

# Exploring the Educational Experiences of Black and Hispanic PhDs in STEM

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## INTRODUCTION

In 2021, approximately 32,000 PhDs were awarded to U.S. citizens in the United States. Although the U.S. population is 12% Black and 19% Hispanic,<sup>1</sup> only 8% and 9% of the PhDs were awarded to Black and Hispanic researchers, respectively.<sup>2</sup> When limiting PhDs to Science, Technology, Engineering, and Mathematics (STEM) fields, disparities are even more stark, with only 5% and 8% of STEM PhDs awarded to Black and Hispanic researchers in 2021.

Given the national economic and moral imperative of seeing the United States' advanced STEM workforce reflect our citizenry, this report investigates four research questions to explore experiences of Black and Hispanic PhDs in STEM:



What are *characteristics of bachelor's degree-granting institutions* attended by STEM PhD recipients, and how do these institutional characteristics vary by recipients' race and ethnicity?



What are *characteristics of doctoral degree-granting institutions* attended by STEM PhD recipients, and how do these institutional characteristics vary by recipients' race and ethnicity?



What are *postsecondary educational pathways and experiences* of STEM PhD recipients, and how do these pathways and experiences vary by recipients' race and ethnicity?



How *much debt is incurred and what sources of support* are received by STEM PhD recipients, and how does this educational funding vary by recipients' race and ethnicity?

1 American Community Survey, Table DP05 ACS Demographic and Housing Estimates, 2021: ACS 5-Year Estimates Data Profiles: <https://data.census.gov/table?tid=ACSDP1Y2021.DP05>.

2 Survey of Earned Doctorates, Table 1-11 U.S. Citizen and Permanent Resident Research Doctorate Recipients, by Historical Broad Field of Doctorate, Ethnicity, and Race: Selected Years, 1976–2021: <https://nces.nsf.gov/pubs/nsf23300/data-tables>.



## Data in this report come from three sources:

- 1 National Science Foundation's Survey of Earned Doctorates (SED), which is a census of all research doctorates awarded by U.S. institutions each year.<sup>3</sup>
- 2 U.S. Department of Education's 2008/18 Baccalaureate and Beyond Longitudinal Study (B&B:08/18), which included a nationally representative sample of approximately 14,700 bachelor's degree recipients who were interviewed during their senior year in college and 1, 4, and 10 years after graduation.
- 3 U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS), which includes institutional-level data on every college receiving Title IV federal financial aid in the United States.

In this report, when SED data are used, race and ethnicity are shown in four categories as defined by the National Science Foundation: Asian, Black, Hispanic, and White.<sup>4</sup> When B&B:08/18 data are used, race and ethnicity are shown in two categories: Black or Hispanic, and White.<sup>5</sup> Although combining Black and Hispanic is not ideal, given the different lived experiences of these two groups, when the categories are reported separately, all results are suppressed due to small sample sizes. When IPEDS data are used, race and ethnicity are shown in four categories as defined by the U.S. Department of Education: Asian, Black, Hispanic, and White.<sup>6</sup> In all the data sources, race categories that include small sample sizes, such as American Indian or Alaska Native, are not included because these results are suppressed due to small sample sizes to protect the privacy of survey participants.

3 Although the PhD is the most common research doctoral degree (98% to 99% of all research doctorates awarded are PhDs), other doctorates requiring completion of an original intellectual contribution in the form of a dissertation or an equivalent culminating project, such as a Doctor of Science or Doctor of Engineering, are included in the SED counts in this report.

4 The full category labels in the variable Race and Ethnicity in the SED data are Hispanic or Latino; American Indian or Alaska Native, Not Hispanic or Latino; Asian, Not Hispanic or Latino; Black or African American, Not Hispanic or Latino; White, Not Hispanic or Latino; More than one race, Not Hispanic or Latino; Other race or race not reported, Not Hispanic or Latino; Ethnicity not reported. "More than one race" includes individuals who selected more than one option when self-identifying their race. Individuals who identify as "More than one race" are not included in the analysis because the specific races they identify with are not provided in the available data.

5 The full category labels in the variable RACE in the B&B:08/18 data are White, Black or African American, Asian, American Indian or Alaska Native, Native Hawaiian/Other Pacific Islander, Other, and More than one race. "More than one race" includes individuals who selected that response option when self-identifying their race. Individuals who identify as "More than one race" are not included in the analysis because the specific races they identify with are not collected in the data.

