graduate students to a faculty member's research in an RA position). However, it also seems fairly common for Fellows to bank their final year of Tenure status until they are ready to complete their dissertation, in order to be free of demands associated with other funding sources such as TAing or RAing during that critical time.

Interviewees were asked whether they prefer a different arrangement over the current requirement that Fellows choose to be on Tenure or Reserve status on an annual basis. Responses were somewhat mixed, often depending on the type of respondent. Most faculty members either strongly favored allowing Fellows to make decisions about Tenure and Reserve status on a semester or quarterly basis (mostly in order to dovetail with TA or RA positions), or had no strong opinions on the topic. Administrators tended to be more aware of the added administrative burden that such a change would entail, but many administrators who were responsible for ensuring that graduate students were fully funded each year were in favor of a change to a shorter Tenure period for two reasons: (a) it would reduce other administrative work; and (b) it would relieve the pressure associated with finding half-year funding for Fellows forced to go on Reserve status for a year in order to TA for a single semester.

Apart from the specific issues described above (finding half-year funding for Fellows who are TAing for a single semester or Fellows forgoing TAing or other opportunities while on Tenure status), an administrator for an institution that hosts a large number of Fellows noted that family leave should be

considered a valid reason for making Tenure and Reserve status decisions on a semester or other partial-year basis.

Amount of the Financial Award for GRFP Fellows

The NSF GRFP award to a GRFP institution provides funding to support the NSF Graduate Fellows on Tenure and on partial Tenure at the institution. The amount of the award is based on 12 months of Tenure at $32,000 (taxable) per Fellow as a maximum annual stipend and $12,000 per Fellow as a cost-of-education institutional allowance. The cost-of-education allowance is without regard to the actual amount of tuition and fees involved. While on Tenure, institutions are not allowed to charge Fellows for any costs above this allowance.

Stipends for graduate students vary greatly among institutions and departments, and are often affected by factors such as geographical location, field of study, and institutional factors such as public or private status and size of endowment. For most institutions included in this study, the GRFP stipend was similar to, and often above, the standard stipend. Some institutions, particularly private universities located in expensive urban areas, had standard stipends that were higher than the GRFP stipend in some or all of their GRFP-eligible departments. These institutions tend to be very well funded, and in most cases, supplemented the GRFP stipend with other funds to bring it up to the level (or sometimes slightly above the level) of the standard graduate student stipend. In some rare cases, administrators or faculty members described extremely well-qualified students who turned down the GRFP Fellowship because it would have resulted in receiving a lower stipend, generally because of another fellowship opportunity with a higher stipend, and occasionally because the university or department did not supplement the GRFP stipend to match the standard stipend amount. In cases where the GRFP stipend was lower than or similar to the standard stipend, many institutions or departments supplemented the stipend to a level of a few thousand dollars higher than the standard stipend in order to reward Fellows for receiving outside funding and encourage other graduate students to apply for the GRFP and other similar fellowship programs. When in place, this policy typically applied to fellowships from any source.

At most institutions the GRFP cost-of-education allowance, while increased from $10,500 (since 1998) to $12,000 in 2011, did not cover the full cost of tuition. NSF provides the cost-of-education allowance to institutions to cover or defray the cost of tuition and fees for Fellows on Tenure, and institutions are not allowed to charge Fellows on Tenure for costs above the provided allowance; institutions must make up for the difference between the cost-of-education allowance and the full cost of tuition and fees. At private universities, the highest tuition amount (typically for engineering departments during the first two to four years of graduate school) could be as much as four times the cost-of-education allowance. Because

institutions are not allowed to charge any shortfall to the Fellow, there are two main ways of dealing with this shortfall: waive the remaining tuition amount or pay for the remaining tuition amount with other funds. Very few of the institutions in this study waive the remaining tuition. For institutions that do not waive the remaining tuition, the source of funding depended mostly on whether the university's administrative structure was centralized (in which case funding typically came from the Dean's office or other general graduate school funds) or decentralized (in which case departments or faculty advisors were expected to find funds to allocate to the shortfall). Not every interviewee was familiar with the amount of the cost-of-education allowance or how the difference was made up if necessary. In particular, some faculty members at universities that made up the tuition shortfall centrally were not aware that there was a shortfall at all.

Some interviewees (particularly those who were responsible for finding the funds to make up for the shortfall within their university or department) noted that having to find additional funding to cover Fellows' tuition shortfall placed an unfair burden on their department and/or institution, and took money away from other sources, including funding for other graduate students. However, most interviewees noted that any funding provided to offset tuition costs was welcome whether or not the shortfall resulted in an administrative burden, and they viewed the allowance as freeing up money for other purposes, rather than viewing the shortfall as taking money away from other sources.

Two associate deans from a private institution mentioned that they would strongly prefer NSF provide an increased stipend amount to Fellows, even if that meant reducing the number of Fellows in the program, to avoid having to "top off" the stipend, although they acknowledged that departments seem not to struggle with the shortfall between the cost-of-education allowance and tuition rates. The dean of an engineering school expressed her opinion that the financial award could be made more attractive to institutions by removing restrictions on how certain portions of the money could be used. She stated that if institutions were given the flexibility to allocate Fellowship funding as they saw fit (as long as Fellows received a minimum stipend), they would have an easier time covering for the shortfalls in tuition or stipend amounts.

Harmonization of Program and University/Department Policies

The program policy on departmental service while on Tenure was by far the most common point of discussion in response to questions about how program policies interact with institutional and departmental policies. The current policy is as follows: "Each Fellow is expected to devote full time to advanced scientific study or work during Tenure. However, because it is generally accepted that teaching or similar activity constitutes a valuable part of the education and training of many graduate students, a

Fellow may choose to undertake a reasonable amount of such activities without NSF approval. It is expected that furtherance of the Fellow's educational objectives and the gain of substantive teaching or other experience, not service to the institution as such, will govern these activities. Compensation for such activities is determined by the GRFP institution and is based on the institution's general employment policies. Fellows are required to check with their GRFP institution about specific policies pertaining to GRFP fellowship and paid activities."

Interviewees at different institutions had somewhat different understandings about NSF's current policy on departmental service while on Tenure, and even different interviewees at the same institution sometimes understood the policy differently. Many interviewees believed that NSF forbids, or at least strongly discourages, Fellows from TAing or RAing while on Tenure, and only some interviewees seemed to be aware of recent clarifications to this policy.

As noted earlier, most departments represented by interviewees participating in this study required at least one semester (or quarter) of TAing, and some departments required more. These requirements varied by field as well as by the institutional and departmental need for additional instructors. Different institutions with representatives who believed that TAing while on Tenure is forbidden deal with the conflict between this policy (as they understand it) and departmental TAing requirements in different ways, as discussed in the next paragraph. In addition, state and local laws and labor conditions (most prominently whether or not the institution's graduate students are unionized) affect institutional policies on concurrent service.

Most institutions and departments represented in this study allowed Fellows to TA while on Tenure as long as the amount of TAing was reasonable, and considered TAing to be a critical component of their graduate education as well as an important piece of preparing graduate students for academic careers. However, some institutions and departments required Fellows to be on Reserve status while fulfilling TAing requirements, and/or waived or reduced TAing requirements for Fellows. Among the institutions that allowed TAing while on Tenure, payment practices differed. Some institutions did not pay Fellows additional money for TAing while on Tenure, while others allowed Fellows to "double-dip" and receive additional payment (some were forced to do so based on state or local law, or by negotiation with their graduate students union). The concept of "double-dipping" was flagged as an equity issue by many different interviewees. At institutions where Fellows were paid for TAing while on Tenure, this resulted in Fellows receiving substantially more money than their peers for the same amount of work. For this reason, some institutions prohibited Fellows from TAing while on Tenure, and many other institutions strongly discouraged it. However, institutions that did not pay Fellows for TAing were essentially asking Fellows to work for free, while their peers received tuition remission and payment for the same work.

During discussions about TAing requirements and policies, several interviewees noted their dissatisfaction with the way that the change to the GRFP's policies on concurrent service was made and communicated, although they appreciated that the policy change explicitly disallowing TAing while on Tenure was quickly rescinded based on feedback from institutions. These interviewees felt that NSF should have consulted with institutions before finalizing the policy, and that the first communication from NSF on the subject should not have been a sudden declaration of the new policy.[15]

In addition, the telephone interview protocol asked about the requirement that Fellows must be affiliated with U.S. institutions. Almost all interviewees agreed that this latter policy did not need to be changed, although a small number of faculty members, mostly associated with departments prone to field work in other countries, were not sure exactly how the GRFP defines affiliation with U.S. institutions.

Faculty and Administrator Recommendations for Areas of Improvement

Interviewees were generally very positive about the overall effectiveness of the program, but many suggested possible program improvements that were not covered in the discussion above. We grouped these suggestions into the following areas: the Fellowship selection process, eligibility criteria, additional resources for Fellows, and other logistical improvements.

The Application Review and Selection Process

A large number of interviewees, some of whom had served on review panels for the Fellowship, shared concerns and/or recommendations regarding the application review and selection process.

- Several faculty members did not understand the application review process, and therefore were unable to offer concrete advice to advisees. NSF recommends that advisors sign up as GRFP panelists to gain understanding of the selection process and insight into what constitutes a high-quality application.
- Several interviewees expressed an opinion that certain factors were being given too much or too little weight during the application review process. One departmental administrator was puzzled by questions about "how their research would affect diversity" and was unsure how to provide

[15] NSF responds: GRFP policies are stated in the GRFP Program Announcement and the GRFP Guide that are posted on the GRFP Homepage. These are referenced in communications to GRFP Fellows, Institution GRFP Coordinating Officials, and Principal Investigators of GRFP institution awards.

The policy concerns what can be expected of Fellows during the three years they receive NSF funding (on Tenure). In fall 2010, the GRFP community was informed of this policy clarification, which was formally described in the 2011 Guide (NSF 11-031) before revision. NSF decided to reinstate the previous policy (from the 1997 Administrative Guide, NSF 97-062, in the revised NSF 11-037) while further study is conducted to inform this and other policies of the GRFP.

NSF will continue to gather information and input from students, faculty, and administrators to inform this and other GRFP policies.

guidance to the applicant. A faculty member whose lab has hosted several successful and several unsuccessful applicants was more blunt about his objections to using non-academic factors in application evaluation, opining that such criteria amount to social engineering rather than identifying the strongest applicants. The two NSF Merit Review Criteria include "Broader Impacts" but several interviewees (particularly faculty members) seem to interpret these criteria in specific and perhaps unwarranted ways.

- One faculty member argued that, in order to provide opportunities for students who may not otherwise have them, NSF should focus its funding away from the top, well-funded graduate schools (including his own), because students enrolled in top graduate schools are likely to succeed regardless of the presence of the Fellowship, and students enrolled in other schools would benefit more from receiving the Fellowship. This would necessarily involve reorganizing the GRFP, or creating a new program, to target universities rather than individual students.

Eligibility Criteria

A few interviewees noted that the GRFP's eligibility criteria may be unintentionally excluding populations that should be included, particularly in specific fields in which obtaining a master's degree before applying to Ph.D. programs or pursuing joint degrees are more common.

- An associate dean of graduate studies for humanities and sciences stated that the restriction on joint degrees (the GRFP does not allow Fellows to pursue a joint science-professional degree) was unfairly excluding some top students whom NSF should be interested in funding. His examples included top students pursuing scientific research while enrolled in joint Ph.D./J.D. or Ph.D./M.P.P. programs, where the professional degree adds a level of complexity but their research is as rigorous and scientific as their peers who are pursuing a standard Ph.D. program of study.
- A faculty member in a non-engineering science department noted it is fairly common to obtain a master's degree before applying to a Ph.D. program in some disciplines, so NSF's restriction that applicants may not have a master's degree at the time of application may be negatively impacting certain disciplines in which this approach is common. He felt that as competition for entry into top Ph.D. programs increases, the practice of obtaining a master's degree before applying would become more common.

Additional Resources for Fellows

Several interviewees made suggestions for program enhancements that might benefit Fellows. The most common lament was that the travel allowance had been discontinued, although based on interviewees' responses, they may not have understood the restrictions on the program while it existed. For example,

before 2009, the travel allowance could only be applied to a trip of three months or longer, and therefore could not be applied to conference travel.

- One university administrator who had overseen Fellows who were funded under both the old travel allowance program (which funded travel costs within a minimum 90-day stay until 2009 with no restrictions on destination) and its replacement, the Nordic Research Opportunity (which funds costs associated with research opportunities in Norway, Finland, Denmark, or Sweden), expressed a strong preference for the original travel allowance funding out of the belief that it was useful to many more Fellows than the new program, although most of the examples of Fellows using the old travel allowance were to attend conferences (which would have been against NSF policy until 2009).
- Many other interviewees felt that the travel allowance was critical and that after its discontinuation, departments had to cut back on student opportunities for traveling to conferences, although this was only covered by the travel allowance from 2009 to 2010.
- Several interviewees suggested that, while the NSF aims to provide flexibility to Fellows by providing funding that is not tied to a particular advisor or research lab, research in certain fields is expensive, and without providing additional money specifically to fund research, Fellows will still be effectively tied to an advisor or lab in these fields. Examples included expensive field work or equipment needs that would be covered if a Fellow were working on an advisor's research project but were unlikely to be covered otherwise.
- An administrator at a different institution described his own experiences with another fellowship that provided a valuable mentoring and networking opportunity although he acknowledged that a similar program might be difficult for NSF to implement. His fellowship included the opportunity to work at Bell Labs during the summer, which involved meeting other people in the program as well as scientists and potential mentors. This provided him with a feeling of community and access to mentors working in the field, which he believed to be more valuable than the monetary component of the fellowship.

Other Logistical Improvements

Some interviewees shared suggestions for other improvements.

- A fellowship administrator from a large public university noted that the June start date for GRFP Fellows created problems based on the school's academic calendar (the final term of the year often ends in April) that sometimes resulted in Fellows being denied a month of funding. This school's summer term starts on May 1st, whereas the administrator understood that GRFP mandates June 1st as the official summer starting date for the Fellowship. This results in the

student potentially receiving only 11 months of funding in their final year, because they are no longer a student in May, while the GRFP calendar runs from June through the end of May. However, NSF notes that, while stipend payments end at graduation, summer and fall dates are flexible and determined by the university's schedules.

- A graduate administrator from an institution that hosts many Fellows noted that the timing of the award announcements can create difficulties for her department's decisions about admissions and funding of enrolled students. Her department has a limited number of internal fellowships that can be allocated for recruiting purposes, but based on the university's admission cycle, they have to offer the internal fellowships before GRFP award announcements are made. This often results in students being offered the internal fellowship and then being awarded a GRFP Fellowship. If GRFP Fellowship awards were known beforehand, the department could have more efficiently allocated the internal fellowship offers to other prospective students. Other interviewees described other ways in which the timing of the GRFP award announcements affects their admissions and recruiting processes.
- A dean of graduate education from an institution that hosts many Fellows noted that his strong commitment to funding the shortfall between Fellowship awards and the actual costs of funding a graduate student (particularly, but not limited to, tuition costs) was the key to successfully integrating Fellows into his institution's graduate program, and felt that NSF should strongly recommend this model of centralized administration of funding for Fellows, rather than each department or faculty member being responsible for making up the shortfalls, to all institutions hosting GRFP Fellows. This results in "making the recruitment of the student to the campus a clear win in the eyes of the department and the faculty member who will eventually be the advisor."
- The same dean of graduate education suggested two additional fellowship programs that he felt would complement the GRFP and further NSF's goals and that could be run as parallel programs. One would be an industrially-oriented graduate research fellowship program, in which companies would partially fund the program and fellows would do internships with the participating companies. The second program would be essentially another tier of the GRFP, providing single-year fellowships with the expectation that the institution commit to providing continuation funding for the pursuit of the Ph.D. This would provide opportunities to a larger pool of graduate students without diluting the number of current GRFP Fellows.
- Two administrators from different institutions mention the Ivy Plus Group, an organization of universities that meets regularly to discuss academic-related issues (including the GRFP and other similar programs), and one requested that the NSF consider discussing potential policy changes to

the GRFP with this group because the participating institutions host a substantial percentage of all Fellows.

Chapter 8: Conclusions and Recommendations

This study gathered new data from Fellows, HM designees, and university faculty, administrators, and staff members and used existing data sources collected from nationally representative samples of similar graduate student populations in order to address the research questions specified in Chapter 1: *Introduction and Research Aims*. The newly-collected survey data represent the population of GRFP Fellows and HM designees who applied to the program between 1994 and 2011, with a sample of 13,055 Fellows and HM designees. The institutional site visits and telephone interviews collected detailed information from more than 150 university administrators, faculty, and staff members from 24 institutions that hosted large numbers of current Fellows. In order to understand how the Fellows and HM designees compare and contrast with the larger populations of graduate students and doctorate recipients, the study also compiled national estimates from ongoing surveys conducted by NSF, including the Survey of Earned Doctorates (SED), the Survey of Doctorate Recipients (SDR), the National Survey of Recent College Graduates (NSRCG), and the National Survey of College Graduates (NSCG).

The new and existing data were used in this evaluation to examine Fellows' graduate school experiences and career outcomes, the effects of the GRFP on the institutions that host Fellows, and whether the program design effectively advances the goals of the program. The impact analyses presented in Chapters 3 and 4 address the effect of the GRFP on Fellows' graduate school experiences and career outcomes by comparing the experiences and outcomes of Quality Group 2 (QG2) Fellows and HM designees (two groups of similarly-rated applicants, one of which received Fellowship offers, and one of which did not) after applying statistical adjustments that balance the differences in backgrounds between the two groups to isolate the impact of the program. Chapter 5 presents additional information about Fellows and HM designees as well as context for the results of the impact analyses by comparing Quality Group 1 (QG1; the highest-rated applicants) and QG2 Fellows to HM designees on various background characteristics and outcome measures. Chapter 5 also addresses the effectiveness of the program design through Fellows' perceptions of the desirability of the GRFP relative to other fellowships in their field as well as an analysis of the small population of awardees who declined the Fellowship award. Chapter 6 provides further context for the impact analyses by comparing GRFP Fellows who completed a degree to nationally representative populations of degree completers on important background variables and outcome measures (although these comparisons are strictly descriptive and should not be construed as evidence of GRFP effects). Chapter 7 describes the results of the interviews with university

administrators, faculty, and staff members, and provides information about how the GRFP affects institutions that host Fellows, as well as the institutional perspective on the effectiveness of the program design and policies.

Summary of Main Findings

The evaluation addressed four main research questions:

RQ1. *What is the impact of the GRFP Fellowship on the graduate school experience?*

RQ2. *What is the impact of the GRFP Fellowship on career outcomes?*

RQ3. *What are the effects of the GRFP on institutions?*

RQ4. *Is the program design effective in meeting program goals?*

The analyses bearing on RQ1 and RQ2 consisted of comparisons between two groups of applicants who received similar ratings from the Fellowship application review panels, indicating similar background characteristics, but who differed on receipt of the Fellowship: QG2 Fellows and QG2 HM designees (who did not receive Fellowship offers). These two groups were compared in terms of demographics, aspirations, educational trajectories, career outcomes, and professional productivity, over time (when possible and meaningful). The meaning of "impact" in these findings is defined in methodologically rigorous terms, reflecting the comparability of the QG2 Fellows and HM designees, coupled with use of sophisticated statistical analysis methods designed to isolate the impact of the program from other influences on outcomes. Additional findings from descriptive analyses and from benchmarking the GRFP sample against nationally-representative comparison groups are used to inform these questions and provide further context, although we are careful to note that these are purely descriptive and not intended to measure the "impact" of the program. The findings informing RQ3 were primarily drawn from the interviews of university faculty members and administrators from a select group of universities that host Fellows. Program effects in this context are essentially subjective assessments by the interviewees, which are based on their recent (2012) direct experiences with the program and the Fellows. Finally, we addressed RQ4 with findings from the interviews of university faculty members and administrators, the Follow-up Survey of Fellows and HM designees, and comparison data from nationally representative samples of similar graduate students.

RQ1. What is the impact of the GRFP Fellowship on the graduate school experience?

The GRFP affected Fellows' graduate school experiences in several ways. The program had a medium-sized positive impact on the likelihood of completion of a Ph.D. within ten years, indicating that a higher

proportion of QG2 Fellows completed their degree programs than non-Fellow HM designees, although the program did not appear to affect actual time to degree among those who completed the degree program. QG2 Fellows also reported greater flexibility in choosing their own research project and they presented more papers at international meetings compared to HM designees (with a small effect indicated by the impact analysis).

The impact analysis indicates that the GRFP program has a medium-sized negative impact on working for pay and applying for grants or contracts during graduate school. In addition, QG2 Fellows reported (by a small margin) fewer opportunities to receive training or instruction on research, teaching, industry, or policy and to engage in other research activities through training compared to HM designees. These findings may reflect current program policies and practices, which place some restrictions on working for pay while on Tenure (active Fellowship status, receiving stipend and tuition for the academic year). Additionally, the three full years of funding provided by the GRFP reduce the need to find other sources of financial support.

Our benchmarking analysis found that Fellows, on average, completed the doctoral degree in less time than the SED comparison group (5.95 years compared with 6.69 years). While not a direct measure of the impact of the GRFP, this descriptive finding helps place the Fellows in a national context.

Additional regression analyses found differential effects of GRFP participation for some subpopulations on some of the graduate school experience outcomes, including one differential effect on women (positive impact on the number of patents applied for during graduate school). The GRFP program had no differential impacts on URMs or students with disabilities on graduate school experiences. The additional regression analyses also found differential impacts by field of graduate study. Exhibits showing moderating effects for all subpopulations in the additional regression analyses are in Appendix B.

RQ2. What is the impact of the GRFP Fellowship on career outcomes?

In addition to the Fellowship's positive impacts on Fellows' graduate school experiences, the program also had several significant positive impacts on Fellows' post-graduate careers and experiences. The GRFP had small to medium-sized impacts on the number of papers presented at national or international meetings, the number of papers published (both in refereed journals and overall), and the number of grants and contracts awarded as a PI after graduate school. Additionally, the analysis indicated no negative impacts of being a Fellowship participant on post-graduate career productivity and experiences, particularly in terms of academic career pursuits. These results suggest that the program is succeeding in its goal of developing high-achieving scientists and engineers. Similarly, the program had medium-sized

positive impacts on the likelihood of serving on a committee or panel and providing review services, both activities related to successful STEM-related careers.

The national benchmark comparisons in the current study, while purely descriptive, also showed that Fellows who completed a Ph.D. were more likely than the national population of Ph.D. recipients to be employed in higher education institutions and to report research and development and teaching as primary work activities than their national counterparts.

Additional regression analyses found differential effects of the Fellowship for some subpopulations on some of the career and professional development outcomes, including one differential effect on URMs (negative impact on the number of patents applied for after graduate school). The Fellowship had no differential impacts on women or students with disabilities on career and professional development outcome measures. The additional regression analyses also found differential impacts by field of graduate study. Exhibits showing moderating effects for all subpopulations in the additional regression analyses are in Appendix B.

RQ3. What are the effects of the GRFP on institutions?

The methods used to address RQ3 (described in full in Chapter 7: *Program Effects on Institutions*) focused on current (2012) program policies.

The GRFP provides funding to institutions to support Fellows' graduate school costs, including a stipend and a cost-of-education allowance to the institution in lieu of all required tuition and fees. The institution is not allowed to charge the Fellow any additional tuition if the cost-of-education allowance is less than the institution's yearly tuition. The nature and extent of effects of the GRFP on graduate institutions were assessed through a series of site visit and telephone qualitative interview questions. Faculty and administrators were asked for their views on financial aspects of the Fellowship including adequacy of the cost-of-education allowance and ability to free up resources to provide funding to other students, the extent to which Fellows participate in departmental teaching and research ("service to the department"), effects on student diversity and student quality, and effects, if any, on scholarly productivity and research. Data from the interviews were used to draw out broad themes regarding perceived effects on the institution and perceived benefits to the department of hosting GRFP Fellows.

Faculty and administrators generally saw the GRFP as having strong positive effects on their institutions and departments. They believed the Fellows were high-achieving students who were well-qualified for the award. With regard to demographic characteristics, Fellows were generally viewed as representative of

the graduate student population. Administrators noted that GRFP funding for students freed funding from other sources for non-Fellows, thus improving opportunities for more students and increasing diversity.

RQ4. Is the program design effective in meeting program goals?

NSF has two main program goals for the GRFP. The first is to select, recognize, and financially support, early in their careers, individuals with the demonstrated potential to be high achieving scientists and engineers. As mentioned above, we found that, controlling for background differences, QG2 Fellows were more productive than HM designees in terms of numbers of scientific publications and national and international conference paper presentations and were awarded more contracts and grants as a PI.

The national benchmark comparisons also supported the view of Fellows as being a particularly high-achieving segment of the research doctorate recipient population. As noted above, compared with the national population of Ph.D. recipients, Fellows who completed a Ph.D. were more likely to be employed in higher education institutions and to report research and development and teaching as primary work activities.

The program's second goal is to broaden the participation of underrepresented groups, including women, minorities, and persons with disabilities, in science and engineering fields. The national benchmark data showed that women and URMs are more highly represented among Fellows than in the general population of STEM doctorate recipients, though the differences are not large. Data from the Follow-Up Survey showed that the proportion of women and students with disabilities selected as Fellows increased over time. Our statistical models found minimal differences in how the Fellowship affected women compared to men and on URMs compared to non-URMs, which suggests that the program is successful in ensuring that the benefits of the Fellowship accrue to all Fellows, regardless of demographic characteristics.

The earlier evaluation (Goldsmith, Presley, & Cooley, 2002) had identified major advantages and disadvantages of the GRFP Fellowship as reported by Fellows. The major advantages included financial support, reputation among faculty as a good student, increased employment opportunities, tuition assistance through the cost-of-education allowance, and ability to attend the program full-time. The three-year duration of the fellowship and restrictions on teaching were identified as the major disadvantages. In the current study, about one-third of Cohort 4 (2009–2011) Fellows noted that there were other Fellowships that were more desirable than the GRFP Fellowship (a proportion that has increased over time), primarily because they offered larger stipends, were more prestigious, and/or (to a lesser degree), offered more years of support. This perception varied by field of study, with roughly one-half of Cohort 4

Fellows in most physical science and engineering fields (including Chemistry, Computer and Information Sciences and Engineering, Engineering, Mathematical Sciences, and Physics and Astronomy) holding this perception compared to less than ten percent of Cohort 4 Fellows in Psychology and Social Sciences and between 20 and 30 percent of Cohort 4 Fellows in Geosciences, Life Sciences, and other fields of study.

The current study also investigated the small percentage of awardees who declined the GRFP award (less than 3 percent in Cohort 4). Most reported they had received a fellowship with a higher stipend and/or better non-stipend support (expenses for research, travel, etc.).

Recommendations

The survey findings and interview data converged on a number of strengths of the GRFP. Some recommendations for improvements emerged both directly from the study participants and from NORC's efforts to interpret and synthesize the findings.

Strengthen links between NSF's programs supporting undergraduates and the GRFP. The proportion of Fellows who participated in an NSF-sponsored program as an undergraduate increased from 22.1 percent in Cohort 1 to 30.5 percent in Cohort 2, with most of these Fellows having participated in Research Experiences for Undergraduates, suggesting a valuable link between these NSF programs and GRFP. Further strengthening these ties may provide fruitful in continuing to prepare highly qualified undergraduates for graduate school and strengthening the pipeline between NSF's undergraduate and graduate research funding opportunities, potentially broadening the pool of qualified applicants to GRFP.

Reassess the comparability of GRFP funding levels with other fellowship programs and consider other non-stipend support. Despite the substantial increases in the amount of the annual stipend from $15,000 per year in 2000 to the current $32,000 per year, some faculty and administrators indicated during the interviews that GRFP awards are now falling short of some other fellowships, including department assistantships, which may make the Fellowship less attractive to potential applicants. Additionally, some faculty and administrators (and at least one Fellow who participated in the Follow-up Survey) noted that the cost-of-education allowance did not fully meet tuition costs. About one-third of Fellows from 2009 through 2011 noted that other fellowships were more desirable because they had larger stipends or better non-stipend support (particularly among Fellows in physical science or engineering-related fields). Furthermore, the majority of awardees who had declined the GRFP award (less than 3 percent in Cohort 4) reported they had received a fellowship with a higher stipend and/or better non-stipend support.

The Department of Energy Computational Science Graduate Fellowships (CSGF), for example, is a four-year fellowship which offers $36,000 yearly stipend, payment of all tuition and fees, $5,000 academic allowance in the first fellowship year, and $1,000 academic allowance each renewed year. The Department of Defense National Defense Science and Engineering Graduate (NDSEG) Fellowship, while offering support for three years similar to the GRFP program, offers full tuition and all mandatory fees, a stipend (approximately $31,000/year), and up to $1,000 a year in medical insurance. The Science, Mathematics And Research for Transformation (SMART) Scholarship for Service Program, which offers support for one to five years, pays full tuition and education related fees (not meal plans, housing, or parking), cash awards ranging from $25,000–$41,000 depending on prior educational experience (may be prorated depending on award length), health insurance reimbursement allowance up to $1,200 per calendar year, and a book allowance of $1,000 per academic year.

Consider reducing restrictions on research assistantships during Tenure. The survey data showed that Fellows were less likely than HM designees to have research assistantships. The faculty and administrator interview data indicated that Fellows were missing out on participation in research assistantships (except in departments in which every graduate student joins a lab, in which case the experiences of Fellows were similar to those of non-Fellows) , which can provide valuable exposure to faculty members' larger and more complex research projects. However, the comparison with the SED data indicated that Fellows were as likely to have had either a teaching or research assistantship as the general population of doctorate recipients.

Consider adding, as part of the award requirements, a provision requiring Fellows to provide current contact information. As noted above, NSF's broader strategic organizational goals include learning through assessment and evaluation of NSF programs, processes, and outcomes. As such, the GRFP should track its Fellows and continue to measure the impact of the Fellowship on graduate school experiences and career outcomes. This study found Fellows and HM designees to be responsive, but locating the selected Fellows and HM designees was challenging, especially among the earlier cohorts. If Fellows provided current contact information and participated in periodic surveys, organizations contracted by NSF to conduct future studies would be able to achieve increased response rates at a lower cost. Additionally, having an updated database of Fellows and HM designees would allow NSF to conduct quick turnaround studies in-house on particular topics of interest.

Conduct outreach to reach students in underrepresented fields. Exhibit 6.4 compares the fields of graduate study pursued by Fellows who completed a Ph.D. or master's degree to national populations of degree completers; Life Sciences, Psychology, and Social Sciences are underrepresented among Fellows

compared to the national population of Ph.D. completers. These differences demonstrate how students within different fields of study access the GRFP as a source of support, and the fields of study that are underrepresented within the population of Fellows (and therefore likely to be underrepresented within the pool of applicants) may be productive targets for outreach from the program to increase awareness of or access to the GRFP.

Consider if the GRFP is reaching underserved populations to the greatest degree possible. Exhibit 6.1 indicates that the population of Fellows who complete a Ph.D. has a higher proportional representation of women and URMs than the national population of Ph.D. recipients, suggesting success in the GRFP program goal to broaden the participation of underrepresented groups, including women, minorities, persons with disabilities, and, since 2012, veterans, in science and engineering fields. This exhibit also indicates that Fellows are more likely than the national population of Ph.D. recipients to have parents with advanced degrees, suggesting that Fellows may come from more advantaged backgrounds. In order to truly broaden the participation of underrepresented groups, the GRFP may need to make inroads with first-generation college graduate applicants. Partnerships with other NSF programs such as Research Experiences for Undergraduates may help create a path for such students to apply for the GRFP and attend graduate school.

Directions for Future Study

This study has compiled a wealth of new information on the GRFP, successfully obtaining high participation rates from Fellows, HM designees, and university faculty and administrators, and provided rigorous evidence of the impact of the GRFP on graduate school experiences and career-related outcomes. However, new questions inevitably arise in the course of a research study, pointing to directions for future work to better understand and improve the GRFP. We identify six such directions.

Assess whether the GRFP helps Fellows persist in STEM careers. One of the goals of the GRFP is to "support early in their careers individuals with the demonstrated potential to be high achieving scientists and engineers." The evidence gathered for this assessment indicates that Fellows embark upon STEM-related careers at a higher rate than their non-Fellow peers, but did not assess whether Fellows or their peers persist in STEM-related careers. Future study in this area may determine whether support for STEM career persistence is an area of need that could be filled by the GRFP or another NSF program.

Determine whether the program goals are best served by supporting Ph.D. and master's degree programs under the same fellowship program. Based on the results of this evaluation, the needs and outcomes of Fellows who complete a master's degree and not a Ph.D. may differ substantially from those

of Fellows who pursue and complete a Ph.D. As demonstrated in Exhibit 5.20, Fellows in more recent cohorts are more likely to complete a Ph.D. within ten years of enrollment, and less likely to complete a master's degree within five years of enrollment, compared with Fellows in older cohorts. This may represent a trend among Fellows away from completing master's degrees. Furthermore, Exhibit 6.8 shows that Fellows who complete a master's degree but not a Ph.D. are less likely to be employed in jobs related to their graduate field of study compared to both Fellows who complete a Ph.D. and the national population of terminal master's degree completers. Given that pursuit of master's degrees is far more common in certain fields of study (particularly Engineering). Further study may help determine if the GRFP's current policies support students who intend to seek a master's degree (particularly in Engineering) as well as they support students who intend to seek a Ph.D., and if it should be a goal of the program to do so.

Assess changes in the factors influencing Fellows' choice of graduate programs. Exhibit 5.10 indicates that several factors were more influential for Cohort 4 Fellows' decisions about which graduate program to enroll in compared to Cohort 1 Fellows. Two in particular may be worthy of further examination to assess whether program goals or policies should be altered to accommodate these priorities: the desire to work with a specific faculty member, and to improve employment opportunities in academia. The former suggests that a program linking Fellows or prospective graduate students with faculty members may be beneficial, and the latter suggests an assessment of whether Fellows who wish to pursue STEM-related careers outside of academia are receiving adequate support.

Examine persistence in graduate school. While completion rates are high, a substantial proportion of Fellows do not complete their doctoral degree. Further investigation into the barriers to completion may inform program selection processes and implementation, including examination of reasons for leaving graduate school and particular points during graduate education that present high risk of dropping out.

Further study of trends in Ph.D. completion time. Exhibit 5.22 shows that Fellows in Cohort 2 may have a shorter mean time to complete the Ph.D. compared to Cohort 1 Fellows, but we caution that, because Cohort 1 Fellows enrolled in graduate school earlier than Cohort 2 Fellows, this analysis includes more Cohort 1 Fellows than Cohort 2 Fellows who take longer (at least ten years) to complete their Ph.D., because more Cohort 2 Fellows were still enrolled at the time of the survey. Future study of time to complete the Ph.D. will help determine if this observed difference is a trend or an artifact of the time frames included in the analysis.

Does GRFP funding free other institutional resources that can be used to increase graduate student diversity? Several university administrators suggested that one of the benefits of the GRFP to

institutions is that GRFP funding frees up other institutional resources that can then be used to admit and support graduate students who would not otherwise have been admitted to the university, and that this process increased the diversity of the graduate student population both directly (if other resources were deployed with this goal) and indirectly (by increasing access to education). This evaluation could not assess this claim, and it may be an area worthy of future study.

References

Anderson, M. S., & Louis, K. S. (1994). The graduate student experience and subscription to the norms of science. *Research in Higher Education, 35,* 273–299.

Anderson, M. S., Oju, E. C., & Falkner, T. M. R. (2001). Help from faculty: Findings from the Acadia Institute graduate education study. *Science and Engineering, 7,* 487–503.

Anderson, M. S., & Swazey, J.P. (1998). Reflections on the graduate student experience: An overview. *New Directions for Higher Education, 101* (Spring)*,* 3–11.

Antony, J. S. (2002). Reexamining doctoral student socialization and professional development: Moving beyond the congruence and assimilation orientation. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (Vol. XVII, pp. 349–380). New York: Agathon Press.

Austin, P. C. (2011). A tutorial and case study in propensity score analysis: An application to estimating the effect of in-hospital smoking cessation counseling on mortality. *Multivariate Behavioral Research, 46*, 119–151.

Baker, J. G. (1998). Gender, race and Ph.D. completion in natural science and engineering. *Economics of Education Review, 17,* 179–188.

Becker, G. S. (1993). *Human capital: A theoretical and empirical analysis with special reference to education* (3rd Ed.). Chicago: University of Chicago Press.

Breneman, D. W. (1976). The Ph.D. production process. In J. T. Fromkin, D. T. Jamison, & R. Radner (eds.), *Education as an industry*, Cambridge, MA: Ballinger.

Brim, O. G., Jr. (1966). Socialization through the life cycle. In O.G. Brim, Jr., & S. Wheeler (eds.), *Socialization after childhood: Two essays* (pp. 1–49). New York: Wiley.

Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: a practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society Series* B, *57*, 289–300.

Bowman, N. A. (2012). Effect sizes and statistical methods for meta-analysis in higher education. *Research in Higher Education*, *53*(3), 375–382.

Chapman, G. B., & McCauley, C. (1993). Early career achievements of National Science Foundation (NSF) graduate applicants: Looking for Pygmalion and Galatea effects on NSF winners. *Journal of Applied Psychology, 78,* 815–820.

Chapman, G. B., & McCauley, C. (1994). Predictive validity of quality ratings of National Science Foundation Graduate Fellows. *Educational and Psychological Measurement, 54,* 428–438.

Clotfelter, C. T., Ehrenberg, R. G., Getz, M. G., & Siegfried, J. J. (Eds.). (1991). *Economic challenges in higher education*. Chicago: University of Chicago Press.

Coe, R. (2002). *It's the effect size, stupid*: *What effect size is important and why it is important.* Paper presented at the annual conference of the British Educational Research Association, University of Exeter, England.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*(3), 297–334.

Ehrenberg, R. G. (1991). Academic labor supply. In C.T. Clotfelter, R.G. Ehrenberg, M. G. Getz, & J. J. Siegfried (Eds.), *Economic challenges in higher education* (pp. 142–258). Chicago IL: University of Chicago Press.

Ehrenberg, R. G., Jakubsen, G. H., Groen, J. A., So, E., & Price, J. (2007). Inside the black box of doctoral education: What program characteristics influence doctoral students' attrition and graduate probabilities? *Education Evaluation and Policy Analysis, 29,* 134–150.

Ehrenberg, R. G., & Mavros, P. G. (1995). Do doctoral students' financial support patterns affect their times-to-degree and completion probabilities? *Journal of Human Resources, 30,* 581–609.

Fox, J. (2008). *Applied regression analysis and generalized linear models*. Thousand Oaks, CA: Sage Publications.

Freeman, R. B. (1971). *The market for college-trained manpower: A study in the economics of career choice.* Cambridge, MA: Harvard University Press.

Froomkin, J. T., Jamison, D. T., & Radner, R. (Eds.). (1976). *Education as an industry*. Cambridge, MA: Ballinger Publishing Company.

Goldsmith, S. G., Presley, J. B., & Cooley, E. A. (2002). *National Science Foundation Graduate Research Fellowship Program final evaluation report.* Retrieved from www.nsf.gov/pubs/2002/nsf02080/nsf02080.pdf

National Science Foundation. (2011). *Empowering the nation through discovery and innovation: NSF strategic plan for fiscal years (FY) 2011–2016*. Retrieved from http://www.nsf.gov/news/strategicplan/nsfstrategicplan_2011_2016.pdf

National Science Foundation. (2012). *The National Science Foundation proposal and award policies and procedure guide.* Retrieved from http://www.nsf.gov/pubs/policydocs/pappguide/nsf13001/gpgprint.pdf

Rosenbaum, P. R. & Rubin, D. B. (1985). Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. *American Statistician*, *39*, 33–38.

Solem, M., Lee, J., & Schlemper, B. (2008). Departmental climate and student experiences in graduate geography programs. *Research in Higher Education.* Accessed Online First: http://www.springerlink.com

Sowell, R., Zhang, T., Redd, K. & King, M. (2008). *Ph.D. completion and attrition: Analysis of baseline program data from the Ph.D. Completion Project.* Council of Graduate Schools: Washington, D.C.

Weidman, J. C. (2001). Socialization of graduate and professional students in higher education. *ASHE-ERIC Higher Education Reports,* Vol. 28, Issue 3.

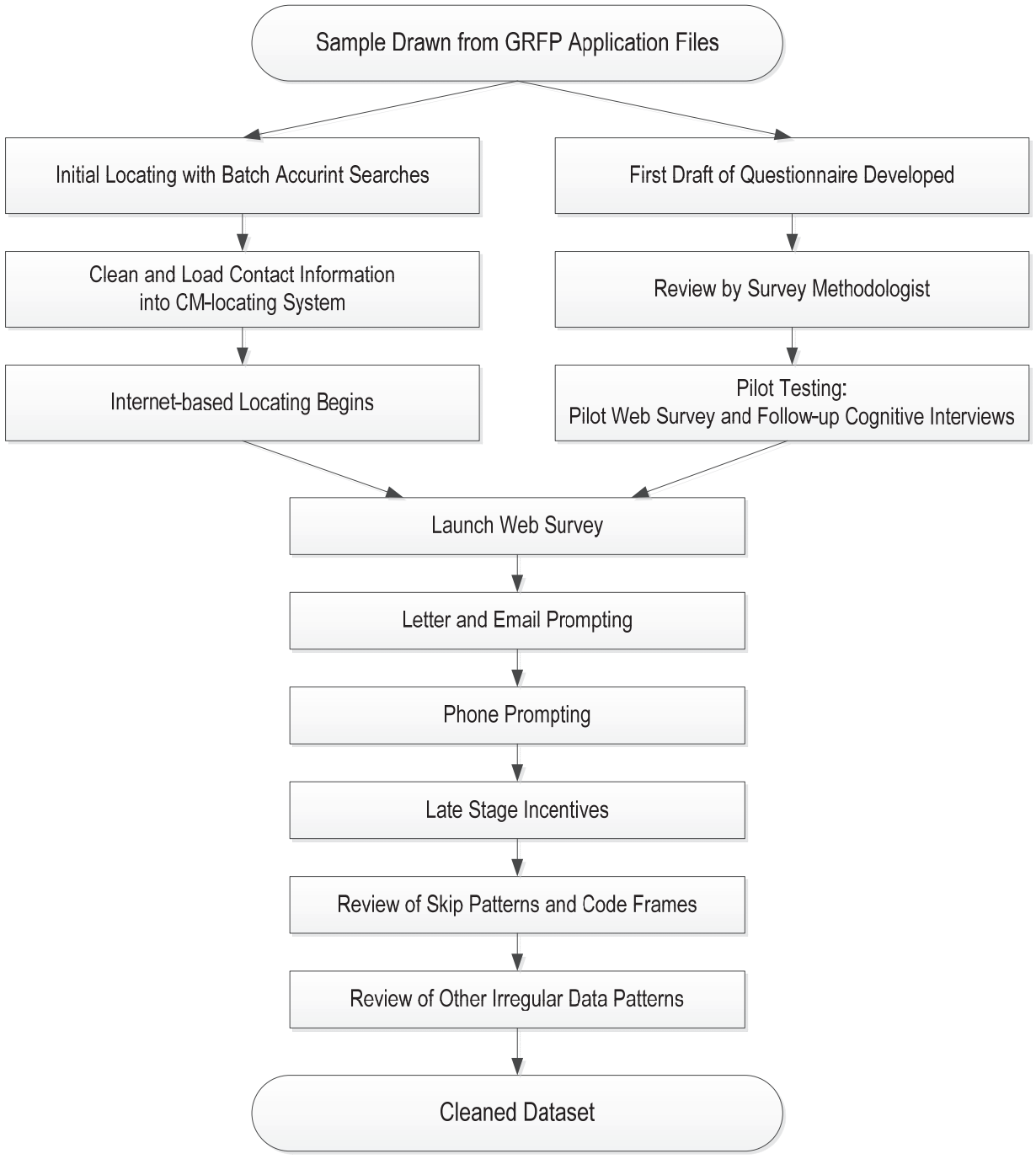
Weiler, W. C. (1993). Post-baccalaureate educational choices of minority students. *Review of Higher Education, 16,* 439–460.

Appendix A. Additional Methodology

Data Collection Methodology

Below we describe the general data collection methodology for the Follow-up Survey. After developing the questionnaire, the team worked with our sampling statistician to draw the sample of Fellows and HM designees across four cohorts: Cohort 1 (1994–1998), Cohort 2 (1999–2004), Cohort 3 (2005–2008), and Cohort 4 (2009–2011). Survey data collection launched in March 2012 and closed in August 2012. Exhibit A.1 offers a high level overview of the data collection process for this study.

Exhibit A.1. Data Collection Methodology



Survey Instrumentation

In order to reduce respondent burden, internet-based surveys were used to collect information from participants. As the populations being surveyed in this study were graduate students in STEM fields or professionals trained as scientists and engineers, they were likely to have easy access to and be fluent in the use of web-based technologies. The use of web-based systems facilitated accuracy, completeness, and speed of data entry, and helped reduce respondent burden. Our web-based survey employed user-friendly features, such as data entry with custom controls such as checkboxes and data verification with error messages for online correction. Survey skip patterns reduced time burden on respondents by automatically moving them to the next appropriate section, simplifying the survey-taking experience.

Initial Data Collection

At the beginning of the data collection period, NORC sent introductory emails to all sample members with an email address informing them of the purpose of the study and the measures taken to assure confidentiality, and providing a unique PIN and password to use for accessing the survey online. Email addresses were collected from the GRFP application files and via web searches by members of the evaluation team. If no email was available for a sample member, an introductory letter was sent through the U.S. Postal Service. Advance materials also included a study toll-free number and email address through which respondents can directly contact project staff to verify study authenticity, ask questions about their participation, or receive technical assistance.

Survey Prompting

To optimize response rates, NORC followed up the advance emails and letters with a series of reminder prompts to complete the survey. When NORC received information that a sample member no longer resided at a particular location or received bouncebacks from email messages, additional steps were taken to locate the individual.

In addition to the standard letter prompts and email prompts, NORC employed phone prompting. Approximately three months after data collection opened, NORC began using phone prompting to encourage sample members to participate in the survey.