6 The full category labels capturing the concepts of race and ethnicity in the IPEDS data are American Indian or Alaska Native, Asian, Black or African American, Hispanic or Latino, Native Hawaiian or Other Pacific Islanders, White, Two or more races, and Race/ethnicity unknown. "Two or more races" is a category reported by institutions when a student selected more than one race. Individuals who identify as "Two or more races" are not included in the analysis because the specific races they identify with are not reported in the data.



## CHARACTERISTICS OF BACHELOR’S DEGREE–GRANTING INSTITUTIONS

Among STEM<sup>7</sup> PhD recipients, the types of bachelor’s degree–granting institutions attended differed across racial and ethnic groups. The SED data show that 64% of Hispanic students attended a public bachelor’s degree–granting institution, compared with 57% of White students, 56% of Black students, and 43% of Asian students (*Exhibit 1*).

Higher proportions of White and Asian students attended a private bachelor’s degree–granting institution (36% and 32%, respectively), compared with Hispanic and Black students (29% and 28%, respectively). Asian students were the most likely to attend a bachelor’s degree–granting institution that was foreign or whose control was not classified (25%, compared with 16% for Black students and 7% each for Hispanic and White students).

### EXHIBIT 1

Control of Bachelor’s Degree–Granting Institution Among STEM PhD Recipients Who Are U.S. Citizens or Permanent Residents, by Race and Ethnicity: 2021 SED

| Race/ Ethnicity | Total  |        | Public |       | Private |       | Foreign or Not Classified |       |
|-----------------|--------|--------|--------|-------|---------|-------|---------------------------|-------|
|                 | #      | %      | #      | %     | #       | %     | #                         | %     |
| Asian           | 2,249  | 100.0% | 962    | 42.8% | 729     | 32.4% | 559                       | 24.8% |
| Black           | 946    | 100.0% | 531    | 56.2% | 263     | 27.8% | 152                       | 16.0% |
| Hispanic        | 1,520  | 100.0% | 974    | 64.1% | 438     | 28.8% | 108                       | 7.1%  |
| White           | 12,736 | 100.0% | 7,255  | 57.0% | 4,621   | 36.3% | 860                       | 6.8%  |

**NOTE:** The majority of the schools in “Foreign or Not Classified” are foreign. A few schools are not classified because the respondent did not provide the name of their bachelor’s degree–granting institution in the SED.

**SOURCE:** National Center for Science and Engineering Statistics, Restricted Data Analysis System (RDAS), Survey of Earned Doctorates (SED), 2021.

The Carnegie Classification of STEM PhDs’ bachelor’s degree–granting institutions also differed across racial and ethnic groups (*Exhibit 2*). According to the SED data, 68% of Hispanic students, 66% of White students, and 65% of Asian students graduated from a bachelor’s degree–granting institution where the highest degree offered was a doctoral degree, compared with 56% of Black students. Black STEM PhDs were more likely to graduate with a bachelor’s degree from an institution where the highest degree offered was a master’s degree (19% for Black STEM PhDs, compared with 15%, 13%, and 5% for Hispanic, White, and Asian STEM PhDs, respectively). Asian and Black STEM PhDs were more likely to earn a bachelor’s degree from an institution where the highest degree offered was a bachelor’s degree or from a foreign institution or an institution with an unclassified Carnegie Classification (31% and 25% for Asian and Black STEM PhDs compared with 20% and 18% for White and Hispanic STEM PhDs).

### EXHIBIT 2

Carnegie Classification of Bachelor’s Degree–Granting Institution Among STEM PhD Recipients Who Are U.S. Citizens or Permanent Residents, by Race and Ethnicity: 2021 SED

| Race/ Ethnicity | Total  |        | Doctoral Universities |       | Master’s Colleges and Universities |       | Bachelor’s Colleges or Foreign or Not Classified |       |
|-----------------|--------|--------|-----------------------|-------|------------------------------------|-------|--|-------|
|                 | #      | %      | #                     | %     | #                                  | %     | #  | %     |
| Asian           | 2,249  | 100.0% | 1,461                 | 65.0% | 103                                | 4.6%  | 686  | 30.5% |
| Black           | 946    | 100.0% | 531                   | 56.1% | 181                                | 19.1% | 234  | 24.7% |
| Hispanic        | 1,520  | 100.0% | 1,026                 | 67.5% | 228                                | 15.0% | 266  | 17.5% |
| White           | 12,736 | 100.0% | 8,466                 | 66.5% | 1,677                              | 13.2% | 2,593  | 20.4% |

**NOTE:** The majority of the schools in “Foreign or Not Classified” are foreign. A few schools are not classified because the respondent did not provide the name of their bachelor’s–granting institution in the SED.