To ensure the confidentiality of sample members, the survey Web page and all advance and prompting materials contained generic branding referring to a "graduate student follow-up study" rather than referring to any particular group (e.g., Fellows and HM designees). Specific paths through the survey

were based on participants' fellowship status, determined upfront by the survey login PIN and password each was assigned, and graduate school enrollment status.

Locating

Accurate address and telephone contact information are essential for notifying sample members of their selection in the sample as well as to further prompt for survey completion. Because we used the GRFP applicant records as the data source for sample member contact information, typically captured at the time of applying to the program, we encountered cases where contact information was out of date, particularly among older cohorts. Respondent locating efforts were conducted prior to and throughout the data collection process, as needed.

Prior to the beginning of data collection locating was conducted using a service that maintains a database of national information. During the data collection period, cases whose mail was returned as undeliverable or whose emails appeared to be dormant after repeated prompting were designated for more intensive locating treatments. Additionally, sample members whose surveys had not been started at the midpoint of the data collection period were forwarded for additional locating. Some email accounts were found to be valid but no longer used or infrequently used by a sample member. In cases where mail sent via U.S. Post did not solicit a response, we conducted additional locating to determine if a more up-to-date address was available.

Cases identified for additional locating were processed by NORC's production center, where locating specialists employed more intensive search techniques relying on Internet-based tools, university websites, and campus directories. Cases with incorrect phone numbers were also identified for additional locating and searches for valid phone numbers were conducted. Throughout the process, locators took special care to identify and to catalog sample members' email addresses. Email messages provided a direct link to the web survey and reduced the effort of sample members in accessing the survey.

Analytical Dataset

During the Follow-up Survey, some respondents who were sampled as Fellows indicated that they declined the GRFP award offer, and some respondents who were sampled as either Fellows or HM designees indicated that they did not attend graduate school; both of these sets of respondents were excluded from the analyses and considered ineligible respondents for the purposes of response rate calculations. Note, however, that the data reported by the survey respondents who reported that they declined the GRFP award offer was used in Exhibits 5.14 , 5.15, and 5.16, which examine the reasons for declining the GRFP award. Exhibit A.2 shows how the analytical dataset was constructed from the initial set of completed surveys, and how many survey respondents were excluded because they did not attend graduate school or did not accept the GRFP award offer, overall and by award status and cohort.

Exhibit A.2. Cases Included in Analysis Dataset

		Award Status			Applicant Cohort			
	Total	QG1 Fellows	QG2 Fellows	QG2 HM Designees	Cohort 1 (1994–1998) (N=6,091)	Cohort 2 (1999–2004) (N= 7,472)	Cohort 3 (2005–2008) (N=5,850)	Cohort 4 (2009–2011) (N=9,166)
Total Completed Surveys	10,213	3,483	3,531	3,199	2,319	2,477	2,629	2,788
Cases That Did Not Attend Graduate School	53	4	6	43	14	12	9	18
Cases That Did Not Accept GRFP	398	259	139	N/A	190	144	14	50
Cases Included for Analysis	9,762	3,220	3,386	3,156	2,115	2,321	2,606	2,720

NOTES: All cases that did not attend graduate school during the award period or did not accept the GRFP award were excluded from the analysis dataset.

Composite Scaled Measures

Several of the outcomes in the impact analyses and elsewhere in this Appendix are composite measures constructed from two or more conceptually related survey items that were found through factor analysis to represent a common underlying factor. Exhibits A.3 through A.6 present the constituent measures that comprise scaled measures of perceptions of graduate school quality (Exhibit A.3), attitudes toward faculty and peers during graduate school (Exhibit A.4), research activities and collaboration during graduate school (Exhibit A.5), and dimensions of graduate training received (Exhibit A.6), along with the Cronbach's alpha measure of internal consistency (Cronbach, 1951). Some items were reversed in valence to match the other items in the scaled measure.

Exhibit A.3. Scaled Measures of Perceptions of Graduate School Quality

Scaled Measures and Constituent Items	Internal Consistency
Quality of guidance, support, and professional development	*a* = 0.916
Advice and guidance on program of study[1]	
Advice and guidance on post-graduation career steps[1]	
Assistance on job search[1]	
Support from dissertation or thesis advisor[1]	
Graduate school prepared me for the challenges of my career[1]	
Opportunities for career and professional development[2]	
Quality and Reputation of University, Program, and Peers	*a* = 0.817
Program's reputation[1]	
University's reputation[1]	
Program faculty's reputation[1]	
Academic quality of peers[1]	
Quality of curriculum, instruction, and research training	*a* = 0.767
Curriculum[1]	
Quality of instruction[1]	
Training in research methods[1]	
Quality of tuition and financial support	*a* = 0.878
Tuition assistance or cost of education allowance[1]	
Support through assistantships, scholarships, fellowships, etc.[1]	
Quality of climate for women and minorities	*a* = 0.864
Environment for minority students[1]	
Environment for female students[1]	

SOURCE: 2012 GRFP Follow-up Survey

NOTES: Extraction Method = Principal Component Analysis. Rotation method = Varimax with Kaiser Normalization. All items were standardized into Z-scores. Internal Consistency is based on Cronbach's Alpha.

[1] Response options include: 1 = Extremely poor, 2 = Below average, 3 = Average, 4 = Above average, 5 = Excellent.

[2] Response options include: 1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree.

Exhibit A.4. Scaled Measures of Attitudes Towards Faculty and Peers During Graduate School

Scaled Measures and Constituent Items	Internal Consistency
Positive Attitude Towards Faculty[1]	*a* = 0.928
The faculty exposed me to a wide variety of useful research experiences	
Faculty considered me an asset to their projects	
The faculty saw me as a serious scholar	
I felt free to call on the faculty for academic help	
The faculty was accessible for scholarly discussions outside of class	
The faculty was aware of student problems and concerns	
I could trust the faculty to give me good academic advice	
I was treated as a colleague by the faculty	
There was at least one faculty member (including your advisor) in my department who was particularly supportive of me and my work	
I identified well with the faculty	
The faculty seemed to treat each other as colleagues	
Positive Attitude Towards Peers[1]	*a* = 0.769
I identified well with my fellow students	
My peers considered me a good student	
Scholarly interchange was fostered between students and faculty	
The educational climate encouraged the scholarly aspirations of all students	
There was an emphasis on engaging in scholarly activities (research, writing other than dissertations, etc.)	

SOURCE: 2012 GRFP Follow-up Survey

NOTES: All items were standardized into Z-scores. Internal Consistency is based on Cronbach's Alpha.

[1] Response options for all items include: 1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree.

Exhibit A.5. Scaled Measures of Research Activities and Collaboration During Graduate School

Scaled Measures and Constituent Items	Internal Consistency
Frequency of Research Activities	*a* = 0.879
You performed research of your own that was not required by your program or courses[1]	
You called or wrote to a scholar at another institution to exchange views on scholarly work[1]	
You wrote, alone or with others, a grant proposal[1]	
You were asked by a fellow student to critique his/her work1	
You asked a fellow student to critique your work[1]	
Frequency of Collaboration	*a* = 0.840
You participated in or led a research team[1]	
I had opportunities to work on a team with people other than my advisor[2]	
I had opportunities to collaborate with other students, faculty, or outside departments[2]	
Worked on a team with people other than your advisor[3]	
Collaborated on a research paper or project[3]	
Frequency of Conversations and Discussions	*a* = 0.786
You engaged in conversations of a social (rather than professional) nature either inside or outside of the school setting[1]	
You discussed topics in your primary field of study outside of the classroom[1]	
You discussed topics of intellectual interest outside of the classroom[1]	
Frequency of Interdisciplinary Research	*a* = 0.854
I was offered opportunities to conduct interdisciplinary research[2]	
Undertook interdisciplinary research[3]	

SOURCE: 2012 GRFP Follow-up Survey

NOTES: Extraction Method = Principal Component Analysis. Rotation method = Varimax with Kaiser Normalization. All items were standardized into Z-scores. Internal Consistency is based on Cronbach's Alpha.

[1] Response options include: 1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Very often.

[2] Response options include: 1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree.

[3] Response options include: 1 = Not at all, 2 = Very little, 3 = Somewhat, 4 = To a great extent.

Exhibit A.6. Scaled Measures of Dimensions of Graduate Training Received

Scaled Measures and Constituent Items	Internal Consistency
Received Training or Instruction in Research, Teaching, Industry, and Policy	*a* = 0.801
Training or instruction in effective teaching practices[1]	
Training or instruction in student mentoring[1]	
Training or instruction on interaction between academic research and industrial technical requirements[1]	
Training or instruction for applying research to address public policy concerns or issues[1]	
Opportunities to develop or present course and/or curriculum materials[1]	
Opportunities to Engage in Research Activities Through Training	*a* = 0.875
I had opportunities to present my research[2]	
My coursework laid a good foundation for doing independent work[2]	
I learned the art of survival in this field[2]	
I was taught the details of good research practice[2]	
I was offered a variety of enrichment activities (seminars, colloquia, social events, etc.) in addition to regular classes[2]	
Advice and guidance on my program of studies[3]	
Research experience[3]	
Assistance was available to me in writing for presentations and publications[2]	
I had opportunities to assist faculty on their projects[2]	
Opportunities to Learn and Develop Career and Professional skills	*a* = 0.825
I had opportunities to learn about proposal writing[2]	
Learned organizational or managerial skills[4]	
I had opportunities to develop career skills (personnel management, budgeting, etc.)[2]	

SOURCE: 2012 GRFP Follow-up Survey

NOTES: Extraction Method = Principal Component Analysis. Rotation method = Varimax with Kaiser Normalization. All items were standardized into Z-scores. Internal Consistency is based on Cronbach's Alpha.

[1] Response options include: 1 = Not at all, 2 = Very little, 3 = Somewhat, 4 = To a great extent.

[2] Response options include: 1 = Extremely poor, 2 = Below average, 3 = Average, 4 = Above average.

[3] Response options include: 1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree.

[4] Response options include: 1 = Not at all, 2 = Very little, 3 = Somewhat, 4 = To a great extent.

SED and NSCG/NSRCG Crosswalks

Several of the analyses in Chapter 6 compare data from the SED and NSCG/NSRCG to the GRFP, including field of study and sources of financial support. There were some instances in which a field of study or other categorical response reported in one of these data sets did not exactly match a category as we have defined it in this evaluation; Exhibits A.7 through A.10 display how we converted these categories for comparison purposes. Exhibit A.7 is a crosswalk between the fine field of study as reported in the SED and the broad fields of study reported in the GRFP and Exhibit A.8 contains similar information for mapping the fine fields of study reported in the NSCG/NSRCG data sets to GRFP broad

fields of study. Exhibit A.9 shows how the sources of funding during graduate school reported in the SED were mapped to GRFP sources of funding, and Exhibit A.10 shows how the occupational fields reported in the NSCG/NSRCG were mapped to GRFP occupational fields.

Exhibit A.7. Crosswalk Between SED Fine Field of Study and GRFP Broad Field of Study

SED Code	SED Fine Field of Study	GRFP Broad Field of Study
560	Acoustics	Physics and Astronomy
561	Atomic/ Molecular/ Chemical Physics	Physics and Astronomy
562	Electron Physics	Physics and Astronomy
563	Electromagnetism	Physics and Astronomy
564	Particle (Elementary) Physics	Physics and Astronomy
565	Biophysics (also in BIOLOGICAL SCIENCES)	Physics and Astronomy
566	Fluids Physics	Physics and Astronomy
567	Mechanics	Physics and Astronomy
568	Nuclear Physics	Physics and Astronomy
569	Optics/ Photonics	Physics and Astronomy
570	Plasma/ Fusion Physics	Physics and Astronomy
572	Polymer Physics	Physics and Astronomy
573	Thermal Physics	Physics and Astronomy
574	Condensed matter/ Low Temperature Physics	Physics and Astronomy
575	Theoretical Physics	Physics and Astronomy
576	Applied Physics	Physics and Astronomy
578	Physics, General	Physics and Astronomy
579	Physics, Other	Physics and Astronomy
500	Astronomy	Physics and Astronomy
505	Astrophysics	Physics and Astronomy
506	Astronomy & Astrophysics	Physics and Astronomy
400	Computer Science	Computer Science
410	Information Science & Systems	Computer Science
419	Computer & Information Science, Other	Computer Science
460	Computing Theory & Practice	Computer Science
600	Clinical Psychology	Psychology
603	Cognitive Psychology & Psycholinguistics	Psychology
606	Comparative Psychology	Psychology
609	Counseling	Psychology
612	Developmental & Child Psychology	Psychology
613	Human Development & Family Studies	Psychology
615	Experimental Psychology	Psychology
616	Experimental/ Comparative & Physiological Psychology	Psychology
618	Educational Psychology (also in EDUCATION)	Psychology
619	Human Engineering	Psychology
620	Family Psychology	Psychology
621	Industrial & Organizational Psychology (see also BUSINESS MANAGEMENT/ Organization Behavior)	Psychology

SED Code	SED Fine Field of Study	GRFP Broad Field of Study
624	Personality Psychology	Psychology
627	Physiological/ Psychobiology	Psychology
630	Psychometrics	Psychology
633	Psychometrics and Quantitative Psychology	Psychology
636	School Psychology (also in EDUCATION)	Psychology
639	Social Psychology	Psychology
648	Psychology, General	Psychology
649	Psychology, Other	Psychology
300	Aerospace, Aeronautical & Astronautical	Engineering
303	Agricultural	Engineering
306	Bioengineering & Biomedical	Engineering
309	Ceramic Sciences	Engineering
312	Chemical	Engineering
315	Civil	Engineering
318	Communications	Engineering
321	Computer	Engineering
322	Electrical	Engineering
323	Electronics	Engineering
324	Electrical, Electronics, and Communications	Engineering
327	Engineering Mechanics	Engineering
330	Engineering Physics	Engineering
333	Engineering Science	Engineering
336	Environmental Health Engineering	Engineering
339	Industrial & Manufacturing	Engineering
342	Materials Science	Engineering
345	Mechanical	Engineering
348	Metallurgical	Engineering
351	Mining & Mineral	Engineering
354	Naval Architecture & Marine Engineering	Engineering
357	Nuclear	Engineering
360	Ocean	Engineering
363	Operations Research (also in MATHEMATICS & in BUSINESS MANAGEMENT)	Engineering
366	Petroleum	Engineering
369	Polymer & Plastics	Engineering
372	Systems	Engineering
375	Textile	Engineering
376	Engineering Management & Administration	Engineering
398	Engineering, General	Engineering
399	Engineering, Other	Engineering
420	Applied Mathematics	Math
425	Algebra	Math
430	Analysis & Functional Analysis	Math
435	Geometry/ Geometric Analysis	Math
440	Logic	Math
445	Number Theory	Math
450	Statistics (also in SOCIAL SCIENCES)	Math

SED Code	SED Fine Field of Study	GRFP Broad Field of Study
455	Topology/ Foundations	Math
465	Operations Research (also in ENGINEERING & in BUSINESS MANAGEMENT/ ADMIN)	Math
498	Mathematics/ Statistics, General	Math
499	Mathematics/ Statistics, Other	Math
874	Mathematics Education	Math
650	Anthropology	Social Science
652	Area/ Ethnic/ Cultural/ Gender Studies	Social Science
657	Criminal Justice & Corrections	Social Science
658	Criminology	Social Science
662	Demography/ Population Studies	Social Science
667	Economics	Social Science
668	Econometrics	Social Science
670	Geography	Social Science
674	International Relations/ Affairs	Social Science
676	Linguistics	Social Science
678	Political Science & Government	Social Science
679	Political Science/ Public Administration	Social Science
682	Public Policy Analysis	Social Science
686	Sociology	Social Science
690	Statistics (also in MATHEMATICS)	Social Science
694	Urban Affairs/ Studies	Social Science
695	Urban / City, Community & Regional Planning	Social Science
698	Social Sciences, General	Social Science
699	Social Sciences, Other	Social Science
885	Social Science Education	Social Science
773	Archeology	Social Science
520	Analytical Chemistry	Chemistry
521	Agriculture & Food Chemistry	Chemistry
522	Inorganic Chemistry	Chemistry
524	Nuclear Chemistry	Chemistry
526	Organic Chemistry	Chemistry
528	Medicinal/ Pharmaceutical Chemistry	Chemistry
530	Physical Chemistry	Chemistry
532	Polymer Chemistry	Chemistry
534	Theoretical Chemistry	Chemistry
538	Chemistry, General	Chemistry
539	Chemistry, Other (see also BIOLOGICAL/ Biochemistry)	Chemistry
510	Atmospheric Chemistry and Climatology	Geosciences
512	Atmospheric Physics and Dynamics	Geosciences
514	Meteorology	Geosciences
518	Atmospheric Science/ Meteorology, General	Geosciences
519	Atmospheric Science/ Meteorology, Other	Geosciences
540	Geology	Geosciences
542	Geochemistry	Geosciences
544	Geophysics & Seismology	Geosciences
545	Geophysics (solid earth)	Geosciences

SED Code	SED Fine Field of Study	GRFP Broad Field of Study
546	Paleontology	Geosciences
547	Fuel Technology & Petroleum Engineering	Geosciences
548	Mineralogy & Petrology	Geosciences
549	Mineralogy/ Petrology/ Geological Chemistry	Geosciences
550	Stratigraphy & Sedimentation	Geosciences
552	Geomorphology & Glacial Geology	Geosciences
554	Applied Geology	Geosciences
555	Applied Geology/ Geological Engineering	Geosciences
558	Geological and Earth Sciences, General	Geosciences
559	Geological and Earth Sciences, Other	Geosciences
585	Hydrology & Water Resources	Geosciences
590	Oceanography, Chemical and Physical	Geosciences
000	Agricultural Economics	Life Sciences
002	Agricultural Business & Management	Life Sciences
005	Agricultural Animal Breeding	Life Sciences
007	Animal Husbandry	Life Sciences
010	Animal Nutrition	Life Sciences
012	Dairy Science	Life Sciences
014	Animal Science, Poultry (or Avian)	Life Sciences
019	Animal Science, Other	Life Sciences
020	Agronomy & Crop Science	Life Sciences
025	Agricultural & Horticultural Plant Breeding	Life Sciences
030	Plant Pathology/ Phytopathology	Life Sciences
032	Plant Protect/ Pest Management	Life Sciences
039	Plant Sciences, Other	Life Sciences
040	Food Sciences	Life Sciences
042	Food Distribution	Life Sciences
043	Food Science	Life Sciences
044	Food Sciences and Technology, Other	Life Sciences
045	Soil Sciences	Life Sciences
046	Soil Chemistry/ Microbiology	Life Sciences
049	Soil Sciences, Other	Life Sciences
050	Horticulture Science	Life Sciences
054	Fish & Wildlife	Life Sciences
055	Fishing and Fisheries Sciences/ Management	Life Sciences
060	Wildlife Management	Life Sciences
065	Forestry Science	Life Sciences
066	Forest Sciences and Biology	Life Sciences
068	Forest Engineering	Life Sciences
070	Forest/ Resources Management	Life Sciences
072	Wood Science & Pulp/ Paper Technology	Life Sciences
074	Natural Resources/ Conservation	Life Sciences
079	Forestry & Related Science, Other	Life Sciences
080	Wildlife/ Range Management	Life Sciences
081	Environmental Science	Life Sciences
098	Agriculture, General	Life Sciences

SED Code	SED Fine Field of Study	GRFP Broad Field of Study
099	Agricultural Science, Other	Life Sciences
100	Biochemistry (see also PHYSICAL SCIENCES/ Chemistry, other)	Life Sciences
102	Bioinformatics	Life Sciences
103	Biomedical Sciences	Life Sciences
105	Biophysics (also in PHYSICS)	Life Sciences
107	Biotechnology	Life Sciences
110	Bacteriology	Life Sciences
115	Plant Genetics	Life Sciences
120	Plant Pathology/ Phytopathology (also in AGRICULTURAL SCIENCES)	Life Sciences
125	Plant Physiology	Life Sciences
129	Botany/ Plant Biology	Life Sciences
130	Anatomy	Life Sciences
133	Biometrics & Biostatistics	Life Sciences
136	Cell/ Cellular Biology and Histology	Life Sciences
137	Evolutionary Biology	Life Sciences
139	Ecology	Life Sciences
140	Hydrobiology	Life Sciences
142	Developmental Biology/ Embryology	Life Sciences
145	Endocrinology	Life Sciences
148	Entomology	Life Sciences
151	Immunology	Life Sciences
154	Molecular Biology	Life Sciences
156	Microbiology & Bacteriology	Life Sciences
157	Microbiology	Life Sciences
158	Cancer Biology	Life Sciences
160	Neurosciences	Life Sciences
163	Nutrition Sciences	Life Sciences
166	Parasitology	Life Sciences
169	Toxicology	Life Sciences
170	Genetics/ genomics, Human & Animals	Life Sciences
171	Genetics	Life Sciences
175	Pathology, Human & Animals	Life Sciences
180	Pharmacology, Human & Animals	Life Sciences
185	Physiology, Human & Animals	Life Sciences
186	Animal & Plant Physiology	Life Sciences
189	Zoology	Life Sciences
198	Biology/ Biomedical Sciences, General	Life Sciences
199	Biology/ Biomedical Sciences, Other	Life Sciences
580	Environmental Science	Life Sciences
595	Marine Sciences	Life Sciences
599	Ocean/ Marine, Other	Life Sciences
860	Agricultural Education	Life Sciences

Exhibit A.8. Crosswalk Between NSCG/NSRCG Fine Field of Study and GRFP Broad Field of Study

SESTAT Code	SESTAT Fine Field of Study	GRFP Broad Field of Study
116710	Computer and information sciences	Computer Science
116730	Computer science	Computer Science
116740	Computer systems analysis	Computer Science
116760	Information services and systems	Computer Science
116770	OTHER computer and information sciences	Computer Science
128410	Applied mathematics	Math
128420	Mathematics, general	Math
128430	Operations research	Math
128440	Statistics	Math
128450	OTHER mathematics	Math
216050	Animal sciences	Life Sciences
216060	Food sciences and technology	Life Sciences
216070	Plant sciences	Life Sciences
216080	OTHER agricultural sciences	Life Sciences
226310	Biochemistry and biophysics	Life Sciences
226320	Biology, general	Life Sciences
226330	Botany	Life Sciences
226340	Cell and molecular biology	Life Sciences
226350	Ecology	Life Sciences
226360	Genetics, animal and plant	Life Sciences
226370	Microbiological sciences and immunology	Life Sciences
226380	Nutritional sciences	Life Sciences
226390	Pharmacology, human and animal	Life Sciences
226400	Physiology and pathology, human and animal	Life Sciences
226410	Zoology, general	Life Sciences
226420	OTHER biological sciences	Life Sciences
236800	Environmental science or studies	Life Sciences
236810	Forestry sciences	Life Sciences
318730	Chemistry, except biochemistry	Chemistry
328720	Atmospheric sciences and meteorology	Geosciences
328740	Earth sciences	Geosciences
328750	Geology	Geosciences
328760	Geological sciences, other	Geosciences
328770	Oceanography	Geosciences
338710	Astronomy and astrophysics	Physics and Astronomy
338780	Physics	Physics and Astronomy
348790	OTHER physical sciences	Geosciences
349910	Science, unclassified	Other
416010	Agricultural economics	Social Science
419230	Economics	Social Science
429020	Public policy studies	Social Science
429270	International relations	Social Science
429280	Political science and government	Social Science

SESTAT Code	SESTAT Fine Field of Study	GRFP Broad Field of Study
437040	Educational psychology	Psychology
438910	Clinical psychology	Psychology
438920	Counseling psychology	Psychology
438930	Experimental psychology	Psychology
438940	General psychology	Psychology
438950	Industrial/Organizational psychology	Psychology
438960	Social psychology	Psychology
438970	OTHER psychology	Psychology
449210	Anthropology and archaeology	Social Science
449220	Criminology	Social Science
449290	Sociology	Social Science
456200	Area and Ethnic Studies	Social Science
457710	Linguistics	Social Science
458610	Philosophy of science	Other
459240	Geography	Social Science
459250	History of science	Social Science
459300	OTHER social sciences	Social Science
517210	Aerospace, aeronautical and astronautical engineering	Engineering
527250	Chemical engineering	Engineering
537230	Architectural engineering	Engineering
537260	Civil engineering	Engineering
547270	Computer and systems engineering	Engineering
547280	Electrical, electronics and communications engineering	Engineering
557330	Industrial and manufacturing engineering	Engineering
567350	Mechanical engineering	Engineering
577220	Agricultural engineering	Engineering
577240	Bioengineering and biomedical engineering	Engineering
577290	Engineering sciences, mechanics and physics	Engineering
577300	Environmental engineering	Engineering
577310	Engineering, general	Engineering
577320	Geophysical and geological engineering	Engineering
577340	Materials engineering, including ceramics and textiles	Engineering
577360	Metallurgical engineering	Engineering
577370	Mining and minerals engineering	Engineering
577380	Naval architecture and marine engineering	Engineering
577390	Nuclear engineering	Engineering
577400	Petroleum engineering	Engineering
577410	OTHER engineering	Engineering
627020	Computer teacher education	Computer Science
627060	Mathematics teacher education	Math
627090	Science teacher education	Other
627120	Social science teacher education	Social Science
636720	Computer programming	Computer Science
636750	Data processing	Computer Science
637510	Electrical and electronic technologies	Engineering
637520	Industrial production technologies	Engineering

SESTAT Code	SESTAT Fine Field of Study	GRFP Broad Field of Study
637530	Mechanical engineering-related technologies	Engineering
637540	OTHER engineering-related technologies	Engineering
766820	OTHER natural resources and conservation	Life Sciences
11671D	Computer/information sciences (SDR only code)	Computer Science
11679S	SUPPRESSED-Computer and Info Sci. Minor group (93 NSCG only code)	Computer Science
12849S	SUPPRESSED-Mathematical Sciences Minor group(93 NSCG only code)	Math
12899S	SUPPRESSED-Computer and Math Minor group (93 NSCG only code)	Math
21609S	SUPPRESSED-Agricultural and Food Minor group (93 NSCG only code)	Life Sciences
22639S	SUPPRESSED-Biological Sciences Minor group (93 NSCG only code)	Life Sciences
22699S	SUPPRESSED-Life and Related Sciences Major group (93 NSCG only code)	Life Sciences
23689S	SUPPRESSED-Environmental Sciences Minor group (93 NSCG only code)	Life Sciences
32879S	SUPPRESSED-Earth Sciences Group Minor (93 NSCG only code)	Geosciences
33879S	SUPPRESSED-Physics and Astronomy Minor Group (93 NSCG only code)	Physics and Astronomy
34879D	OTHER physical sciences (SDR only code)	Geosciences
38879S	SUPPRESSED-Physical and Related Sci Major Group (93 NSCG only code)	Geosciences
39879S	SUPPRESSED-Physical and Related Sci Major Group (93 NSCG only code)	Geosciences
41939S	SUPPRESSED-Economics Minor Group (93 NSCG only code)	Social Science
42929S	SUPPRESSED-Political and related sciences Minor group (93 NSCG only code)	Social Science
43899S	SUPPRESSED-Psychology Minor group (93 NSCG only code)	Psychology
44929S	SUPPRESSED-Sociology and Anthropology Group (93 NSCG only code)	Social Science
45939S	SUPPRESSED-OTHER Social Sciences Minor group (93 NSCG only code)	Social Science
48939S	SUPPRESSED-Social and Related Sciences Major group (93 NSCG only code)	Social Science
53729S	SUPPRESSED-Civil and Architecture Eng Minor Group (93 NSCG only code)	Engineering
54749S	SUPPRESSED-Electrical and Electronics Engineering Minor Group (93 SCG on	Engineering
57741D	OTHER engineering (SDR only code)	Engineering
57749S	SUPPRESSED-OTHER Engineering Minor Group (93 NSCG only code)	Engineering
59799S	SUPPRESSED-Engineering Major Group (93 NSCG only code)	Engineering
59999S	SUPPRESSED-All Science and Engineering Major Group (93 NSCG only code)	Engineering

Exhibit A.9. Crosswalk Between SED and GRFP Sources of Funding During Graduate School

SED Code	SED Source of Funding	GRFP Source of Funding
12	University fellowship	Fellowship, scholarship
23	NIH Fellowship (dropped FY 1984, see code 21)	Fellowship, scholarship
25	ADAMHA Fellowship (FY 1984–1986)	Fellowship, scholarship
29	Other HHS (added FY 1984, includes PHS, NIMH, NIAA, NIDA, HRA, RSA, NIOSH)	Fellowship, scholarship
33	NSF Fellowship*	Fellowship, scholarship
40	Patricia Roberts-Harris Fellowship (includes former G*POP; added FY 1980)+	Fellowship, scholarship
43	NDEA Fellowship (dropped FY 1984)+	Fellowship, scholarship
44	Title VI Foreign Language Fellowship (includes FLAS & NDFL; added FY 1984)	Fellowship, scholarship
49	Other Department of Education (added FY 1984; includes NDEA fellowship after FY 1984, also EPDA)	Fellowship, scholarship
53	USDA Fellowship (added FY 1988)	Fellowship, scholarship
55	NEH (added FY 1996)	Fellowship, scholarship
61	Fulbright Fellowship (added FY 1996)	Fellowship, scholarship
64	AEC/ERDA/DOE Fellowship (dropped FY 1984)	Fellowship, scholarship
68	Other HEW (available FY 1973–1983)	Fellowship, scholarship
69	Other federal (includes Fulbright fellowships, AEC/ERDA/DOE fellowships after FY 1984,NSF traineeships after FY 1984)	Fellowship, scholarship
70	Ford Foundation Fellowship (added FY 1984)	Fellowship, scholarship
71	Rockefeller Foundation Fellowship (added FY 1984)	Fellowship, scholarship
72	Woodrow Wilson Fellowship (dropped FY 1984)	Fellowship, scholarship
73	Mellon Foundation Fellowship (added FY 1990)	Fellowship, scholarship
78	Other fellowship (added FY 1984; includes Woodrow Wilson after 1984, also Danforth, Hertz, Earhart, AFGRAD)	Fellowship, scholarship
79	Other national fellowship (dropped FY 1984)	Fellowship, scholarship
60	Veterans Administration (G.I. Bill; added FY 1969)	Fellowship, scholarship
93	NSF Fellowship (FY 1987 collation)*	Fellowship, scholarship
19	Other institutional funds (includes sabbatical, Robert A. Welch Foundation)	Grant
92	State government (added FY 1990)	Grant
10	Teaching assistantship	Teaching, Research, and Other Assistantship
11	Research assistantship	Teaching, Research, and Other Assistantship
22	NIH Research Assistantship (added FY 1987	Teaching, Research, and Other Assistantship
32	NSF Research Assistantship (added FY 1987)	Teaching, Research, and Other Assistantship
52	USDA Research Assistantship (added FY 1988)2009 DOCTORATE RECORDS FILE CODEBOOK 88	Teaching, Research, and Other Assistantship
62	Other federal research assistantship (added FY 1987)	Teaching, Research, and Other Assistantship
65	NASA Traineeship (dropped FY 1982)	Internship
21	NIH Traineeship/Fellowship (fellowship added in FY 1990; see code 23)	Internship
31	NSF Traineeship (dropped FY 1984)	Internship

SED Code	SED Source of Funding	GRFP Source of Funding
24	ADAMHA Traineeship (FY 1984–1986)	Internship
80	Guaranteed Student Loan (Stafford Loan; added FY 1984)	Loans
81	Perkins Loan (includes former NDSL; added FY 1975)	Loans
89	Other loans (includes NDEA, FISL, HELP	Loans
1	Own earnings	Personal or family sources
2	Spouse's earnings	Personal or family sources
3	Family contributions	Personal or family sources
14	College work-study (added FY 1984)	Personal or family sources
90	Business/employer funds	Employer assistance
91	Foreign (non-U.S.) government (added FY 1987)	Foreign (non-U.S.) support
99	Other (includes religious support, welfare, local government, inheritance)	Other

Exhibit A.10. Crosswalk Between NSCG/NSRCG and GRFP Occupational Fields

SESTAT Code	SESTAT Occupational Field	GRFP Occupational Field
621450	Natural sciences managers	Biological, agricultural, and environmental life sciences
210210	Agricultural and food scientists	Biological, agricultural, and environmental life sciences
220220	Biochemists and biophysicists	Biological, agricultural, and environmental life sciences
220230	Biological scientists (e.g., botanists, ecologists, zoologists)	Biological, agricultural, and environmental life sciences
230240	Forestry and conservation scientists	Biological, agricultural, and environmental life sciences
640260	Technologists and technicians in the biological/life sciences	Biological, agricultural, and environmental life sciences
220270	OTHER biological and life scientists	Biological, agricultural, and environmental life sciences
282710	Postsecondary Teachers: Agriculture	Biological, agricultural, and environmental life sciences
282970	Postsecondary Teachers: OTHER Natural Sciences	Biological, agricultural, and environmental life sciences
282730	Postsecondary Teachers: Biological Sciences	Biological, agricultural, and environmental life sciences
621420	Computer and information systems managers	Computer and information sciences
110510	Computer & information scientists, research	Computer and information sciences
110520	Computer network architect	Computer and information sciences
640530	Computer programmers (business, scientific, process control)	Computer and information sciences
110540	Computer support specialists	Computer and information sciences
110550	Computer system analysts	Computer and information sciences
110560	Database administrators	Computer and information sciences
110570	Information security analysts	Computer and information sciences
110580	Network and computer systems administrators	Computer and information sciences
110590	Software developers - applications and systems software	Computer and information sciences
110600	Web developers	Computer and information sciences

SESTAT Code	SESTAT Occupational Field	GRFP Occupational Field
110610	OTHER computer information science occupations	Computer and information sciences
182760	Postsecondary Teachers: Computer Science	Computer and information sciences
651710	Actuaries	Mathematics and statistics
121720	Mathematicians	Mathematics and statistics
121730	Operations research analysts, including modeling	Mathematics and statistics
121740	Statisticians	Mathematics and statistics
641750	Technologists and technicians in the mathematical sciences	Mathematics and statistics
121760	OTHER mathematical scientists	Mathematics and statistics
182860	Postsecondary Teachers: Mathematics and Statistics	Mathematics and statistics
331910	Astronomers	Physical sciences
321920	Atmospheric and space scientists	Physical sciences
311930	Chemists, except biochemists	Physical sciences
321940	Geologists, including earth scientists	Physical sciences
321950	Oceanographers	Physical sciences
331960	Physicists, except biophysicists	Physical sciences
641970	Technologists and technicians in the physical sciences	Physical sciences
341980	OTHER physical scientists	Physical sciences
382750	Postsecondary Teachers: Chemistry	Physical sciences
382890	Postsecondary Teachers: Physics	Physical sciences
382770	Postsecondary Teachers: Earth, Environmental, and Marine Science	Physical sciences
432360	Psychologists, including clinical	Psychology
482910	Postsecondary Teachers: Psychology	Psychology
442310	Anthropologists	Social sciences
412320	Economists	Social sciences
632540	Teachers: Secondary - social sciences	Social sciences
422350	Political scientists	Social sciences
442370	Sociologists	Social sciences
452380	OTHER social scientists	Social sciences
482930	Postsecondary Teachers: Sociology	Social sciences
482980	Postsecondary Teachers: OTHER Social Sciences	Social sciences
482780	Postsecondary Teachers: Economics	Social sciences
482900	Postsecondary Teachers: Political Science	Social sciences
621430	Engineering managers	Engineering
510820	Aeronautical/aerospace/astronautical engineers	Engineering
570830	Agricultural engineers	Engineering
570840	Bioengineers or biomedical engineers	Engineering
520850	Chemical engineers	Engineering
530860	Civil, including architectural/sanitary engineers	Engineering
540870	Computer engineer - hardware	Engineering
110880	Computer engineers - software	Engineering
540890	Electrical and electronics engineers	Engineering
570900	Environmental engineers	Engineering
550910	Industrial engineers	Engineering
570920	Marine engineers and naval architects	Engineering
570930	Materials and metallurgical engineers	Engineering
560940	Mechanical engineers	Engineering

SESTAT Code	SESTAT Occupational Field	GRFP Occupational Field
570950	Mining and geological engineers	Engineering
570960	Nuclear engineers	Engineering
570970	Petroleum engineers	Engineering
570980	Sales engineers	Engineering
570990	OTHER engineers	Engineering
641000	Electrical, electronic, industrial, and mechanical technicians	Engineering
641010	Drafting occupations, including computer drafting	Engineering
641020	Surveying and mapping technicians	Engineering
641030	OTHER engineering technologists and technicians	Engineering
582800	Postsecondary Teachers: Engineering	Engineering
220250	Medical scientists (excluding practitioners)	Health
611110	Diagnosing/treating practitioners (dent, optom, physicians, psych, pod, surgn	Health
611120	RNs, pharmacists, dieticians, therapists, physician asst, nurse practict	Health
611130	Health technologists and technicians (dent hyg, hlth rcrd tech, LPN, lab/ra	Health
611140	OTHER health occupations	Health
621440	Medical and health services managers	Health
612870	Postsecondary Teachers: Health and Related Sciences	Health
999989	Logical Skip	Missing
632530	Teachers: Secondary - computer, math or sciences	Other
641040	Surveyors, cartographers, photogrammetrists	Other
650810	Architects	Other
711410	Top-level managers, execs, admins (CEO/COO/CFO, pres, dist/gen mngr, prov	Other
711460	Education administrators (e.g. registrar, dean, principal)	Other
711470	OTHER mid-level managers	Other
721510	Accountants, auditors, and other financial specialists	Other
721520	Personnel, training, and labor relations specialists	Other
721530	OTHER management related occupations	Other
732510	Teachers: Pre-kindergarten and kindergarten	Other
732520	Teachers: Elementary	Other
732550	Teachers: Secondary - other subjects	Other
732560	Teachers: Special education - primary and secondary	Other
732570	Teachers: OTHER precollegiate area	Other
742720	Postsecondary Teachers: Art, Drama, and Music	Other
742740	Postsecondary Teachers: Business Commerce and Marketing	Other
742790	Postsecondary Teachers: Education	Other
742810	Postsecondary Teachers: English	Other
742820	Postsecondary Teachers: Foreign Language	Other
742830	Postsecondary Teachers: History	Other
742880	Post-sec teachers - physical education	Other
742990	Postsecondary Teachers: OTHER Postsecondary fields	Other
750400	Clergy and other religious workers	Other
750700	Counselors (Educational, vocational, mental health, and substance abuse)	Other
752400	Social Workers	Other
762000	Insurance, securities, real estate and business services	Other
762010	Sales- Commodities except retail (industrial/med/dental machine, equip, su	Other

SESTAT Code	SESTAT Occupational Field	GRFP Occupational Field
762020	Sales- retail (e.g., furnishings, clothing, motor vehicles, cosmetics)	Other
762030	OTHER marketing and sales occupations	Other
770100	Writers, editors, PR specialists, artists, entertainers, broadcasters	Other
772330	Historians	Other
780310	Accounting clerks and bookkeepers	Other
780320	Secretaries, receptionists, typists	Other
780330	OTHER administrative (e.g. record clerks, telephone operators)	Other
781100	Farmers, Foresters and Fishermen	Other
781200	Lawyers, judges	Other
781300	Librarians, archivists, curators	Other
782210	Food preparation and service (e.g., cooks, waitresses, bartenders)	Other
782220	Protective services (e.g., fire fighters, police, guards, wardens, park	Other
782230	OTHER service occupations, except health (probation officer ,human servic	Other
783000	OTHER teachers and instructors (private tutors, dance, flying, martial a	Other
784010	Construction and extraction occupations	Other
784020	Installation, maintenance, and repair occupations	Other
784030	Precision/production occupations (metal/wood work, butchers, baker, assmblr	Other
784050	Transportation and material moving occupations	Other
785000	OTHER OCCUPATIONS	Other

Appendix B. Additional Details of the Impact Models

This appendix provides additional details about the models that were used for gauging the impact of GRFP on various outcomes, including graduate school experiences, professional productivity while in graduate school, degree completion, and a range of career-related outcomes. As noted earlier, these models were estimated using quality group 2 (QG2) Fellows and HM designees. This appendix includes more details on the models and a description of the additional impact analyses we undertook to examine the validity of our impact models and investigate whether the whether the GRFP had differential impacts on women, URMs, students with disabilities, students in different fields of study, or students attending different institutions.

Details of the Propensity Score Weighting

The propensity score weighting method used for the impact analyses is based on a logistic regression where the dependent variable was the dichotomous GRFP Fellow versus non-Fellow indicator and the regressors included:

Participants

- Gender (male vs. female)
- Race/Ethnicity (Hispanic; non-Hispanic Black, Asian, White, other)
- Disability Status (one or more disabilities vs. none)
- Citizenship (U.S. vs. permanent resident)
- Parents' educational attainment (ordinal, ranging from less than B.A./B.S. to Ph.D.)
- Age in years
- Community college attendance (yes/no)
- NSF participant as undergraduate (yes/no)
- Intended graduate field of study (ten fields)
- GRFP cohort (four cohorts)

Undergraduate Institution (derived from IPEDS)

- Control (Public vs. Private)
- Carnegie Classification
- Selectivity (75th percentile ACT/SAT of entering undergrads)

Intended Graduate Institution (derived from IPEDS)

- Control (Public vs. Private)
- Carnegie Classification (Research I, Research II, other)
- Region (four regions)

Because the number of cases included in each outcome analysis differed (for example, only respondents who were not currently enrolled in graduate school were included in the career outcomes analysis) the propensity scores were estimated separately for each outcome. Propensity scores were used to construct "inverse probability weights" (IPW) which were then applied to the sample and used to calculate average outcomes for the treatment and control groups (Austin, 2011). The weighted treatment-control differences are the impact estimates reported in the report.

To assess the adequacy of the propensity model in adjusting for background differences between the Fellows and HM designees, we examined the covariate balance in our analyses. Ideally, any observable covariate differences that existed between the Fellows and HM designees prior to the propensity weighting are eliminated after the propensity weighting. To the extent that these differences are eliminated, the covariates are well balanced. To assess the degree of covariate balance, we examined the standardized bias for each covariate, which is the mean difference between the Fellows and HM designees on the covariate after weighting divided by the square root of the average of the covariate variance of the two groups prior to weighting (Rosenbaum & Rubin, 1985). Although there are no formal guidelines or consensus within the literature as to decide when a standardized bias is unacceptably large, Rosenbaum and Rubin (1985) suggested that a value of 20 is large. In examining the covariate balance across each of our outcomes, none of the standardized bias statistics approached 20, suggesting that the covariates tended to be well-balanced in our models.

Details of the Impact Models

In addition to the propensity score weighting methodology used for the impact estimates in the report, we also estimated program effects using regression analysis to assess whether (1) the impact estimates would change with additional controls for non-GRFP variables that might affect outcomes, (2) impact estimates vary for different subpopulations. The outcomes for the impact estimation include measures of professional productivity during graduate school (presentations, publications, grants, etc.), graduate degree completion, and time to doctoral degree completion, employment status, job field, relatedness of job to graduate field of study, and professional productivity following graduate school. Two sets of additional models were estimated for each outcome, as discussed below. As in the rest of the impact

analyses, we adjusted the p-value for which we considered results significant so that our False Discovery Rate (FDR) level was 5 percent.

Population Average Models

The first additional model was a regression model including as covariates the variables used to estimate the propensity models plus a set of interaction terms between Fellowship status and a set of potentially moderating factors. This model also employed the propensity and survey weights to adjust for selection. The following weighted regression model was used to estimate population average GRFP impacts for linear outcomes:

$$y_i = \beta_0 + \beta_1 (F_i) + \sum_{p=2} \beta_p X_{ip} + \sum_m \gamma_m M_i + \sum_m \lambda_m M_i F_i + \varepsilon_i$$

where y_i is the outcome of interest for individual i, F is the treatment indicator (1 = QG2 Fellow, 0 = QG2 HM designee), X is a set of control variables such as cohort indicators, M is a set of moderators such as gender, minority status, disability status, and field of study, and MF is the interaction between these moderators and the treatment indicator.

In each model we used moderators to test whether the effects of treatment differed by group. In the case of gender and URM, this is straightforward from a modeling perspective because they are dichotomous moderators (if there is an effect of being female, then there is logically an effect of being male, for example). For field of study, which is a ten category variable, we employed deviance coding (Fox, 2008) so that each estimated field of study coefficient was compared to the population average. All fields of study except for "other" (which had too few observations for a stable model) were tested against the population average.

All variables were grand-mean centered. The coefficient β_1 indicates the population average difference between the treatment and control groups, γ_m is the effect of the *mth* moderator and λ_m is the difference in the treatment effect for the *mth* moderator.

The following weighted generalized linear model used to estimate GRFP impacts for dichotomous outcomes:

$$\ln\left(\frac{\Pr(y_i = 1)}{1 - \Pr(y_i = 1)}\right) = \beta_0 + \beta_1 (F_i) + \sum_{p=2} \beta_p X_{ip} + \sum_m \gamma_m M_i + \sum_m \lambda_m M_i F_i$$

where all effects are differences in the log-odds.

Count outcomes employed the following weighted generalized linear model:

$$\ln(y_i) = \beta_0 + \beta_1(F_i) + \sum_{p=2} \beta_p X_{ip} + \sum_m \gamma_m M_i + \sum_m \lambda_m M_i F_i$$

where all effects are differences in the log-events.

Institutional Effect Models

The second set of models accounted for possible institutional effects on treatment. We employed multi-level (or "mixed") models to estimate these effects. These models also employed the propensity and survey weights to adjust for selection.