**SOURCE:** National Center for Science and Engineering Statistics, Restricted Data Analysis System (RDAS), Survey of Earned Doctorates (SED), 2021.

<sup>7</sup> In the SED data, those who earned a research doctorate in the life sciences, physical sciences and earth sciences, mathematics and computer science, and engineering are considered STEM PhD recipients.

The size of STEM PhDs' bachelor's degree-granting institutions also varied by race and ethnicity (*Exhibit 3*). Interestingly, racial and ethnic patterns across the size of STEM PhDs' bachelor's degree-granting institutions varied from racial and ethnic patterns across bachelor's degree-granting institutions in general. Among all bachelor's degree recipients in B&B:08/18, the distribution of enrollment across school sizes was similar between Black or Hispanic students and White students. For example, 35% of White bachelor's degree recipients attended a school with more than 20,000 students, and 31% of Black or Hispanic students graduated from a similarly sized school. Similarly, 26% of both Black or Hispanic students and White students attended an institution with 5,000 students or less.

**EXHIBIT 3**

Enrollment Size of Bachelor's Degree-Granting Institutions: B&B:08/18

| Race/ Ethnicity                         | ≤ 5,000 | 5,001–20,000 | > 20,000 |
|---|---------|--------------|----------|
| <b>All Bachelor's Degree Recipients</b> |         |              |          |
| Black or Hispanic                       | 26.2%   | 42.5%        | 31.3%    |
| White                                   | 25.5%   | 39.8%        | 34.7%    |
| <b>STEM PhD Recipients</b>              |         |              |          |
| Black or Hispanic                       | 40.4%   | 40.5%        | 19.1%    |
| White                                   | 31.9%   | 25.6%        | 42.5%    |

**NOTE:** Some estimates in this table, especially in the Black or Hispanic rows, have large standard errors due to small samples sizes and should be viewed with caution.

**SOURCE:** U.S. Department of Education, National Center for Education Statistics, Baccalaureate and Beyond: 2008/2018 (B&B:08/18).

One might assume the enrollment pattern would be the same for STEM<sup>8</sup> PhDs in particular, but it is not. Black or Hispanic STEM PhDs were less likely to come from a large bachelor's degree-granting institution and more likely to come from a small institution, relative to their White peers. Some 43% of White STEM PhDs earned their bachelor's degree at an institution with more than 20,000 students, compared with just 19% for Black or Hispanic STEM PhDs. Some 40% of Black or Hispanic STEM PhDs earned their bachelor's degree at an institution with 5,000 students or less, compared with 32% of White STEM PhDs. Overall, these findings indicate that a greater proportion of Black or Hispanic students who earned their bachelor's degrees at small institutions go on to earn doctorates in STEM, relative to those at large bachelor's degree-granting institutions.

In addition to exploring the general characteristics of institutions that produced Black and Hispanic STEM PhDs, it is informative to investigate which individual schools were the bachelor's degree-granting institutions of the most Black and Hispanic STEM PhDs in recent years. According to the SED data, between 2010 and 2020, approximately 184,000 STEM PhDs were awarded in the United States to students who also earned their bachelor's degree in the United States. Roughly 7,000 of those STEM PhDs were earned by Black individuals, and 10,000 were earned by Hispanic individuals. *Exhibit 4* shows the top 20 bachelor's degree-granting institutions that produced the most STEM PhDs for Black and Hispanic students. Interestingly, these top 20 bachelor's degree-granting institutions produced a large percentage of all Black and Hispanic STEM PhDs. The top 20 institutions for Black STEM PhDs were the bachelor's degree-granting institution for 26% of all Black STEM PhDs awarded between 2010–2020. The top 20 institutions for Hispanic STEM PhDs were the bachelor's degree-granting institution for 37% of all Hispanic STEM PhDs over this period.

<sup>8</sup> In the B&B:08/18 data, those who earned a research doctorate in computer and information sciences, engineering and engineering technology, biology, physical science, science technology, math, and agriculture are considered STEM PhD recipients.

**EXHIBIT 4**

## Top 20 Bachelor's Degree–Granting Institutions of Black and Hispanic STEM PhD Recipients: 2010–2020 SED

| Institution   | Black (#) |
|---|-----------|
| University of Maryland, Baltimore County                          | 157       |
| North Carolina Agricultural and Technical State University (HBCU) | 133       |
| Howard University (HBCU)  | 123       |
| Spelman College (HBCU)  | 121       |
| Florida A&M University (HBCU)                                     | 112       |
| University of Florida   | 99        |
| University of Maryland, College Park                              | 97        |
| Xavier University of Louisiana (HBCU)                             | 93        |
| Morehouse College (HBCU)  | 85        |
| Morgan State University (HBCU)                                    | 84        |
| Jackson State University (HBCU)                                   | 80        |
| Southern University and A&M College, Baton Rouge (HBCU)           | 73        |
| Tuskegee University (HBCU)  | 68        |
| Massachusetts Institute of Technology                             | 68        |
| Hampton University (HBCU)   | 65        |
| Florida State University  | 62        |
| University of North Carolina, Chapel Hill                         | 62        |
| University of Illinois, Urbana-Champaign                          | 61        |
| Georgia Institute of Technology                                   | 60        |
| University of Michigan, Ann Arbor                                 | 59        |

| Institution   | Hispanic (#) |
|---|--------------|
| University of Puerto Rico, Mayaguez (HSI)                             | 640          |
| University of Puerto Rico, Rio Piedras (HSI)                          | 379          |
| University of Texas, El Paso (HSI)                                    | 277          |
| University of Florida   | 256          |
| Florida International University (HSI)                                | 202          |
| University of California, Los Angeles                                 | 191          |
| University of California, Berkeley                                    | 178          |
| Massachusetts Institute of Technology                                 | 167          |
| University of Texas, Austin (HSI)                                     | 167          |
| University of California, Davis                                       | 164          |
| University of California, Irvine (HSI)                                | 158          |
| Texas A&M University, College Station and Health Science Center (HSI) | 150          |
| University of Arizona (HSI)   | 140          |
| University of California, San Diego                                   | 139          |
| University of New Mexico, Albuquerque (HSI)                           | 132          |
| University of Miami   | 115          |
| University of California, Riverside (HSI)                             | 107          |
| New Mexico State University, Las Cruces (HSI)                         | 99           |
| University of Puerto Rico, Humacao (HSI)                              | 98           |
| Stanford University   | 94           |

**NOTES:** STEM fields include Chemistry, Geosciences, Physics and Astronomy, Computer and Information Sciences, Mathematics and Statistics, Engineering, Agricultural Sciences and Natural Resources, Biological and Biomedical Sciences, and Health Sciences. HBCU = Historically Black College or University. HSI = Hispanic-Serving Institution.

**SOURCE:** National Center for Science and Engineering Statistics, Survey of Earned Doctorates (SED), 2010–2020.

It is also informative to investigate what role minority-serving institutions play as bachelor's degree-granting institutions for individuals who eventually earn PhDs in STEM. The SED data show that, among the 184,000 STEM PhDs awarded in the United States between 2010 and 2020 to students who also earned their bachelor's degree in the United States, approximately 1.5% (2,800) earned their bachelor's degree from a Historically Black College or University (HBCU), and approximately 8.9% (16,300) earned their bachelor's degree from a Hispanic-Serving Institution (HSI). Among the STEM PhDs awarded between 2010 and 2020 to Black students who completed their bachelor's degree in the United States, 31% earned their bachelor's degree at an HBCU. Among STEM PhDs awarded between 2010 and 2020 to Hispanic students who completed their bachelor's degree in the U.S., approximately 41% earned their bachelor's degree at an HSI.

To understand the contributions of HSIs and HBCUs as the bachelor's degree-granting institution of STEM PhDs, one can rank all bachelor's degree-granting institutions, with the top ranked school being the bachelor's degree-granting institution for the most students who later earned a PhD in a particular field. *Exhibit 5* shows which specific HSIs are in the top 20 of all bachelor's degree-granting institutions by field. As the exhibit shows, several HSIs granted bachelor's degrees to large numbers of individuals who went on to earn PhDs in STEM, although specific schools varied by field. Seven HSIs were among the top 20 bachelor's degree-granting institutions over the past 10 years. For example, among those who earned a PhD in Agricultural Sciences and Natural Resources between 2010 and 2020, more completed their bachelor's degree at Texas A&M University, College Station (an HSI) than at any other institution, which is why it has a rank of 1. No other HSI was in the top 20 of bachelor's degree-granting institutions of PhDs in Agricultural Sciences and Natural Resources over that period. To give another example, among those who earned a PhD in Chemistry between 2010 and 2020, the top 10 bachelor's degree-granting institutions were all non-HSIs. The HSI that was the bachelor's degree-granting institution for the most PhDs in Chemistry was the University of Texas at Austin (ranked 11 overall). The University of California, Irvine (ranked 17) and the University of Puerto Rico, Rio Piedras (ranked 18) were the other two HSIs in the top 20 of bachelor's degree-granting institutions overall for PhDs in Chemistry.