The following weighted mixed regression model used to estimate population average GRFP impacts for linear outcomes:

$$y_{ij} = \beta_{0j} + \beta_{1j}(F_{ij}) + \sum_{p=2} \beta_p X_{ijp} + \sum_m \gamma_m M_{ij} + \sum_m \lambda_m M_{ij} F_{ij} + \varepsilon_{ij}$$

where

$$\beta_{0j} = \pi_{00} + \xi_{0j}$$
$$\beta_{1j} = \pi_{10} + \xi_{1j}$$

where y_{ij} is the outcome of interest for individual *i from institution j*, F is the treatment indicator (1 = QG2 Fellow, 0 = QG2 HM designee), X is a set of control variables such as cohort indicators, M is a set of moderators such as gender, minority status, and field of study, and MF is the interaction between these moderators and the treatment indicator. As in the population average models, field of study was deviance coded. All variables were grand-mean centered. The coefficient π_{10} indicates the average of the institution-specific difference between the treatment and control groups, ξ_{1j} is the institution specific random effect distributed normal with a mean of *0* and standard deviation σ. This σ is reported in our tables to represent the institutional effects. As with the other models, γ_m is the effect of the *mth* moderator and λ_m is the difference in the treatment effect for the *mth* moderator. The effects of the moderators and interactions were constrained to be fixed parameters. The following weighted generalized linear model used to estimate GRFP impacts for dichotomous outcomes:

$$\ln\left(\frac{\Pr(y_i=1)}{1-\Pr(y_i=1)}\right)=\beta_{0j}+\beta_{1j}(F_{ij})+\sum_{p=2}\beta_p X_{ijp}+\sum_m \gamma_m M_{ij}+\sum_m \lambda_m M_{ij}F_{ij}$$

where

$$\beta_{0j}=\pi_{00}+\xi_{0j}$$
$$\beta_{1j}=\pi_{10}+\xi_{1j}$$

where all effects are differences in the log-odds.

Count outcomes employed the following weighted generalized linear model:

$$\ln(y_i)=\beta_{0j}+\beta_{1j}(F_{ij})+\sum_{p=2}\beta_p X_{ijp}+\sum_m \gamma_m M_{ij}+\sum_m \lambda_m M_{ij}F_{ij}$$

where

$$\beta_{0j}=\pi_{00}+\xi_{0j}$$
$$\beta_{1j}=\pi_{10}+\xi_{1j}$$

where all effects are differences in the log-events.

Model Estimates

The following exhibits present the results of the additional impact analyses and include the population effect size (in standard deviation units) of the GRFP Fellowship on the outcome, the effect size (also in standard deviation units) for the institutional average effects, and the effect differences indicating whether or not the treatment effect was significantly moderated by gender (Female = 1), underrepresented minority status (URM = 1), disability status (with disabilities = 1), and graduate field of study ("Other" was the excluded reference category), and by how much (the actual effect by subpopulation can be determined by adding the effect difference for the subpopulation to the main impact effect size). Population average estimated effects were grand mean centered from fixed models with cluster-robust standard errors. Institutional average estimated effects were grand mean centered from mixed models.

Exhibit B.1. Additional Models of Estimated Impact of the GRFP Fellowship on Reported Quality of Graduate School Experiences

	Population Average[a]	Institutional Average[b]
Guidance, support, and professional development		
Effect size	0.055	0.086
Institutional random effect size (SD)	----	0.113
Moderated by:		
Graduate field of study[c]		
Chemistry	0.056	0.065
Computer and Information Sciences and Engineering	-0.116	-0.124
Engineering	0.055	0.062
Geosciences	0.181	0.180
Life Sciences	-0.048	-0.039
Mathematical Sciences	-0.073	-0.092
Physics and Astronomy	-0.001	-0.003
Psychology	-0.067	-0.067
Social Sciences	0.025	0.029
Female	0.016	-0.004
URM	-0.088	-0.088
With disabilities	0.000	0.016
Reputation (program, university, faculty, and peers)		
Effect size	0.036	0.074
Institutional random effect size (SD)	----	0.197
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.114	-0.019
Computer and Information Sciences and Engineering	-0.070	-0.088
Engineering	-0.063	-0.032
Geosciences	0.217	0.212
Life Sciences	-0.045	-0.020
Mathematical Sciences	-0.036	-0.136
Physics and Astronomy	0.015	0.046
Psychology	0.011	-0.069
Social Sciences	0.076	0.096
Female	0.039	-0.036
URM	-0.081	-0.062
With disabilities	0.184	0.135
Curriculum, instruction, and research training		
Effect size	0.059	0.099
Institutional random effect size (SD)	----	0.080
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.011	0.005
Computer and Information Sciences and Engineering	0.064	0.047
Engineering	-0.020	0.029
Geosciences	0.151	0.156
Life Sciences	-0.008	-0.009

	Population Average[a]	Institutional Average[b]
Mathematical Sciences	-0.137	-0.138
Physics and Astronomy	-0.034	-0.034
Psychology	-0.152	-0.159
Social Sciences	0.103	0.102
Female	-0.041	-0.056
URM	-0.115	-0.111
With disabilities	-0.243	-0.243
Climate for women and minorities		
Effect size	-0.005	0.003
Institutional random effect size (SD)	----	0.042
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.071	-0.082
Computer and Information Sciences and Engineering	-0.040	-0.024
Engineering	-0.005	-0.010
Geosciences	0.099	0.091
Life Sciences	-0.000	0.006
Mathematical Sciences	0.091	0.067
Physics and Astronomy	-0.093	-0.088
Psychology	-0.105	-0.090
Social Sciences	0.118	0.126
Female	-0.003	-0.015
URM	-0.131	-0.117
With disabilities	0.309	0.332
Tuition and financial support		
Effect size	-0.039	-0.013
Institutional random effect size (SD)	----	0.077
Moderated by:		
Graduate field of study[c]		
Chemistry	0.006	0.016
Computer and Information Sciences and Engineering	-0.027	-0.035
Engineering	-0.015	0.007
Geosciences	-0.094	-0.062
Life Sciences	-0.099	-0.053
Mathematical Sciences	0.200	0.138
Physics and Astronomy	0.038	-0.026
Psychology	-0.051	-0.052
Social Sciences	0.037	0.064
Female	0.048	0.027
URM	-0.078	-0.060
With disabilities	-0.199	-0.211

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted. (a) Estimates are grand mean centered from fixed models with cluster-robust standard errors. (b) Estimates are grand mean centered from mixed models. (c) "Other" is the excluded reference category.

*p<0.05 (adjusted)

**p<0.01 (adjusted)

Exhibit B.2. Additional Models of Estimated Impact of the GRFP Fellowship on Reported Frequency of Research Activities and Collaboration During Graduate School

	Population Average[a]	Institutional Average[b]
Research activities		
Effect size	0.135*	0.136*
Institutional random effect size (SD)	----	0.021
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.078	-0.076
Computer and Information Sciences and Engineering	-0.142	-0.140
Engineering	-0.103	-0.103
Geosciences	0.015	0.013
Life Sciences	0.005	0.001
Mathematical Sciences	0.284	0.287
Physics and Astronomy	0.021	-0.254
Psychology	-0.098	-0.098
Social Sciences	0.099	0.100
Female	-0.124	-0.122
URM	0.062	0.063
With disabilities	-0.230	-0.232
Collaboration		
Effect size	0.072	0.078
Institutional random effect size (SD)	----	0.066
Moderated by:		
Graduate field of study[c]		
Chemistry	0.089	0.095
Computer and Information Sciences and Engineering	-0.103	-0.101
Engineering	-0.011	-0.007
Geosciences	0.061	0.073
Life Sciences	-0.040	-0.033
Mathematical Sciences	0.207	0.187
Physics and Astronomy	-0.115	-0.125
Psychology	-0.030	-0.028
Social Sciences	-0.058	-0.060
Female	-0.002	-0.007
URM	-0.127	-0.126
With disabilities	0.082	0.074
Professional conversations and discussions		
Effect size	0.047	0.086
Institutional random effect size (SD)	----	0.107
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.133	-0.128
Computer and Information Sciences and Engineering	-0.059	0.058
Engineering	0.001	0.002
Geosciences	0.077	0.078
Life Sciences	-0.005	-0.005

	Population Average[a]	Institutional Average[b]
Mathematical Sciences	-0.109	-0.106
Physics and Astronomy	0.074	0.085
Psychology	0.158	0.139
Social Sciences	0.012	0.011
Female	-0.019	-0.034
URM	-0.092	-0.091
With disabilities	0.251	0.235
Interdisciplinary research		
Effect size	.044	0.043
Institutional random effect size (SD)	----	0.035
Moderated by:		
Graduate field of study[c]		
Chemistry	0.011	0.015
Computer and Information Sciences and Engineering	-0.031	-0.031
Engineering	0.006	0.013
Geosciences	0.083	0.089
Life Sciences	-0.051	-0.046
Mathematical Sciences	0.054	0.047
Physics and Astronomy	0.048	-0.063
Psychology	-0.118	-0.118
Social Sciences	0.089	0.090
Female	-0.030	-0.030
URM	-0.052	-0.049
With disabilities	0.176	0.175

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted. (a) Estimates are grand mean centered from fixed models with cluster-robust standard errors. (b) Estimates are grand mean centered from mixed models. (c) "Other" is the excluded reference category.

*p<0.05 (adjusted)

**p<0.01 (adjusted)

Exhibit B.3. Additional Models of Estimated Impact of the GRFP Fellowship on Graduate School Training and Instruction

	Population Average[a]	Institutional Average[b]
Received training or instruction in research, teaching, industry, and policy		
Effect size	-0.019	-0.019
Institutional random effect size (SD)	----	0.081
Moderated by:		
Graduate field of study[c]		
Chemistry	0.063	0.059
Computer and Information Sciences and Engineering	0.020	0.023
Engineering	-0.045	-0.055
Geosciences	0.171	0.166
Life Sciences	-0.013	-0.013
Mathematical Sciences	-0.065	-0.055

	Population Average[a]	Institutional Average[b]
Physics and Astronomy	-0.084	-0.075
Psychology	-0.037	-0.038
Social Sciences	-0.108	-0.011
Female	-0.006	-0.009
URM	0.021	0.025
With disabilities	0.057	0.043
Opportunities to engage in research activities through training		
Effect size	-0.020	-0.013
Institutional random effect size (SD)	----	0.066
Moderated by:		
Graduate field of study[c]		
Chemistry	0.064	0.064
Computer and Information Sciences and Engineering	0.002	0.001
Engineering	-0.041	-0.050
Geosciences	0.158	0.153
Life Sciences	-0.015	-0.010
Mathematical Sciences	-0.050	-0.046
Physics and Astronomy	-0.069	-0.064
Psychology	-0.049	-0.049
Social Sciences	-0.003	-0.002
Female	-0.004	-0.009
URM	-0.014	-0.011
With disabilities	0.002	-0.015
Opportunities to learn and develop career and professional skills		
Effect size	0.022	0.025
Institutional random effect size (SD)	----	0.021
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.003	-0.003
Computer and Information Sciences and Engineering	0.006	-0.012
Engineering	-0.004	-0.009
Geosciences	0.146	0.149
Life Sciences	0.010	0.005
Mathematical Sciences	-0.044	-0.031
Physics and Astronomy	-0.087	-0.096
Psychology	-0.122	-0.112
Social Sciences	0.099	0.110
Female	-0.073	-0.068
URM	0.060	0.051
With disabilities	-0.056	-0.046

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted. (a) Estimates are grand mean centered from fixed models with cluster-robust standard errors. (b) Estimates are grand mean centered from mixed models. (c) "Other" is the excluded reference category.

*p<0.05 (adjusted)

**p<0.01 (adjusted)

Exhibit B.4. Additional Models of Estimated Impact of the GRFP Fellowship on Flexibility and Choice During Graduate School

	Population Average[a]	Institutional Average[b]
Opportunities to choose research projects		
Effect size	0.144**	0.145*
Institutional random effect size (SD)	----	0.019
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.135	-0.134
Computer and Information Sciences and Engineering	-0.033	-0.030
Engineering	-0.030	-0.030
Geosciences	0.107	0.107
Life Sciences	0.029	0.029
Mathematical Sciences	0.068	0.069
Physics and Astronomy	0.108	0.108
Psychology	-0.114	-0.115
Social Sciences	-0.003	-0.003
Female	-0.045	-0.045
URM	0.000	0.000
With disabilities	0.232	0.232
Ease of changing departments		
Effect size	-0.047	-0.040
Institutional random effect size (SD)	----	0.029
Moderated by:		
Graduate field of study[c]		
Chemistry	0.128	0.113
Computer and Information Sciences and Engineering	0.003	0.009
Engineering	-0.021	-0.025
Geosciences	0.152	0.151
Life Sciences	0.021	0.021
Mathematical Sciences	-0.022	-0.006
Physics and Astronomy	-0.138	-0.142
Psychology	-0.157	-0.160
Social Sciences	0.038	0.043
Female	0.013	0.006
URM	0.027	0.024
With disabilities	0.120	0.109
Ease of changing advisors		
Effect size	0.111	0.131*
Institutional random effect size (SD)	----	0.091
Moderated by:		
Graduate field of study[c]		
Chemistry	0.015	0.020
Computer and Information Sciences and Engineering	-0.105	-0.103
Engineering	-0.102	-0.103
Geosciences	0.133	0.110
Life Sciences	-0.098	-0.091

	Population Average[a]	Institutional Average[b]
Mathematical Sciences	0.130	0.140
Physics and Astronomy	0.073	0.078
Psychology	0.006	-0.009
Social Sciences	-0.040	-0.029
Female	-0.084	-0.096
URM	-0.015	-0.013
With disabilities	0.141	0.143
Changed field of study		
Effect size	0.043	0.036
Institutional random effect size (SD)	----	0.363
Moderated by:		
Graduate field of study[c]		
Chemistry	0.245	0.267
Computer and Information Sciences and Engineering	-0.088	-0.082
Engineering	-0.431	-0.451
Geosciences	0.181	0.174
Life Sciences	0.011	0.029
Mathematical Sciences	0.320	0.337
Physics and Astronomy	-0.301	-0.333
Psychology	-0.452	-0.447
Social Sciences	0.665	0.660
Female	-0.220	-0.224
URM	-0.276	-0.281
With disabilities	0.879	0.891

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted. (a) Estimates are grand mean centered from fixed models with cluster-robust standard errors. (b) Estimates are grand mean centered from mixed models. (c) "Other" is the excluded reference category.

*p<0.05 (adjusted)

**p<0.01 (adjusted)

Exhibit B.5. Additional Models of Estimated Impact of the GRFP Fellowship on Positive Attitudes Towards Graduate School Faculty and Peers

	Population Average[a]	Institutional Average[b]
Positive attitude towards faculty		
Effect size	0.060	0.063
Institutional random effect size (SD)	----	0.020
Moderated by:		
Graduate field of study[c]		
Chemistry	0.098	0.101
Computer and Information Sciences and Engineering	-0.141	-0.156
Engineering	0.001	0.001
Geosciences	0.251*	0.256*
Life Sciences	-0.022	-0.021
Mathematical Sciences	-0.053	-0.052

	Population Average[a]	Institutional Average[b]
Physics and Astronomy	-0.014	-0.021
Psychology	-0.120	-0.116
Social Sciences	-0.002	0.009
Female	-0.001	0.000
URM	-0.079	-0.080
With disabilities	0.047	0.058
Positive attitude towards peers		
Effect size	0.039	0.042
Institutional random effect size (SD)	----	0.049
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.030	-0.025
Computer and Information Sciences and Engineering	-0.150	-0.159
Engineering	-0.058	-0.063
Geosciences	0.173	0.177
Life Sciences	0.008	0.010
Mathematical Sciences	-0.021	-0.023
Physics and Astronomy	0.089	0.086
Psychology	-0.049	-0.050
Social Sciences	0.040	0.051
Female	-0.045	-0.046
URM	-0.134	-0.135
With disabilities	0.034	0.036

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted. (a) Estimates are grand mean centered from fixed models with cluster-robust standard errors. (b) Estimates are grand mean centered from mixed models. (c) "Other" is the excluded reference category.

*p<0.05 (adjusted)

**p<0.01 (adjusted)

Exhibit B.6. Additional Models of Estimated Impact of the GRFP Fellowship on Working and Internships During Graduate School

	Population Average[a]	Institutional Average[b]
Worked for pay		
Effect size	-0.299	-0.291
Institutional random effect size (SD)	----	0.231
Moderated by:		
Graduate field of study[c]		
Chemistry	0.558	0.540
Computer and Information Sciences and Engineering	-0.145	-0.141
Engineering	0.027	-0.036
Geosciences	-0.030	-0.016
Life Sciences	0.044	0.046
Mathematical Sciences	0.520	0.556
Physics and Astronomy	-0.486	0.448

	Population Average[a]	Institutional Average[b]
Psychology	-0.370	-0.359
Social Sciences	-0.101	-0.125
Female	-0.165	-0.168
URM	0.038	0.027
With disabilities	-0.054	-0.015
Average hours working per week		
Effect size	0.002	-0.050
Institutional random effect size (SD)	----	0.903
Moderated by:		
Graduate field of study[c]		
Chemistry	0.349	0.424
Computer and Information Sciences and Engineering	0.246	0.127
Engineering	-0.017	-0.241
Geosciences	-0.115	0.087
Life Sciences	-0.055	0.052
Mathematical Sciences	0.212	-0.045
Physics and Astronomy	0.054	0.352
Psychology	-0.719*	-0.798*
Social Sciences	0.109	0.074
Female	-0.049	-0.181
URM	-0.062	0.097
With disabilities	-0.088	-0.437
Had an internship		
Effect size	-0.143	-0.125
Institutional random effect size (SD)	----	0.240
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.165	-0.146
Computer and Information Sciences and Engineering	-0.233	-0.231
Engineering	0.026	-0.004
Geosciences	0.672	0.700
Life Sciences	-0.068	-0.075
Mathematical Sciences	0.158	0.170
Physics and Astronomy	-0.504	-0.513
Psychology	0.327	0.322
Social Sciences	-0.119	-0.125
Female	-0.205	-0.202
URM	0.186	0.170
With disabilities	0.029	0.049

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted. (a) Estimates are grand mean centered from fixed models with cluster-robust standard errors. (b) Estimates are grand mean centered from mixed models. (c) "Other" is the excluded reference category.

*p<0.05 (adjusted)

**p<0.01 (adjusted)

Exhibit B.7. Additional Models of Estimated Impact of the GRFP Fellowship on Presentations and Publications During Graduate School

	Population Average[a]	Institutional Average[b]
Number of papers presented at national meetings		
Effect size	-0.007	0.054
Institutional random effect size (SD)	----	0.432
Moderated by:		
Graduate field of study[c]		
Chemistry	0.000	0.005
Computer and Information Sciences and Engineering	-0.098	-0.159
Engineering	0.014	-0.026
Geosciences	0.262	0.300*
Life Sciences	-0.000	0.027
Mathematical Sciences	0.063	0.077
Physics and Astronomy	-0.232	-0.262
Psychology	-0.133	-0.110
Social Sciences	0.110	0.133
Female	0.005	0.004
URM	0.019	-0.018
With disabilities	0.081	0.068
Number of papers presented at international meetings		
Effect size	0.021	0.150
Institutional random effect size (SD)	----	0.472
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.129	-0.119
Computer and Information Sciences and Engineering	-0.071	-0.051
Engineering	0.120	0.094
Geosciences	0.423**	0.433
Life Sciences	0.084	0.090
Mathematical Sciences	-0.113	-0.152
Physics and Astronomy	0.010	-0.018
Psychology	-0.326	-0.307
Social Sciences	-0.020	0.005
Female	0.038	0.030
URM	0.120	0.081
With disabilities	0.127	0.098
Number of refereed journal articles published as primary or co-author		
Effect size	0.040	0.100
Institutional random effect size (SD)	----	0.474
Moderated by:		
Graduate field of study[c]		
Chemistry	0.027	0.008
Computer and Information Sciences and Engineering	-0.053	-0.031
Engineering	-0.071	-0.107
Geosciences	0.188	0.205
Life Sciences	-0.040	-0.025

	Population Average[a]	Institutional Average[b]
Mathematical Sciences	0.345	0.301
Physics and Astronomy	-0.102	-0.117
Psychology	-0.226	-0.188
Social Sciences	-0.088	-0.071
Female	-0.020	-0.029
URM	0.079	0.066
With disabilities	0.068	0.071

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted. (a) Estimates are grand mean centered from fixed models with cluster-robust standard errors. (b) Estimates are grand mean centered from mixed models. (c) "Other" is the excluded reference category.

*p<0.05 (adjusted)

**p<0.01 (adjusted)

Exhibit B.8. Additional Models of Estimated Impact of the GRFP Fellowship on Grant and Patent Applications During Graduate School

	Population Average[a]	Institutional Average[b]
Number of patents applied for		
Effect size	-0.370	0.833
Institutional random effect size (SD)	----	0.708
Moderated by:		
Graduate field of study[c]		
Chemistry	0.381	-0.467
Computer and Information Sciences and Engineering	0.265	-0.582
Engineering	0.128	0.800
Geosciences	-0.048	1.613
Life Sciences	-0.517	-1.480
Mathematical Sciences	13.294**	16.725
Physics and Astronomy	-1.233	-2.286
Psychology	-0.736	-1.727
Social Sciences	-11.544**	-10.944
Female	0.723	0.719*
URM	0.047	0.046
With disabilities	0.598	0.535
Applied to at least one grant/contract as PI or Co-PI		
Effect size	-0.297	-0.396*
Institutional random effect size (SD)	----	0.295
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.188	-0.249
Computer and Information Sciences and Engineering	0.211	0.207
Engineering	-0.012	-0.019
Geosciences	0.575	0.634
Life Sciences	0.123	0.113
Mathematical Sciences	-0.498	-0.479

	Population Average[a]	Institutional Average[b]
Physics and Astronomy	0.071	0.024
Psychology	-0.377	-0.307
Social Sciences	0.069	0.055
Female	-0.320	-0.270
URM	-0.041	-0.060
With disabilities	0.560	0.595

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted. (a) Estimates are grand mean centered from fixed models with cluster-robust standard errors. (b) Estimates are grand mean centered from mixed models. (c) "Other" is the excluded reference category.

*p<0.05 (adjusted)

**p<0.01 (adjusted)

Exhibit B.9. Additional Models of Estimated Impact of the GRFP Fellowship on Graduate Degree Attainment

	Population Average[a]	Institutional Average[b]
Earned a master's degree within 5 years		
Effect size	-0.117	-0.129
Institutional random effect size (SD)	----	0.121
Moderated by:		
Graduate field of study[c]		
Chemistry	0.056	0.047
Computer and Information Sciences and Engineering	-0.201	-0.161
Engineering	0.142	0.103
Geosciences	0.014	0.030
Life Sciences	-0.253	-0.246
Mathematical Sciences	0.423	0.443
Physics and Astronomy	-0.044	-0.129
Psychology	-0.189	-0.155
Social Sciences	0.080	0.115
Female	0.056	0.045
URM	0.028	0.020
With disabilities	-0.639	-0.577
Earned a Ph.D. within 10 years		
Effect size	-0.476	-0.024
Institutional random effect size (SD)	----	0.150
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.498	-0.478
Computer and Information Sciences and Engineering	0.218	0.213
Engineering	0.277	0.285
Geosciences	0.378	0.370
Life Sciences	-0.279	-0.264
Mathematical Sciences	0.209	0.184
Physics and Astronomy	-0.052	-0.058

	Population Average[a]	Institutional Average[b]
Psychology	-0.500	-0.497
Social Sciences	0.102	0.095
Female	0.322	0.303
URM	-0.133	-0.127
With disabilities	-0.231	-0.234

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted. (a) Estimates are grand mean centered from fixed models with cluster-robust standard errors. (b) Estimates are grand mean centered from mixed models. (c) "Other" is the excluded reference category.

*p<0.05 (adjusted)

**p<0.01 (adjusted)

Exhibit B.10. Additional Models of Estimated Impact of the GRFP Fellowship on Time to Degree Completion

	Population Average[a]	Institutional Average[b]
Years taken to complete master's degree		
Effect size	0.122	0.110
Institutional random effect size (SD)	----	0.146
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.045	-0.031
Computer and Information Sciences and Engineering	0.088	0.039
Engineering	-0.185	-0.175
Geosciences	0.320	0.332
Life Sciences	0.141	0.139
Mathematical Sciences	-0.195	-0.134
Physics and Astronomy	-0.248	-0.283
Psychology	0.118	0.106
Social Sciences	0.049	0.057
Female	-0.238	-0.210
URM	0.027	0.012
With disabilities	-0.093	-0.058
Years taken to complete Ph.D.		
Effect size	-0.055	-0.046
Institutional random effect size (SD)	----	0.112
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.029	-0.033
Computer and Information Sciences and Engineering	0.212	0.220
Engineering	0.028	0.016
Geosciences	-0.005	-0.014
Life Sciences	0.067	0.063
Mathematical Sciences	-0.136	-0.120
Physics and Astronomy	-0.268	-0.261
Psychology	-0.031	-0.034

	Population Average[a]	Institutional Average[b]
Social Sciences	.0175	0.177
Female	-0.007	-0.010
URM	-0.054	-0.052
With disabilities	-0.008	-0.005

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted. (a) Estimates are grand mean centered from fixed models with cluster-robust standard errors. (b) Estimates are grand mean centered from mixed models. (c) "Other" is the excluded reference category.

*p<0.05 (adjusted)

**p<0.01 (adjusted)

Exhibit B.11. Additional Models of Estimated Impact of the GRFP Fellowship on Primary Work Activities Since Graduate School

	Population Average[a]	Institutional Average[b]
Research and development		
Effect size	0.079	0.050
Institutional random effect size (SD)	----	0.222
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.009	0.022
Computer and Information Sciences and Engineering	-0.017	-0.041
Engineering	-0.163	-0.177
Geosciences	-0.574	-0.621
Life Sciences	-0.129	-0.118
Mathematical Sciences	0.426	0.448
Physics and Astronomy	-0.122	-0.063
Psychology	0.528	0.526
Social Sciences	-0.052	-0.105
Female	0.276	0.260
URM	0.250	0.265
With disabilities	0.285	0.156
Teaching		
Effect size	0.095	0.143
Institutional random effect size (SD)	----	0.664
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.382	-0.382
Computer and Information Sciences and Engineering	0.172	0.122
Engineering	-0.222	-0.208
Geosciences	-0.256	-0.277
Life Sciences	-0.086	-0.077
Mathematical Sciences	-0.229	-0.216
Physics and Astronomy	0.915*	0.916*
Psychology	0.188	0.144
Social Sciences	-0.156	-0.086

	Population Average[a]	Institutional Average[b]
Female	0.052	0.044
URM	0.214	0.191
With disabilities	-0.401	-0.422
Management or administration		
Effect size	0.200	0.238
Institutional random effect size (SD)	----	0.294
Moderated by:		
Graduate field of study[c]		
Chemistry	0.463	0.487
Computer and Information Sciences and Engineering	0.043	0.039
Engineering	-0.576	-0.555*
Geosciences	0.165	0.164
Life Sciences	-0.563	-0.567*
Mathematical Sciences	1.382	1.387*
Physics and Astronomy	0.212	0.205
Psychology	-0.473	-0.479
Social Sciences	-0.504	-0.516
Female	-0.287	-0.293
URM	0.103	0.095
With disabilities	1.140	1.152
Professional services		
Effect size	-0.398	-0.423
Institutional random effect size (SD)	----	0.316
Moderated by:		
Graduate field of study[c]		
Chemistry	0.306	0.290
Computer and Information Sciences and Engineering	0.109	0.128
Engineering	0.594**	0.611
Geosciences	-0.676	-0.679
Life Sciences	0.403	0.404
Mathematical Sciences	-0.120	-0.097
Physics and Astronomy	-0.639	-0.660
Psychology	0.124	0.146
Social Sciences	-0.038	-0.073
Female	0.119	0.133
URM	-0.216	-0.207
With disabilities	1.284	1.289

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted. (a) Estimates are grand mean centered from fixed models with cluster-robust standard errors. (b) Estimates are grand mean centered from mixed models. (c) "Other" is the excluded reference category.

*p<0.05 (adjusted)

**p<0.01 (adjusted)

Exhibit B.12. Additional Models of Estimated Impact of the GRFP Fellowship on Presentations and Publications Since Graduate School

	Population Average[a]	Institutional Average[b]
Number of papers presented at national or international meetings		
Effect size	0.039	-0.132
Institutional random effect size (SD)	----	0.984
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.339	-0.343
Computer and Information Sciences and Engineering	0.261	0.191
Engineering	0.145	0.181
Geosciences	0.248	0.467
Life Sciences	-0.122	-0.164
Mathematical Sciences	-0.319	-0.276
Physics and Astronomy	0.121	0.032
Psychology	0.042	-0.084
Social Sciences	-0.039	-0.019
Female	0.174	0.213
URM	-0.358	-0.338
With disabilities	0.682	0.711
Publications: Any source, as primary- or co-author		
Effect size	0.094	0.008
Institutional random effect size (SD)	----	0.958
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.071	-0.069
Computer and Information Sciences and Engineering	0.024	0.024
Engineering	-0.039	-0.077
Geosciences	0.059	0.260
Life Sciences	-0.094	-0.129
Mathematical Sciences	0.244	0.200
Physics and Astronomy	0.183	0.102
Psychology	-0.015	-0.127
Social Sciences	-0.266*	-0.182
Female	0.090	0.171
URM	-0.139	-0.231
With disabilities	0.167	0.180
Publications: Refereed journal articles, as primary- or co-author		
Effect size	0.148	0.144
Institutional random effect size (SD)	----	0.844
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.193	-0.174
Computer and Information Sciences and Engineering	0.156	0.097
Engineering	-0.012	-0.047
Geosciences	0.168	0.368
Life Sciences	-0.103	-0.173

	Population Average[a]	Institutional Average[b]
Mathematical Sciences	0.192	0.128
Physics and Astronomy	0.102	0.078
Psychology	-0.015	-0.093
Social Sciences	-0.264	-0.187
Female	0.090	0.128
URM	-0.186	-0.266
With disabilities	-0.027	-0.178

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted. (a) Estimates are grand mean centered from fixed models with cluster-robust standard errors. (b) Estimates are grand mean centered from mixed models. (c) "Other" is the excluded reference category.

*p<0.05 (adjusted)

**p<0.01 (adjusted)

Exhibit B.13. Additional Models of Estimated Impact of the GRFP Fellowship on Patents, Grants, and Contracts Since Graduate School

	Population Average[a]	Institutional Average[b]
Patents sought and awarded		
Effect size	-1.432**	---[d]
Institutional random effect size (SD)	----	---[d]
Moderated by:		
Graduate field of study[c]		
Chemistry	1.978**	---[d]
Computer and Information Sciences and Engineering	1.731**	---[d]
Engineering	1.431**	---[d]
Geosciences	-9.591**	---[d]
Life Sciences	0.391	---[d]
Mathematical Sciences	0.585	---[d]
Physics and Astronomy	2.012**	---[d]
Psychology	1.215	---[d]
Social Sciences	0.209	---[d]
Female	0.440	---[d]
URM	-0.069	---[d]
With disabilities	0.438	---[d]
Number of grant and contracts awarded as PI		
Effect size	0.118	0.085
Institutional random effect size (SD)	----	0.897
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.264	-0.328*
Computer and Information Sciences and Engineering	0.114	-0.056
Engineering	0.255	0.130
Geosciences	-0.311	0.040
Life Sciences	-0.088	-0.138
Mathematical Sciences	0.042	0.063

	Population Average[a]	Institutional Average[b]
Physics and Astronomy	0.356	0.268
Psychology	-0.096	-0.026
Social Sciences	0.053	0.072
Female	-0.120	0.082
URM	-0.541	-0.646*
With disabilities	0.049	-0.097

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted. (a) Estimates are grand mean centered from fixed models with cluster-robust standard errors. (b) Estimates are grand mean centered from mixed models. (c) Engineering and Other are the excluded reference categories. (d) This model could not be estimated.

*p<0.05 (adjusted)

**p<0.01 (adjusted)

Exhibit B.14. Additional Models of Estimated Impact of the GRFP Fellowship on Teaching Activities Since Graduate School

	Population Average[a]	Institutional Average[b]
Participated in any teaching activities		
Effect size	0.001	0.104
Institutional random effect size (SD)	----	0.288
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.051	-0.011
Computer and Information Sciences and Engineering	-0.015	-0.054
Engineering	-0.175	-0.187
Geosciences	-0.043	-0.017
Life Sciences	-0.056	-0.032
Mathematical Sciences	-0.190	-0.206
Physics and Astronomy	0.390	0.351
Psychology	0.245	0.175
Social Sciences	-0.052	0.029
Female	0.103	0.134
URM	0.309	0.252
With disabilities	1.315	1.385

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted. (a) Estimates are grand mean centered from fixed models with cluster-robust standard errors. (b) Estimates are grand mean centered from mixed models. (c) Engineering and Other are the excluded reference categories.

*p<0.05 (adjusted)

**p<0.01 (adjusted)

Exhibit B.15. Additional Models of Estimated Impact of the GRFP Fellowship on Professional Services Undertaken Since Graduate School

	Population Average[a]	Institutional Average[b]
Service to K–12 system, students, and professionals		
Effect size	0.152	0.238
Institutional random effect size (SD)	----	0.326
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.562	-0.572
Computer and Information Sciences and Engineering	0.590	0.495
Engineering	-0.344	-0.382
Geosciences	0.368	0.404
Life Sciences	-0.113	-0.156
Mathematical Sciences	-0.360	-0.360
Physics and Astronomy	0.599	0.687
Psychology	0.203	0.221
Social Sciences	-0.406	-0.362
Female	-0.005	0.018
URM	0.135	0.061
With disabilities	-0.210	-0.221
Editorial services		
Effect size	-0.064	---[d]
Institutional random effect size (SD)	----	---[d]
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.108	---[d]
Computer and Information Sciences and Engineering	0.387	---[d]
Engineering	-0.153	---[d]
Geosciences	0.434	---[d]
Life Sciences	0.278	---[d]
Mathematical Sciences	-0.760	---[d]
Physics and Astronomy	-0.291	---[d]
Psychology	0.529	---[d]
Social Sciences	-0.320	---[d]
Female	0.079	---[d]
URM	-0.057	---[d]
With disabilities	1.501	---[d]
Committee or panel participation		
Effect size	0.251	0.216
Institutional random effect size (SD)	----	0.437
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.102	-0.100
Computer and Information Sciences and Engineering	-0.039	-0.063
Engineering	-0.290	-0.272
Geosciences	0.153	0.199
Life Sciences	0.006	-0.077

	Population Average[a]	Institutional Average[b]
Mathematical Sciences	-0.252	-0.194
Physics and Astronomy	0.329	0.343
Psychology	0.374	0.380
Social Sciences	-0.129	-0.162
Female	-0.046	0.092
URM	-0.033	0.032
With disabilities	0.440	-0.417
Review services		
Effect size	0.059	-0.017
Institutional random effect size (SD)	----	0.243
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.126	-0.127
Computer and Information Sciences and Engineering	-0.383	-0.398
Engineering	-0.227	-0.241
Geosciences	0.178	0.217
Life Sciences	-0.288	-0.303
Mathematical Sciences	0.083	0.114
Physics and Astronomy	0.733	0.707
Psychology	-0.036	-0.022
Social Sciences	-0.024	-0.035
Female	0.220	0.246
URM	0.080	0.061
With disabilities	0.502	0.530

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted. (a) Estimates are grand mean centered from fixed models with cluster-robust standard errors. (b) Estimates are grand mean centered from mixed models. (c) Engineering and Other are the excluded reference categories. (d) This model could not be estimated.

*p<0.05 (adjusted)

**p<0.01 (adjusted)

Exhibit B.16. Additional Models of Estimated Impact of the GRFP Fellowship on Employment

	Population Average[a]	Institutional Average[b]
Currently employed		
Effect size	1.978**	4.686
Institutional random effect size (SD)	----	0.139
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.111	-2.820
Computer and Information Sciences and Engineering	11.991**	33.630
Engineering	-2.169**	---d
Geosciences	-0.825	-3.520
Life Sciences	-2.081**	-4.788
Mathematical Sciences	-2.332**	-5.031
Physics and Astronomy	-2.753**	-5.462
Psychology	0.257	-2.464
Social Sciences	-2.116**	-4.829
Female	-0.595	-0.591
URM	-0.271	-0.271
With disabilities	0.129	0.128

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted. (a) Estimates are grand mean centered from fixed models with cluster-robust standard errors. (b) Estimates are grand mean centered from mixed models. (c) Engineering and Other are the excluded reference categories. (d) This model could not be estimated.

*p<0.05 (adjusted)

**p<0.01 (adjusted)

Exhibit B.17. Additional Models of Estimated Impact of the GRFP Fellowship on Employment in Field Related to Field of Graduate Studies

	Population Average[a]	Institutional Average[b]
Current or most recent job related to field of graduate studies		
Effect size	0.037	0.031
Institutional random effect size (SD)	----	0.088
Moderated by:		
Graduate field of study[c]		
Chemistry	0.127	0.122
Computer and Information Sciences and Engineering	0.178	0.171
Engineering	0.079	0.081
Geosciences	-0.151	-0.149
Life Sciences	0.050	0.054
Mathematical Sciences	-0.025	-0.030
Physics and Astronomy	-0.035	-0.047
Psychology	-0.152	-0.139
Social Sciences	-0.043	-0.033

	Population Average[a]	Institutional Average[b]
Female	-0.091	-0.085
URM	-0.089	-0.092
With disabilities	0.100	0.101
First job after graduate school related to field of graduate studies		
Effect size	0.044	0.045
Institutional random effect size (SD)	----	0.040
Moderated by:		
Graduate field of study[c]		
Chemistry	-0.055	-0.057
Computer and Information Sciences and Engineering	0.284	0.280
Engineering	0.017	0.013
Geosciences	-0.089	-0.090
Life Sciences	-0.044	-0.045
Mathematical Sciences	0.171	0.175
Physics and Astronomy	-0.040	-0.044
Psychology	-0.226	-0.222
Social Sciences	-0.017	-0.012
Female	0.012	0.014
URM	-0.071	-0.072
With disabilities	0.216	0.231

SOURCE: GRFP Follow-up Survey

NOTES: All estimates are propensity-score weighted. (a) Estimates are grand mean centered from fixed models with cluster-robust standard errors. (b) Estimates are grand mean centered from mixed models. (c) Engineering and Other are the excluded reference categories.

*p<0.05 (adjusted)

**p<0.01 (adjusted)

Appendix C. GRFP Follow-Up Survey

NORC at the University of Chicago
GRFP Survey
2012
OMB Control Number 3145-0218

The evaluation of the Graduate Research Fellowship Program (GRFP) is being conducted by NORC at the University of Chicago on behalf of the National Science Foundation (NSF). The study seeks to understand the educational and professional decisions, experiences, and aspirations of NSF Graduate Fellows. The study will also provide an understanding of how the program is implemented by universities and whether and how specific program policies could be adjusted to make the program more effective in supporting future STEM scholars. Our findings will be made available in a public report in the near future, and will help the GRFP by providing information that can be used to improve the program and make it more effective in supporting future STEM scholars.

Login screen:

Welcome to the Evaluation of the National Science Foundation's Graduate Research Fellowship Program

You should have received a Personal Identification Number (PIN) and a password to gain access to this survey. Please enter them below, and then click the "Continue" button. If you do not have your PIN or password, please contact grfp@norc.org or call 1-877-253-0989.

Please enter your PIN: _____
Please enter your Password: _____

The Evaluation of the National Science Foundation's Graduate Research Fellowship Program is sponsored by the National Science Foundation (NSF) and is being conducted by NORC at the University of Chicago.

IMPORTANT: THIS SURVEY IS BEST VIEWED ON A COMPUTER SCREEN AND HAS NOT BEEN DESIGNED TO BE TAKEN ON A MOBILE PHONE.

Opening Screen:

About the Study

NORC at the University of Chicago is conducting a nationwide study for The Graduate Research Fellowship Program (GRFP). The primary purpose of the GRFP study is to provide basic information on early career and professional outcomes of Fellows and Honorable Mention recipients of the GRFP and to determine how these outcomes compare with the national pool of doctorate recipients. The evaluation is also designed to provide evidence on the effects of the GRFP on individuals' professional productivity, career preparations, aspirations and progress, and educational decisions.

All the information you provide will be treated as confidential and used only for research and statistical purposes by the National Science Foundation, NORC at the University of Chicago, and collaborating researchers for the purpose of analyzing data, and preparing scientific reports or articles. Any information publicly released (such as statistical summaries) will be in a form that does not personally identify you.

Participation Information:

- On average, it will take about 25 minutes to complete the questionnaire. Actual time may vary depending on your circumstances.
- Your response is voluntary and failure to provide some or all of the requested information will not in any way adversely affect you.

Navigation Instructions Page:

Navigation Instructions

- Move forward or backward one question at a time by clicking on the Next Page or Previous Page buttons. (DO NOT use your browser's Back or Forward buttons.)
- Move from field to field either by clicking with your mouse or using the [Tab] key
- If you need to save and come back to your survey, please use the Stop/Save button. When you log back into the survey you will be returned to the point where you left off.

Section I
GRFP Award Status

SECTION I: GRFP FELLOWSHIP STATUS

The first set of questions addresses your GRFP Fellowship status and experiences with the program.

1. Did you accept the NSF GRFP award? CHOOSE ONE

Yes **(SKIP TO I.5)**

No

2. Why did you not accept the NSF GRFP award?

CHOOSE ALL THAT APPLY.

I received **another fellowship** that offered a higher stipend
I received **another fellowship** that offered better non-stipend support (expenses for research, travel, etc.)
I received **another financial award** (e.g., scholarship, grant, etc.) that offered a higher stipend
I received **another financial award** (e.g., scholarship, grant, etc.) that offered better non-stipend support (expenses for research, travel, etc.)
I accepted a **research assistantship** instead of the GRFP award
I accepted a **teaching assistantship** instead of the GRFP award
I decided not to pursue my graduate studies at that time
Other **(PROCEED TO I.2A)**

Missing flag – set to 1 automatically if respondent chooses not to answer question

2a. Please specify why you did <u>not</u> accept the NSF GRFP award.

3. Did the NSF GRFP award requirements influence your decision to <u>not</u> accept the award? CHOOSE ONE

Yes

No **(SKIP TO I.5)**

4. Please indicate which program requirement discouraged you from accepting the award
(CHOOSE ALL THAT APPLY):

The requirement that I attend a graduate program at a U.S. institution
The three year duration of the award
Not being allowed to concurrently accept other federal fellowship money
Other **(PROCEED TO I.4A)** _____

Missing flag – set to 1 automatically if respondent chooses not to answer question

4a. Please specify which program requirement discouraged you from accepting the award.

5. Did you receive another fellowship or sponsored program award (e.g., Fulbright Program, NASA Aeronautics Scholarship Program, etc.) at any time during the five year period when you could have used the GRFP Fellowship?

Yes
No

6. **In your field, are there other fellowships or other sources of student support that are more desirable than the NSF Graduate Research Fellowship?**

Click here to view a list of other fellowship programs

Yes
No **(SKIP TO SECTION II, #1)**

7. **Please select from the drop-down list and identify why that award is more desirable.**

CHOOSE ALL THAT APPLY

Fellowship or other source	Larger stipend	Longer duration	More prestige	Other—please specify
1. See below list				
2. See below list				
3. See below list				

PROGRAMMING NOTE: If respondent chooses "other" in the fellowship dropdown, s/he will proceed to 7a:

7a. Please specify the name of the award that was more desirable than the GRFP

PROGRAMMING NOTE: If a respondent checks a box in the "other" column, s/he will proceed to 7b:

7b. Please specify the reason that fellowship was more desirable

Insert the following list as a drop-down menu for I.7:

Alcatel-Lucent Foundation Bell Labs Graduate Fellowship
Dept of Defense NDSEG Fellowship
Dept of Defense SMART
Dept of Education GAANN
Dept of Education Jacob Javits Fellowship
Dept of Energy
Dept of Homeland Security
Dept of State Fulbright Program
EPA Star Fellowship
Ford Foundation Fellowship
Hertz Fellowship
Marshall Scholarship Program
NASA Aeronautics Scholarship Program
NASA GSRP
National Park Service
National Physical Science Consortium Fellowship
NIEHS fellowship
NIH Ruth L Kirschstein Fellowship
NOAA fellowship
NSF Alliances for Graduate Education and the Professoriate (AGEP) Program
NSF Arctic Research Opportunities
NSF Astronomy and Astrophysics Postdoctoral Fellowships
NSF Bridge to the Doctorate (LSAMP-BD)
NSF Centers of Research Excellence in Science and Technology (CREST)
NSF Developing Global Scientists and Engineers (International Research Experiences for Students (IRES) and Doctoral Dissertation Enhancement Projects (DDEP))
NSF Doctoral Dissertation Improvement Grants in the Directorate for Biological Sciences
NSF Dynamics of Coupled Natural and Human Systems
NSF East Asia and Pacific Summer Institutes for U.S. Graduate Students
NSF Ethics Education in Science and Engineering
NSF Federal Cyber Service: Scholarship for Service
NSF Graduate STEM Fellows in K–12 Education
NSF HBCU Research Infrastructure for Science and Engineering (RISE)
NSF Integrative Graduate Education and Research Traineeship Program
NSF International Research and Education: Planning Visits and Workshops
NSF Minority Graduate Research Fellowship
NSF National STEM Education Distributed Learning
NSF Pan-American Advanced Studies Institutes Program
NSF Partnerships for International Research and Education

NSF Presidential Awards for Excellence in Science, Mathematics and Engineering

Mentoring
Rhodes Scholarship
University Fellowship
USDA fellowship
USFWS fellowship
USGS fellowship
Whitaker
Other

****

PROGRAMMING NOTE: after answering #I.6 or #I.7 (if applicable), those who didn't accept the award skip until Section VI, "Undergraduate Educational Background""

****

Section II
Graduate School Background Information

****

Transition page:

II. GRADUATE SCHOOL BACKGROUND INFORMATION

The next set of questions addresses your graduate school history.

****

1. Please provide the following information about the institution and degree program you attended using your GRFP support. If you used the GRFP award to attend more than one institution, please indicate the institution and degree program at which you spent most of your time as a GRFP fellow.

ALTERNATE TEXT FOR HONORABLE MENTIONS: Please provide the following information about the institution and degree program you attended after receiving the GRFP Honorable Mention recognition.

****

PROGRAMMING NOTE: Respondent is asked to select the state, then city, then school name from a set of drop-downs.