### EXHIBIT 5

HSIs and HBCUs Awarding the Most Bachelor's Degrees to Students Who Eventually Earn PhDs in STEM, by Overall Rank and STEM Field of Study: 2010–2020 SED

| Institution  | Chemistry | Geosciences | Physics and Astronomy | Engineering | Biological and Biomedical Sciences | Mathematics and Statistics | Computer and Information Sciences | Agricultural Sciences and Natural Resources | Health Sciences |
|--|-----------|-------------|-----------------------|-------------|------------------------------------|----------------------------|-----------------------------------|---|-----------------|
| <b>Hispanic-Serving Institutions (in the top 20 overall)</b>                 |           |             |                       |             |                                    |                            |                                   |   |                 |
| The University of Texas at Austin  | rank: 11  | rank: 15    |                       | rank: 10    | rank: 12                           | rank: 11                   | rank: 8                           |   | rank: 8         |
| Texas A&M University, College Station  |           |             |                       | rank: 16    | rank: 17                           |                            |                                   | rank: 1                                     |                 |
| University Arizona   |           |             | rank: 8               |             |                                    |                            |                                   |   |                 |
| University of California, Santa Barbara                                      |           | rank: 8     | rank: 18              |             |                                    |                            |                                   |   |                 |
| University of California, Santa Cruz   |           | rank: 16    |                       |             |                                    |                            |                                   |   |                 |
| University of California, Irvine   | rank: 17  |             |                       |             |                                    |                            |                                   |   |                 |
| University of Puerto Rico, Rio Piedras                                       | rank: 18  |             |                       |             |                                    |                            |                                   |   |                 |
| <b>Historically Black Colleges and Universities (in the top 100 overall)</b> |           |             |                       |             |                                    |                            |                                   |   |                 |
| Alabama A&M University   |           |             |                       |             |                                    |                            |                                   | rank: 93                                    |                 |
| Southern University and A&M College, Baton Rouge                             |           |             |                       |             |                                    |                            |                                   | rank: 100                                   |                 |
| Howard University  |           |             |                       |             |                                    |                            |                                   |   | rank: 80        |

SOURCE: National Center for Science and Engineering Statistics, Survey of Earned Doctorates (SED), 2010–2021



HBCUs do not produce the numbers to appear in the top 20 bachelor’s degree–granting institutions for any given STEM field, although three HBCUs appear in the top 100 bachelor’s degree–granting institutions. For example, on a list ranking bachelor’s degree–granting institutions that produced the most students who went on to earn PhDs in Health, Howard University (ranked 80) was the only HBCU in the top 100.

## CHARACTERISTICS OF DOCTORAL DEGREE–GRANTING INSTITUTIONS

In measuring institution control of doctoral degree-granting institutions, SED data only differentiate between public and private institutions, grouping private nonprofit and private for-profit institutions into the same category. IPEDS data, however, differentiate between private nonprofit and private for-profit institutions, and the data indicate some substantial differences across racial and ethnic groups. The IPEDS data show that 68% of White STEM<sup>9</sup> PhDs, 64% of Hispanic STEM PhDs, and 60% of Asian STEM PhDs earned their doctorate from a public institution, compared with 50% of Black STEM PhDs (*Exhibit 6*). The differences are even greater in private for-profit institutions, with 24% of Black STEM PhDs earning their doctorate from a private for-profit institution, compared to just 3% each of Asian, Hispanic, and White STEM PhDs.