****

FIRST SCREEN: First please select the state in which the institution is located

SECOND SCREEN: First please select the city in which the institution is located

THIRD SCREEN: First please select the institution

Not applicable- I decided not to pursue graduate studies at the time of my award (SKIP TO SECTION VI, #1)

ALTERNATE TEXT FOR HONORABLE MENTIONS: Not applicable- I decided not to pursue graduate studies at the time of my GRFP Honorable Mention recognition (SKIP TO SECTION VI, #1)

****
PROGRAMMING NOTE: If respondent selects "other" for 'state', 'city', or 'institution' they are sent to a screen where they can enter information into a text box.
****

1a. Please enter the information below.

Name of this college or university	
City:	
Country:	

2. Please provide the following information about the institution and degree program you attended using your GRFP support. If you used the GRFP award to attend more than one institution, please indicate the institution and degree program at which you spent most of your time as a GRFP fellow.

ALTERNATE TEXT FOR HONORABLE MENTIONS: Please provide the following information about the institution and degree program you attended after receiving the GRFP Honorable Mention recognition.

Primary field of study:

- € Chemistry
- € Computer and Information Science and Engineering (CISE)
- € Engineering
- € Geosciences
- € Life Sciences
- € Mathematical Sciences
- € Physics and Astronomy
- € Psychology
- € Social Sciences
- € Other – non NSF-supported Field of Study

PRORGAMMING NOTE: If respondent selects "Other- Non NSF supported Field Of study" the following screen appears:

2a. Please specify the type of other –non NSF-supported field of study

3. Select your major area of concentration from the list below

PROGRAMMING NOTE: If respondent selects "other" the respondent is lead to this screen:

3a. Please specify the type of [field of study].

4. Month and year you enrolled at REFERENCE PROGRAM

_ _ (month) _ _ (year) [range 1992-2012]

5. Select the degree program(s) you attended at REFERENCE PROGRAM:

Note: If you are/were enrolled in a combined degree program (e.g. MA and PHD; MD and PHD, etc.) please select more than one

Master's degree e.g., MA, MS, etc.)
Professional degree (e.g., MD, DDS, JD, D.Min., Psy.D., etc.)
Research doctoral degree / Ph.D.
BS/MS Joint Program

6. Select the degree(s) you earned

Degree	Month completed	Year Completed (1994-2012)	Currently enrolled and working towards my degree	Did not complete degree and not currently enrolled

PROGRAMMING NOTE: If respondent selects "Currently enrolled and working towards my degree", s/he will skip the employment section (Section V) and have alternate text for several of the following questions

7. Have you ever attended any other graduate degree program(s)?

□ Yes
□ No (SKIP TO II.14)

8. Please provide the following information about the <u>additional</u> graduate degree programs in which you have enrolled. [1, 3]

First please select the state in which the institution is located (dropdown menu)

****

PROGRAMMING NOTE: Respondent asked to select the state, then city, then school name from a set of drop-downs.

****

FIRST SCREEN: First please select the state in which the institution is located

SECOND SCREEN: First please select the city in which the institution is located

THIRD SCREEN: First please select the institution

****

PROGRAMMING NOTE: If respondent selects "other" for 'state', 'city', or 'institution' , or "next" they are sent to a screen where they can enter information into a text box.

****

8a. Please enter the information below.

Name of this college or university	
City:	
Country:	

9. Primary field of study

- € Chemistry
- € Computer and Information Science and Engineering (CISE)
- € Engineering
- € Geosciences
- € Life Sciences
- € Mathematical Sciences
- € Physics and Astronomy
- € Psychology
- € Social Sciences
- € Other – non NSF-supported Field of Study

PROGRAMMING NOTE: If respondent selects "Other- Non NSF supported Field Of study" the following screen appears:

9a. Please specify the type of other –non NSF-supported field of study

10. Select your major area of concentration from the list below

PROGRAMMING NOTE: If respondent selects "other" the respondent is lead to this screen:

10a. Please specify the type of [field of study].

11. Month and year you enrolled in PROGRAM _ _ (month) _ _ (year)

12. Select the degree you sought. PLEASE SELECT ALL THAT APPLY:

Note: If you are/were enrolled in a combined degree program (e.g. MA and PHD; MD and PHD, etc.) please select more than one

Master's degree e.g., MA, MS, etc.)
Professional degree (e.g., MD, DDS, JD, D.Min., Psy.D., etc.)
Research doctoral degree / Ph.D.
BS/MS Joint Program

Select the degree(s) you earned:

Degree	Month completed	Year Completed	Currently enrolled and working towards my degree	Did not complete degree and not currently enrolled
Degree 2 (if applicable)				
Degree 3 (if				

13. Have you ever attended any other graduate degree program(s)?

Yes (**RETURN TO II.8**)
No

14. At any time during your graduate education did you take a leave of absence (stop out or did not register for credit)? Do not count summer enrollment unless your program required summer enrollment.

ALTERNATE TEXT for CURRENTLY ENROLLED: At any time during your graduate education have you taken a leave of absence (stop out or did not register for credit)? Do not count summer enrollment unless your program requires summer enrollment

Yes
No (**SKIP TO II.17**)

15. If yes, what was the total duration of your leave of absence?

Less than one academic year
One academic year
Between one and two academic years
Two or more academic years
Other **(PROCEED TO II.15A)**

15a. Please specify the total duration of your leave of absence

16. What were your main factors that led you to take a leave of absence from your graduate program? CHOOSE ALL THAT APPLY

Financial
Family-related
Work-related
Health
Academic difficulty
Uncertainty about continuing in the program
Program or advisor not a good match for my research interests
Other (**PROCEED TO II.16A**) _____

Missing flag – set to 1 automatically if respondent chooses not to answer question

16a. Please specify the other.

17. Did you change or transfer institutions at any time during your graduate studies?

ALTERNATE TEXT for CURRENTLY ENROLLED: HAVE YOU changed or transferred institutions at any time during your graduate studies?

Yes
No

18. Did you change your primary field of study at any time during your graduate education?

ALTERNATE TEXT for CURRENTLY ENROLLED: HAVE YOU changed your primary field of study at any time during your graduate education?

Yes
No **(SKIP TO "III. EXPERIENCES DURING GRADUATE SCHOOL")**

19. If yes, select the <u>most</u> important reason for changing fields - CHOOSE ONE

My career goals or interests changed
To gain different skills or knowledge
To improve employment opportunities in industry
To improve employment opportunities in academia
I was not performing well academically
To study a field that better fits my interests
Other (PROCEED TO II.19A)

19a. Please specify the <u>most</u> important reason for changing fields

Section III
Graduate Student Experiences

****

Transition Page:

SECTION III. EXPERIENCES DURING GRADUATE SCHOOL

"You will now be asked about some of the experiences you had during graduate school"

****

Please respond to the following items in terms of your experience at REFERENCE PROGRAM:

1. How would you rate your experience as a graduate student at REFERENCE PROGRAM on each of the following?

	Excellent	Above average	Average	Below average	Extremely poor	Not applicable
• Advice and guidance on my program of studies						
• Advice and guidance on post-graduation career steps						
• Curriculum						
• Quality of instruction						
• Training in research methods						
• Research experience						
• Support from dissertation/thesis advisor						
• Assistance on job search						
• Reputation of the program						
• Reputation of the university						
• Reputation of program faculty						

	Excellent	Above average	Average	Below average	Extremely poor	Not applicable
• Academic quality of peers						
• Financial support (assistantships, scholarships, fellowships, etc.)						
• Tuition assistance / cost of education allowance						
• Environment for minority students						
• Environment for women students						
• Opportunities for career and professional development						

2. While you were a graduate student at REFERENCE PROGRAM, how often did the following occur?

ALTERNATE TEXT for CURRENTLY ENROLLED: As a graduate student at REFERENCE PROGRAM, how often has the following occurred?

	Very often	Often	Sometimes	Rarely	Never
• You engaged in conversations of a social (rather than professional) nature either inside or outside of the school setting					
• You discussed topics in your primary field of study outside of the classroom					
• You discussed topics of intellectual interest outside of the classroom					
• You held membership in or participated in a professional organization					
• You performed research of your own that was not required by your program or courses					
• You called or wrote to a scholar at another institution to exchange views on scholarly work					
• You wrote, alone or with others, a grant proposal					
• You were asked by a fellow student to critique his/her work					
• You asked a fellow student to critique your work					
• You engaged in leadership or service activities in groups such as student organizations, community groups, or K-12 education institutions or agencies.					
• You participated in or led a research team					

3. Thinking about your experience as a graduate student at REFERENCE PROGRAM, to what extent do you agree with the following statements?

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
• I was offered a variety of enrichment activities (seminars, colloquia, social events, etc.) in addition to regular classes					
• There was an emphasis on engaging students in scholarly activities (research, writing other than dissertations, etc.)					
• Assistance was available to me in writing for presentations/publications					
• I learned the art of survival in this field					
• I developed professional relationships with others in my field					
• I was taught the details of good research practice					
• Graduate students had to compete for department or program resources					
• Scholarly interchange was fostered between students and faculty					
• My scholarly self-confidence was fostered					
• The educational climate encouraged the scholarly aspirations of all students					
• I identified well with my fellow students					
• My peers considered me a good student					

4. Once again thinking about your experience as a graduate student at REFERENCE PROGRAM, to what extent do you agree with the following statements?

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
• I had opportunities to learn about proposal writing					
• I had opportunities to choose research projects					
• I had opportunities to assist faculty on their projects					
• I had opportunities to present my research					
• I had opportunities to work on a team with people other than my advisor					
• I had opportunities to collaborate with other students, faculty, or outside departments					
• I was offered opportunities to conduct interdisciplinary research					
• My graduate school experiences prepared me for the challenges of my career					
• I had opportunities to develop career skills (personnel management, budgeting, etc.)					
• Courses, seminars, or workshops were offered in responsible conduct of research or ethics training.					
• My coursework laid a good foundation for doing independent work					
• I was provided opportunities to participate in grant-writing activities					

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
• I had opportunities to travel outside of the U.S. for training and research purposes					
• It was easy to change departments					
• It was easy to change advisors					

5. To what extent would you agree with the following statements about the faculty you interacted with while a graduate student at REFERENCE PROGRAM?

ALTERNATE TEXT for CURRENTLY ENROLLED: To what extent would you agree with the following statements about the faculty you have interacted with as a graduate student at REFERENCE PROGRAM

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
• I identified well with the faculty					
• I could trust the faculty to give me good academic advice					
• I was treated as a colleague by the faculty					
• The faculty saw me as a serious scholar					
• I often felt exploited by faculty					
• I felt free to call on the faculty for academic help					
• There was at least one faculty member (including your advisor, if appropriate) in my department who was particularly supportive of me and my work					
• The faculty exposed me to a wide variety of useful research experiences					
• The faculty was accessible for scholarly discussions outside of class					
• The faculty was aware of student problems and concerns					
• The faculty seemed to treat each other as colleagues					
• Faculty considered me an asset to their projects					

6. To what extent were you provided with the following while a graduate student at REFERENCE PROGRAM?
ALTERNATE TEXT for CURRENTLY ENROLLED: To what extent have you been provided with the following while a graduate student at REFERENCE PROGRAM?

	To a great extent	Somewhat	Very little	Not at all
• Training or instruction (e.g., courses, workshops) in effective teaching practices				
• Training or instruction (e.g., courses, workshops) in student mentoring				
• Training or instruction on the interaction between academic research and industrial technical requirements				
• Training or instruction for applying research to address public policy concerns or issues				
• Opportunities to develop or present course and/or curriculum materials				

7. To what extent did you participate in the following graduate school activities while at REFERENCE PROGRAM?
ALTERNATE TEXT for CURRENTLY ENROLLED: To what extent have you participated in the following graduate school activities while at REFERENCE PROGRAM?

	To a great extent	Somewhat	Very little	Not at all
• Worked on a team with people other than your advisor				
• Collaborated on a research paper or project				
• Undertook interdisciplinary research				
• Learned organizational or managerial skills				
• Collaborated with a researcher or researchers located in countries other than the U.S.				

INSERT A PAGE:

There are just a few more questions left in this section!
****

8. When thinking about your intended career path, how important were the following considerations?

ALTERNATE TEXT for CURRENTLY ENROLLED: When thinking about your intended career path, how important are the following considerations?

	Essential	Very important	Somewhat important	Not important
• Working for social change				
• High income potential				
• Social recognition or status				
• Stable, secure future				
• Creativity and initiative				
• Expression of personal values				
• Availability of jobs				
• Limited working hours				
• Leadership potential				
• Discovery/advancement of knowledge				
• Balance between work and family life				

9. Reflecting on your graduate school enrollment decision, to what extent do you agree or disagree with the following statements?

I decided to enroll in my particular graduate program at REFERENCE PROGRAM:

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
• Because it provided me with opportunities to teach					
• To work with a specific faculty member					
• To improve my employment opportunities in industry					
• To improve my employment opportunities in academia					
• To attend an institution that was socially desirable					
• To attend an institution that was academically desirable					
• To attend an institution that was desirable due to its geographic location					
• To attend an institution that provided a good fit for me personally (e.g., in terms of family or health circumstances)					

Section IV
Professional Productivity and Financial Support During Graduate School

Transition Page:

SECTION IV. PROFESSIONAL PRODUCTIVITY AND FINANCIAL SUPPORT DURING GRADUATE SCHOOL

The next series of questions asks about your employment patterns and finances during graduate school.

****

1. Which of the following were sources of financial support during your graduate education?
ALTERNATE TEXT for CURRENTLY ENROLLED: Which of the following have been sources of financial support during your graduate education?

CHOOSE ALL THAT APPLY

Fellowship, scholarship
Grant
Teaching assistantship
Research assistantship
Other assistantship
Internship
Loans (from any source)
Personal savings
Personal earnings during graduate school (other than sources listed above)
Spouse's, partner's, or family's earnings or savings
Employer reimbursement/assistance
Foreign (non-U.S.) support
Other **(PROCEED TO IV.1A)** _____
Missing flag – set to 1 automatically if respondent chooses not to answer question

1a. Please specify your source of financial support during the course of your overall graduate school experience.

2. Did you work for pay during your time as a graduate student at REFERENCE PROGRAM?

Please do not include teaching and research assistantships, traineeships, fellowships, and internships.

ALTERNATE TEXT FOR CURRENTLY ENROLLED: Have you worked for pay during your time as a graduate student at REFERENCE PROGRAM? Please do not include teaching and research assistantships, traineeships, fellowships and internships.

Yes

No **(SKIP TO IV.7)**

3. On average, how many hours per week did you work? (If you held more than one job, please count the hours/week you worked at all jobs.) _____

ALTERNATE TEXT FOR CURRENTLY ENROLLED: On average, how many hours per week do/did you work? (If you hold/held more than one job, please count the total hours/week at all jobs)

- € 0-4
- € 5-8
- € 9-12
- € 13-16
- € 17-20
- € 21-24
- € 25-28
- € 29-32
- € 33-36
- € 37-40
- € 41-48
- € 49-56
- € 57-64
- € 65-72
- € 73-80
- € 81-88
- € 89-96
- € 97-104
- € 105 or more

4. Did you work on-campus, off-campus, or both?
ALTERNATE TEXT for CURRENTLY ENROLLED: Have you worked or do you currently work on –campus, off-campus, or both?"

On-campus
Off-campus
Both on-campus and off-campus

5. Was your job related to your graduate school major field of study? (If you held more than one job, please respond in terms of the one where you worked the most hours.) **ALTERNATE TEXT for CURRENTLY ENROLLED: Is/was your job related to your graduate school major field of study? (If you have/had more than one job, please respond in terms of the one where you work/worked the most hours)**

Yes
No

6. Why did you work?
ALTERNATE TEXT for CURRENTLY ENROLLED: Why have you worked while enrolled in graduate school?

CHOOSE ALL THAT APPLY

Required as part of my teaching, research, or graduate assistantship
Living expenses
Experience
Support family
Pay back loans or other education-related debt
Pay for school
Help pay for social activities
Fits into career path/internship/gain experience or skills
Make money/create savings
Other **(IF SELECTED, CONTINUE TO IV.6a)**

Missing flag – set to 1 automatically if respondent chooses not to answer question

6a. Please specify why you worked while enrolled in your graduate program at REFERENCE PROGRAM

7. Did you have an internship during your time at REFERENCE PROGRAM?
ALTERNATE TEXT for CURRENTLY ENROLLED: Have you had an internship during your time at REFERENCE PROGRAM?

Yes
No **(SKIP TO IV.10)**

8. Was (were) your internship(s):

Paid
Unpaid
I held both paid and unpaid internships while at REFERENCE PROGRAM

9. Was (were) your internship(s):

In an academic setting
In a non-academic setting (e.g., industry, government)
I held internships in both academic and non-academic settings while at REFERENCE PROGRAM

10. How many papers did you present while in graduate school?
ALTERNATE TEXT for CURRENTLY ENROLLED: How many papers have you presented while in graduate school?

National meetings or conferences	International meetings or conferences
□ None	□ None
□ 1-4	□ 1-4
□ 5-8	□ 5-8
□ 9-12	□ 9-12
□ 13-16	□ 13-16
□ 17-20	□ 17-20
More than 20	More than 20

11. **How many of the following publications did you produce in graduate school? (Include publications in press.)**

ALTERNATE TEXT for CURRENTLY ENROLLED: How many of the following publications have you produced in graduate school? (Include publications in press)

	Primary Author	Other Co-Author
Refereed journal articles	Drop down range 0-50	Drop down range 0-50
Non-refereed articles (i.e., newspaper and magazine articles, book reviews)	Drop down range 0-50	Drop down range 0-50
Book chapters/edited books	Drop down range 0-50	Drop down range 0-50
Books published	Drop down range 0-50	Drop down range 0-50

12. How many patents did you apply for while in graduate school?

ALTERNATE TEXT for CURRENTLY ENROLLED: How many patents have you applied for while in graduate school?

(Number) _____ *Drop down range 0-50*

13. Did you apply to any of the following types of grants/contracts as a Principal Investigator (PI) or Co-PI while in graduate school?

ALTERNATE TEXT for CURRENTLY ENROLLED: Have you applied to any of the following types of grants/contracts as a Principal Investigator (PI) or Co-PI while in graduate school?

Yes	No	
□	□	Federal government
□	□	State government
□	□	Local government
□	□	Foundation
□	□	Business/industry
□	□	Employing organization
□	□	Not-for-profit agency
□	□	Professional society or association

Section V
Academic & Career Outcomes

****

Programming Note: Those who receive this section are those who are not currently enrolled in their reference program

****

****

Transition Page:

V. JOB HISTORY

Here we will be gathering more specific information regarding your employment history. Please note that for the purposes of this section, a postdoctoral appointment should be considered employment.

****

1. At the present time, which of the following best describes your employment status? Please do not include teaching and research assistantships, traineeships, fellowships, and internships.

Employed (including self-employment, postdoctoral appointment, or on any kind of paid or unpaid leave, including vacation) **(SKIP TO V.3)**
Not currently working for pay

2. What best describes your reason for not currently working? (SELECT ONE)

Further education (this EXCLUDES postdoctoral study)
Retired
On layoff from job
Family responsibilities
Medical condition (chronic illness, disability, etc.)
Seeking employment
Do not need or want to work
Other **(PROCEED TO V.2a)**

2a. Please specify your reason for not currently working.

3. How many jobs have you held since leaving REFERENCE PROGRAM? ____

PROGRAMMING NOTE: If a person has worked 0 jobs, then skip to #V.28 in the employment section

4. When was your most recent year of employment? _____

5. Thinking about your *current* employment, do you work for pay at a second job (or business), including part-time, evening, or weekend work?
ALTERNATE TEXT FOR UNEMPLOYED: Thinking about your *most recent* employment, did you work for pay at a second job (or business), including part-time, evening, or weekend work?

Yes
No

6. Thinking of your *current* employment, using the job categories listed, please choose the code that best describes your *current* job: If you have more than one job, please focus on the job where you work the most hours:
ALTERNATE TEXT FOR UNEMPLOYED: Thinking of your *most recent* employment, using the job categories listed, please choose the code that best described your *most recent* job: If you had more than one job, please focus on the job where you worked the most hours

PROGRAMMING CODE: If a respondent selects "500 OTHER OCCUPATIONS", proceed to V.6a)

6a. Please specify your occupation

7. Please consider your *current* employer. Counting all locations that your employer operates, how many people work for this employer? Your best estimate is fine.
ALTERNATE TEXT FOR UNEMPLOYED: Please consider your *most recent* employer. Counting all locations that your employer operated, how many people worked for this employer? Your best estimate is fine

(If you have more than one job, please focus on the job where you worked the most hours)

10 or fewer employees
11 - 24 employees
25 - 99 employees
100 - 499 employees

500 - 999 employees
1,000 - 4,999 employees
5,000 - 24,999 employees
25,000+ employees

8. What type of employer are you working for?
ALTERNATE TEXT FOR UNEMPLOYED: What type of employer were you most recently working for?

CHOOSE ONE

EDUCATION (IF SELECTED, GO TO V.9)

U.S. 4-year college or university other than medical school
U.S. medical school *(including university-affiliated hospital or medical center)*
U.S. university-affiliated research institute
U.S. community or two-year college
U.S. preschool, elementary, middle, secondary school or school system
Foreign educational institution

GOVERNMENT - *other than education institution* (IF SELECTED, SKIP TO V.11)

Foreign government
U.S. federal government
U.S. state government
U.S. local government (e.g., city, county, school district)
U.S. Military service
U.S. national laboratory

PRIVATE SECTOR - *other than education institution* (IF SELECTED, SKIP TO V.11)

Not for profit organization
Industry or business (for profit)
Start-up company

OTHER

Self-employed
Other **(PROCEED TO V.8A)** _____

8a. Please specify the type of employer you work for
ALTERNATE TEXT FOR UNEMPLOYED: Please specify the type of employer you worked for

9. (If EDUCATION was selected) Is your *current* job an academic position?
TEXTFILL UNEMPLOYED: Was your *most recent* job an academic position?

Yes
No **(SKIP TO V.11)**

10. What type of academic position(s) do you *currently* hold?
TEXTFILL UNEMPLOYED: What type of academic position(s) did you *most recently* hold?

CHOOSE ALL THAT APPLY

President, Provost, or Chancellor (any level)
Dean (any level), department head or chair
Research faculty, scientist, associate, or fellow
Non-tenure track faculty (e.g., instructor, lecturer, etc.)
Tenure-track faculty (e.g., assistant professor, etc.)
Tenured faculty (e.g., associate professor, etc.)
Adjunct faculty
Postdoc (e.g., postdoctoral fellow or associate)
Research assistant
Teaching assistant
Other position... **(PROCEED TO V.10A)** _____

Missing flag – set to 1 automatically if respondent chooses not to answer question

10a. Please specify the academic position you currently hold
TEXTFILL UNEMPLOYED: Please specify the academic position you most recently held

11. Please indicate your basic annual salary in US dollars in the *current* year you are employed. Do not include bonuses or additional compensation for summertime teaching or research. If you are not salaried, please estimate your earned income

ALTERNATE TEXT FOR UNEMPLOYED: Please indicate your basic annual salary in US dollars in the *most recent* year you were employed. Do not include bonuses or additional compensation for summertime teaching or research. If you are not salaried, please estimate your earned income.

PROGRAMMING CODE: IF RESPONDENT CLICKS "NEXT" WITHOUT ENTERING A VALUE THEN PROCEED TO V.12

12. If you prefer not to report an exact amount, please indicate into which range you expect your salary to fall:

ALTERNATE TEXT FOR UNEMPLOYED: If you prefer not to report an exact amount, please indicate into which range your salary fell

Choose one	
$30,000 or less	$70,001 - $80,000
$30,001 - $35,000	$80,001 - $90,000
$35,001 - $40,000	$90,001 - $100,000
$40,001 - $50,000	$100,001 - $110,000
$50,001 - $60,000	$110,001 or above
$60,001 - $70,000	Don't know

13. Is this salary based on a 52-week year, or less than that?

ALTERNATE TEXT FOR UNEMPLOYED: Was this salary based on a 52-week year, or less than that?

Include paid vacation and sick leave.

□ 52-week year
□ Less than 52 week **(PROCEED TO V.13A)** _____

13a. Please specify the number of weeks your salary is based on

ALTERNATE TEXT FOR UENMPLOYED: Please specify the number of weeks your salary was based on

14. What are your primary and secondary work activities at your *current* job?
ALTERNATE TEXT FOR UNEMPLOYED: What were your primary and secondary work activities at your *most recent* job?

(If you have more than one job, please focus on the job where you worked the most hours)

	PRIMARY	SECONDARY
Research and development	☐	☐
Teaching	☐	☐
Management or administration	☐	☐
Professional services to individuals	☐	☐
Other **(PROCEED TO V.14A AND/OR V.14B)**	☐	☐

Mark if no secondary work activities ☐

Missing flag – set to 1 automatically if respondent chooses not to answer question

14a. Please specify the other primary activity

14b. Please specify the other secondary activity

15. To what extent is your work on your *current /most recent* job related to your field of graduate studies at REFERENCE PROGRAM?

PROGRAMMING NOTE: IF PERSON HAS WORKED 1 JOB SINCE REFERENCE PROGRAM, AFTER THIS QUESTION SKIP TO V.28

Closely related
Somewhat related
Not related

16. Is your *current or most recent* job the same as your *first* job after leaving REFERENCE PROGRAM?

□ Yes, current / most recent job is same as first job **(SKIP TO V.28)**
□ No, current / most recent job is different is different than first job

17. Thinking of the first job you held after leaving REFERENCE PROGRAM, when did you hold this job?

Month you started working this job (1-12) _____

Year you started working this job (1985-2012) _____
Month you last worked at this job (1-12) _____
Year you last worked at this job (1985-2012) _____

18. Thinking of the first job you held after leaving REFERENCE PROGRAM, please choose the code that best describes that first job.

(PROGRAMMING NOTE: If a respondent selects "500 OTHER OCCUPATIONS", proceed to #V.18a. All other responses go to #V.19)

18a. Please specify your occupation

19. Please consider your *first* employer. Counting all locations that your employer operated, how many people worked for your principal employer? Your best estimate is fine.

10 or fewer employees
11 - 24 employees
25 - 99 employees
100 - 499 employees
500 - 999 employees
1,000 - 4,999 employees
5,000 - 24,999 employees
25,000+ employee

20. What type of employer did you work for at your *first* job after leaving REFERENCE PROGRAM?

CHOOSE ONE

EDUCATION (IF SELECTED, PROCEED TO V.21)

U.S. 4-year college or university other than medical school
U.S. medical school (including university-affiliated hospital or medical center)
U.S. university-affiliated research institute
U.S. community or two-year college
U.S. preschool, elementary, middle, secondary school or school system
Foreign educational institution

GOVERNMENT - *other than education institution* (IF SELECTED, SKIP TO V.23)

Foreign government
U.S. federal government
U.S. state government
U.S. local government (e.g., city, county, school district)
U.S. Military service
U.S. national laboratory

PRIVATE SECTOR - *other than education institution* (IF SELECTED, SKIP TO V.23)

Not for profit organization
Industry or business (for profit)
Start-up company

OTHER

Self-employed
Other…**(PROCEED TO V.20A)** _____

20a. Please specify the type of employer you worked for

21. (If EDUCATION was selected)
Was your *first* job after leaving REFERENCE PROGRAM an academic position?

Yes
No **(SKIP TO V.23)**

22. What type of academic position(s) did you have at your *first* job?

CHOOSE ALL THAT APPLY

President, Provost, or Chancellor (any level)
Dean (any level), department head or chair
Research faculty, scientist, associate, or fellow
Non-tenure track faculty (e.g., instructor, lecturer, etc.)
Tenure-track faculty (e.g., assistant professor, etc.)
Tenured faculty (e.g., associate professor, etc.)
Adjunct faculty
Postdoc (e.g., postdoctoral fellow or associate)
Research assistant
Teaching assistant
Other position **(PROCEED TO V.22A)**

_____

Missing flag – set to 1 automatically
if respondent chooses not to answer question

22a. Please specify the academic position you held at your *first* job

23. What was your basic annual salary for your *first* job after REFERENCE PROGRAM? Do not include bonuses or additional compensation for summertime teaching or research. If you were not salaried, please estimate your earned income.

(Programming Note: If respondent enters text, then skip to V.25. If respondent clicks "Next" without entering any text, proceed to V.24)

$ ☐

24. If you prefer not to report an exact amount, please indicate into which range your salary fell:

$30,000 or less	$70,001 - $80,000
$30,001 - $35,000	$80,001 - $90,000
$35,001 - $40,000	$90,001 - $100,000
$40,001 - $50,000	$100,001 - $110,000
$50,001 - $60,000	$110,001 or above
$60,001 - $70,000	Don't know

25. Was this salary based on a 52-week year, or less than that?

Include paid vacation and sick leave.

52-week year
Less than 52 weeks**...(PROCEED TO V.25A)**

25a. Please specify number of weeks

☐

26. Please consider your first employer after leaving REFERENCE PROGRAM. What were your primary and secondary work activities?

	PRIMARY	SECONDARY
Research and development	☐	☐
Teaching	☐	☐
Management or administration	☐	☐
Professional services to individuals	☐	☐
Other **(PROCEED TO V.26A AND/OR V.26B)**	☐	☐

Mark if no secondary work activities ☐

Missing flag – set to 1 automatically if respondent chooses not to answer question

26a. Please specify the other primary activity

26b. Please specify the other secondary activity

27. To what extent was your work on your *first* job related to your field of graduate studies at REFERENCE PROGRAM? CHOOSE ONE

Closely related
Somewhat related
Not related

28. Since leaving your graduate program at REFERENCE PROGRAM, how many papers have you presented?

	National meetings	International meetings
Number of Papers Presented	Range 0-100	Range 0-100

29. Since leaving your graduate program at REFERENCE PROGRAM, how many of the following publications have you produced (include any publications currently in press)?

	Primary Author (Number)	**Other Co-Author** (Number)
Refereed journal articles	Range 0-100	Range 0-100
Non-refereed articles (i.e., newspaper and magazine articles, book reviews)	Range 0-100	Range 0-100
Book chapters/edited books	Range 0-10	Range 0-100
Books published	Range 0-100	Range 0-100

30. Since leaving your graduate program at REFERENCE PROGRAM …

How many applications for U.S. patents have named you as an inventor?	Range 0-100
How many U.S. patents have been granted to you as an inventor?	Range 0-100
How many of the patents recorded as granted (in category 2 above) have resulted in commercialized products or processes or have been licensed?	Range 0-100

31. Since leaving your graduate program at REFERENCE PROGRAM, how many and what types of grants/contracts have you been awarded as Principal Investigator?

If you have not received a grant as PI, mark here and go to the next question.

	Number of Grants or Contracts	**Total Amount (Including Overhead)**
Federal government	Range 0-50	
State government	Range 0-50	
Local government	Range 0-50	
Foundation	Range 0-50	
Business/industry	Range 0-50	
Employing organization	Range 0-50	

32. What teaching activities have you undertaken since leaving your graduate program at REFERENCE PROGRAM?

Mark all that apply.	
Taught course(s) in K-12	Participated in curriculum development
Taught undergraduate course(s)	Mentored/tutored elementary students
Taught graduate course(s)	Mentored/tutored junior high or high students
Developed new course(s)	Mentored undergraduates

Mark all that apply.	
Taught interdisciplinary course(s)	Mentored graduate students
Team taught course(s)	Member of master's thesis committee
Taught distance education course(s), including via Internet	Chair of master's thesis committee
Taught course(s) on-site in business/industry	Member of dissertation committee
Taught course(s) on-site in other nonacademic settings	Chair of dissertation committee
Used computers for instruction	Other **(PROCEED TO V.32A)**
None	

Missing flag – set to 1 automatically if respondent chooses not to answer question

32a. Please specify the other teaching activities you have undertaken since graduate school

33. What professional services have you undertaken since leaving your graduate program at REFERENCE PROGRAM?

CHOOSE ALL THAT APPLY

Conference presentation proposal reviewer
Manuscript/chapter reviewer
Departmental committee
Institutional/company-wide committee
Professional organization committee
Local community/government committee/panel
State-level committee/panel
National committee/panel
Off-campus peer review panel, accreditation and certification team
Member of editorial board of professional journal
Editor of professional journal
Professional peer review of grant proposals
Involved in K-12 Science, Technology, Engineering, Mathematics (STEM) policy
Outreach to K-12 professionals
Participated in professional development activities for K-12 teachers
Other **(PROCEED TO V.33A)**_____

Missing flag – set to 1 automatically if respondent chooses not to answer question

33a. Please specify the professional services you have undertaken since leaving graduate school

Section VI
Background Characteristics

Insert page:

" Thank you for your responses so far! We just have a few additional questions about your background"

****

VI. Undergraduate Educational Background

1. Did you attend community college at any point during your undergraduate education?

□ Yes
□ No **(SKIP TO VI.3)**

2. Please enter the following information about the community college you attended.

Name of community college: _____
City Location: _____
State Location:_____

3. Did you participate in any of the following NSF-sponsored programs during your undergraduate education

Please check all that apply:

I did not participate in any NSF-sponsored programs

Advanced Technological Education
Arctic Research Opportunities
Centers of Research Excellence in Science and Technology (CREST)
HBCU Research Infrastructure for Science and Engineering (RISE)
Developing Global Scientists and Engineers (International Research Experiences for Students (IRES) and Doctoral Dissertation Enhancement Projects (D DEP)
Dynamics of Coupled Natural and Human Systems
Federal Cyber Service: Scholarship for Service
Historically Black Colleges and Universities Undergraduate Program
Integrative Graduate Education and Research Traineeship Program
Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences
International Research and Education: Planning Visits and Workshops

National STEM Education Distributed Learning
NSF Scholarships in Science, Technology, Engineering, and Mathematics
Louis Stokes Alliance for Minority Participation (LSAMP)
Tribal Colleges and Universities Program (TCUP)
NSF Computer Science, Engineering, and Mathematics Scholarships (CSEMS)
Partnerships for International Research and Education
Presidential Awards for Excellence in Science, Mathematics and Engineering Mentoring
Research Experiences for Undergraduates
Research in Disabilities Education
Research in Undergraduate Institutions
Robert Noyce Teacher Scholarship Program
Science, Technology, Engineering, and Mathematics Talent Expansion Program
Transforming Undergraduate Education in Science, Technology, Engineering and Mathematics (TUES)- formerly Course, Curriculum, and Laboratory Improvement (CCLI)
Other **(IF SELECTED, PROCEED TO VI.3A)**

Missing flag – set to 1 automatically if respondent chooses not to answer question

3A. Please provide the name(s) of the NSF-sponsored program(s) you participated in during your undergraduate education

****

Transition Page:

VII. DEMOGRAPHICS

Finally, we have a few background questions that will help us to compare our sample with the national pool of doctorate recipients.

Please note that all information you provide will be treated as confidential and used only for research and statistical purposes. Once again, your response is voluntary and failure to provide some or all of the requested information will not in any way adversely affect you.

****

1. Are you…

Male
Female

2. Which of the following best describes your ethnicity?

Hispanic or Latino
Not Hispanic or Latino **(SKIP TO VII.4)**

3. Which of the following best describes your Hispanic or Latino origin or descent?

CHOOSE ALL THAT APPLY

Mexican or Chicano
Puerto Rican
Cuban
Other Hispanic

4. Do you consider yourself (SELECT ONE OR MORE)

American Indian or Alaska Native
Asian
Black or African American
Native Hawaiian or Other Pacific Islander
White

Missing flag – set to 1 automatically if respondent chooses not to answer question

5. What is the highest degree that you have attained?

Bachelor's Degree
Master's degree (e.g., MA, MS, MBA, MSW, etc.)
Professional degree (e.g., MD, DDS, JD, D.Min., Psy.D., etc.)
Research doctoral degree or Ph.D.
Other **(IF SELECTED, PROCEED TO VII.5A)**

5a. Please specify the highest degree that you have attained

6. What is the highest educational attainment of your mother and father?

Mother	Father	
□	□	Less than high/secondary school graduate
□	□	High/secondary school graduate
□	□	Some college
□	□	Bachelor's degree
□	□	Master's degree (e.g., MA, MS, MBA, MSW, etc.)
□	□	Professional degree (e.g., MD, DDS, JD, D.Min., Psy.D., etc.)
□	□	Research doctoral degree or Ph.D.
□	□	Do not know

7. What is your marital status? (CHOOSE ONE)

Married
Living in a marriage-like relationship
Widowed
Separated
Divorced
Never married

8. Not including yourself or your spouse/partner, how many dependents (children or adults) do you have - that is, how many others receive at least one half of their financial support from you?

Drop down 0-10 _____

PROGRAMMING NOTE: If 0 is selected, Skip to #G.10

9. How many of these dependents are under the age of 18?

Drop down (numbers that are equal to or less than number of dependents from previous question)_____

10. Which of these categories best described your citizenship when <u>entering graduate school?</u>

U.S. Citizen
U.S. National, not a U.S.-Citizen
Non-U.S. Citizen with a Permanent U.S. Resident Visa ("Green Card")

11. Which of these categories best describes your <u>current citizenship status?</u> [1]

U.S. Citizen **(SKIP TO VII.15)**
Non-U.S. Citizen with a Permanent U.S. Resident Visa ("Green Card")
Non-U.S. Citizen with a temporary U.S. Visa
Non-U.S. Citizen and no U.S. visa

12. Of which country are you currently a citizen?

County choices displayed in drop-down

13. Do you have citizenship for any other country?

Yes
No **(SKIP TO VII.15)**

14. Of which other country are you currently a citizen?

County choices displayed in drop-down

15. What is your date of birth?

___Month (1-12)
___Day (1-31)
___Year (19__)

16. Please answer each of the following as Yes or No.

Yes	No	
□	□	Are you deaf or do you have serious difficulty hearing?
□	□	Are you blind or do you have serious difficulty seeing even when wearing glasses?
□	□	Because of a physical, mental, or emotional condition, do you have serious difficulty concentrating, remembering, or making decisions?
□	□	Do you have serious difficulty walking or climbing stairs?
□	□	Do you have difficulty dressing or bathing?
□	□	Because of a physical, mental, or emotional condition, do you have difficulty doing errands alone such as visiting a doctor's office or shopping?

Thank you page:

Thank you for your participation! We welcome you to contact us at any time at grfp@norc.org if you have any further comments or questions.

Your responses will help the NSF's work toward improving opportunities for future generations of graduate students. A report summarizing the findings of this research study will be posted on NORC's website (www.norc.org) in the fall of 2013.

Please hit the submit button before you close out of the survey.

Appendix D. Institutional Site Visit Protocols

Interview Protocols

I. Departmental Staff Protocol

Questions for relevant departmental staff members (e.g., graduate student office or student affairs staff members who have worked with GRFP Fellows):

S1. What is your overall impression of the NSF Graduate Research Fellowship Program (GRFP)? How does it compare, in reputation, with other fellowship programs?

S2. How do Fellows benefit from their GRFP Fellowship? How does your department benefit from hosting GRFP Fellows?

S3. Let's talk about the program's enrollment patterns in terms of gender, ethnicity, and Master's/Ph.D. student ratios. Do Fellows differ from other graduate students in terms of these characteristics? To what extent does the GRFP promote diversity among graduate students enrolled in your department?

S4. What kinds of financial and professional development support are offered to Fellows that are different than those offered to other graduate students? In your opinion, are these helpful to Fellows in terms of timely progress towards degree or better integration into the department?

S5. How does your department financially support its graduate students, for example, how many students receive full support to the completion of their degree, and how is aid awarded? How would the department be affected if GRFP funding were to disappear? How does the GRFP stipend and cost-of-education allowance to the institution figure into the financial planning of the department?

S6. Now let's talk about how the Fellows in your department actually use their Fellowships. When do most Fellows use the three years of the Fellowship? How common is it for Fellows to place their GRFP Fellowship on Reserve for one or two years? How do most GRFP students secure funding when they are not receiving GRFP support? What supplemental funding, if any, is provided to Fellows by the department? How do the guidelines on when Fellows may use their funding affect the experiences of the Fellows and the department? How has this changed over the past few years?

S7. What are the expectations and opportunities for TAing and RAing in the department? Do Fellows participate in these opportunities to the same degree as their peers? If Fellows participate in TA and RA opportunities, how often do they do so while they are on Reserve (not utilizing the fellowship) and while they are on Tenure (receiving the funding)? How has this changed over the past few years?

S8. Over the past few years, how would you say the GRFP has changed, whether in terms of regulations, how it affects Fellows, how it affects your institution, or in some other way?

S9. How could the GRFP be improved? What ideas would you like to communicate to NSF? [If perceived problems are reported:] What solutions would you propose?

II. Departmental Faculty Protocol

Questions for relevant departmental faculty members (e.g., graduate program coordinating officials, department chairs, and faculty who have worked with GRFP Fellows):

F1. What is your overall impression of the NSF Graduate Research Fellowship Program (GRFP)? How does it compare, in reputation, with other fellowship programs? What does it mean to faculty members that a student is a GRFP Fellow?

F2. How does a GRFP Fellowship influence the admissions decisions of your department? How does receiving a GRFP Fellowship influence faculty members' willingness to work with a prospective student?

F3. How do the experiences of Fellows differ from those of other students in the program? Probe for:

- whether Fellows are fully integrated into the program or if their source of funding isolates them;
- whether the GRFP funding provides greater autonomy/flexibility since it is not tied to an advisor or lab;
- whether program guidelines affect Fellows' service to the department in terms of TAing/RAing?

F4. Compared to the other students in your department, do Fellows differ in the length of time they need to finish? What are the career goals of your GRFP Fellows, and do they differ from those of the other students in your department? Compared to other students, to what extent are the Fellows developing the personal and professional skills necessary for success in their chosen field after graduating?

F5. How do Fellows benefit from their GRFP Fellowship? How does your department benefit from hosting GRFP Fellows?

F6. To what extent do Fellows contribute to the research activity of the department? Are the educational and research experiences of Fellows similar to those of other students? How has this changed over the past few years? Do Fellows have different opportunities or make different choices compared to other students? If there are differences, what are they?

F7. How would your department be affected if GRFP funding were to disappear? How does the GRFP stipend and cost-of-education allowance to the institution figure into the financial planning of the department?

F8. How could the GRFP be improved? What changes to the program might benefit the Fellows and the department?

III. University Administrators Protocol

Questions for graduate studies deans and other relevant university administrators (e.g., directors of student financial support, external fellowship advisors, designated Coordinating Officials (COs) of the GRFP):

A1. What is your overall impression of the NSF Graduate Research Fellowship Program (GRFP)? How does it compare, in reputation, with other fellowship programs?

A2. What trends, if any, have you noticed in the granting of GRFP Fellowships? Has the recent increase in the number of Fellowships awarded contributed to these trends? [If needed: for example, in terms of quality of students, racial, ethnic, and gender diversity, field of study, etc.] How has this increase affected your graduate program, if at all?

A3. We are interested in how the GRFP affects the university. To what extent does the program help:

- Recruit students to STEM programs at your university?
- Offset the costs necessary to fund students, in terms of the stipend support for the student and the cost-of-education allowance provided to the university?
- Diversify the student body of STEM programs?

A4. How would your university be affected if GRFP funding were to disappear? How does the GRFP stipend and cost-of-education allowance figure into the financial planning of the graduate studies office or any of your graduate programs?

A5. Does the current amount of funding provided by the GRFP adequately meet the needs of graduate students at your university? How is the cost-of-education allowance provided by the GRFP Fellowship used by the university? For example, how does the institution cover tuition and required fees if the cost-of-education allowance is insufficient?

A6. How many staff members are involved in the administration of GRFP Fellowships? Are there supports or activities provided by the university to the Fellows that are separate from those provided to other graduate students?

A7. Compared to other students, to what extent are Fellows contributing to the research endeavors of the university while they are in graduate school? To what extent are they supporting the department through service and teaching? How has this changed over the past few years? (Probe specifically for changes in Fellows' participation in teaching and research, while on Tenure and while on Reserve.) To what extent are they succeeding in STEM fields upon graduation?

A8. Over the past few years, how would you say the GRFP has changed, whether in terms of regulations, how it affects Fellows, how it affects your institution, or in some other way?

A9. How could the GRFP be improved? What changes to the program would most benefit your university?

Appendix E. Institutional Telephone Interview Protocol

Interview Protocol

NSF is interested in learning how policies of the GRFP are working and the extent to which they could be improved. We are interested in both your experiences with these policies as well as your opinions, suggestions for improvement, and ideas.

- How would you describe the goals of the GRFP program?
- Let's talk about how the Fellows in your department actually use their Fellowships. When do most Fellows use the three years of the Fellowship? How common is it for Fellows to place their Fellowship on Reserve for one or two years? Has this pattern changed over the past few years?
  - How are most Fellows funded when they are not receiving GRFP support? What supplemental funding, if any, is provided to Fellows by the department? How do the GRFP policies on when Fellows may utilize their funding affect the experiences of the Fellows and the department? How do the policies affect the Fellows' progress to degree completion?
  - Does the current amount of funding provided by the GRFP adequately meet the needs of graduate students at your university? How is the cost-of-education allowance provided by the Fellowship used by the university? For example, how does the institution cover tuition and required fees if the cost-of-education allowance is insufficient?
- How do the experiences of Fellows differ from those of other students in the program? Probe for:
  - whether Fellows are fully integrated into the program or if their source of funding isolates them;
  - whether the GRFP funding provides greater autonomy/flexibility since it is not tied to an advisor or lab;
- What kinds of financial and professional development support are offered to Fellows that are different than those offered to other graduate students? In your opinion, are these helpful to Fellows in terms of timely progress towards degree or better integration into the department?
- What are the requirements and opportunities for TAing and RAing in the department? Do Fellows participate in these opportunities to the same degree as their peers? If Fellows participate in TA and RA opportunities, how often do they do so while they are on Reserve (not utilizing the fellowship) and while they are on Tenure (receiving the funding)? How do the program guidelines about the amount of service Fellows may provide to the institution while funded by the

GRFP affect the experiences of Fellows and the department? Could this policy be improved for the Fellows? How has the service provided by Fellows changed over the past few years?

- The program requires that the status of Fellows is decided on an annual basis—i.e. whether they are in a "Tenure" or "Reserve" status for the following GRFP Fellowship year. How do you think this policy works? Is there any need to change it?
- The program also requires that Fellows are affiliated with a U.S. institution. Are there instances (for example, in particular fields) where you would suggest revisiting this policy?
- Is there anything about the program policies [refer to the Administrative Guide if needed] that, if changed, would improve the program or be beneficial for your institution, the graduate programs, or Fellows?