### EXHIBIT 6

Control of Doctoral Degree–Granting Institution Among STEM PhD Recipients Who Are U.S. Citizens or Permanent Residents, by Race and Ethnicity: 2021–22 IPEDS

| Race/ Ethnicity | Total  |      | Public |       | Private, Nonprofit |       | Private, For-Profit |       |
|-----------------|--------|------|--------|-------|--------------------|-------|---------------------|-------|
|                 | #      | %    | #      | %     | #                  | %     | #                   | %     |
| Asian           | 2,754  | 100% | 1,652  | 60.0% | 1,026              | 37.3% | 76                  | 2.8%  |
| Black           | 1,938  | 100% | 977    | 50.4% | 505                | 26.1% | 456                 | 23.5% |
| Hispanic        | 2,121  | 100% | 1,359  | 64.1% | 694                | 32.7% | 68                  | 3.2%  |
| White           | 15,822 | 100% | 10,713 | 67.7% | 4,670              | 29.5% | 439                 | 2.8%  |

**SOURCE:** U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), 2021–22.

The Carnegie Classification of the institutions where PhDs earned their degree also differed across racial and ethnic groups (*Exhibit 7*). Note that Exhibit 7 includes all PhDs in the SED data, not only STEM PhDs, due to suppression rules related to sample sizes. According to SED data, 81% of Asian PhD recipients, 77% of White PhDs, and 73% of Hispanic PhDs completed their doctorate at a highest research activity institution, compared with 53% of Black PhDs. A greater share of Black PhDs earned their doctorate from a moderate research activity institution than did their Hispanic, White, and Asian counterparts (19% vs. 6%, 4%, and 2%, respectively).

### EXHIBIT 7

Carnegie Classification of Doctoral Degree–Granting Institution Among PhD Recipients Who Are U.S. Citizens or Permanent Residents, by Race and Ethnicity: 2021 SED

| Race/ Ethnicity | Total  |      | Doctoral Universities: Highest Research Activity |       | Doctoral Universities: Higher Research Activity |       | Doctoral Universities: Moderate Research Activity |       | Other |      |
|-----------------|--------|------|--|-------|---|-------|---|-------|-------|------|
|                 | #      | %    | #  | %     | #   | %     | #   | %     | #     | %    |
| Asian           | 3,314  | 100% | 2,688  | 81.1% | 378   | 11.4% | 66  | 2.0%  | 181   | 5.5% |
| Black           | 2,716  | 100% | 1,433  | 52.8% | 555   | 20.4% | 515   | 19.0% | 213   | 7.8% |
| Hispanic        | 3,030  | 100% | 2,218  | 73.2% | 426   | 14.1% | 177   | 5.8%  | 209   | 6.9% |
| White           | 23,152 | 100% | 17,889   | 77.3% | 3,307   | 14.3% | 903   | 3.9%  | 1,054 | 4.6% |

**SOURCE:** National Center for Science and Engineering Statistics, Restricted Data Analysis System (RDAS), Survey of Earned Doctorates (SED), 2021.

<sup>9</sup> In the IPEDS data, those who earned a research doctorate in the Agriculture, Agriculture Operations and Related Sciences, Natural Resources and Conservation, Computer and Information Sciences and Support Services, Engineering, Engineering Technologies and Engineering-related Fields, Biological and Biomedical Sciences, Mathematics and Statistics, Military Technologies and Applied Sciences, Physical Sciences, Science Technologies/Technicians, and Health Professions and Related Programs were classified as STEM PhD recipients.

Similar to the previous discussion on bachelor’s degree–granting institutions, when discussing types of doctoral degree–granting institutions students attend, it is important to consider the role of minority-serving institutions. The IPEDS data enable us to explore minority-serving doctoral degree–granting institutions that STEM PhDs are most likely to attend. Between 2017 and 2021, approximately 144,000 STEM PhDs were awarded at Title IV degree-granting institutions in the United States. Among these PhDs, approximately 0.6% (840) were earned from an HBCU, and approximately 11.5% (16,600) were earned from an HSI.

Several HSIs granted doctoral degrees to large numbers of individuals in STEM, although the specific schools varied by field. Six HSIs were among the top 20 doctoral degree–granting institutions overall over the past 5 years. Their rankings by STEM field are shown in *Exhibit 8*. For example, the top 11 doctoral-granting institutions for PhDs in Mathematics and Statistics between 2017 and 2021 were all non-HSIs. The HSI that produced the most PhDs in Mathematics and Statistics was Texas A&M University, College Station (ranked 12 overall). No other HSI was in the top 20 overall for PhDs in Mathematics and Statistics.

## EXHIBIT 8

HSIs Awarding the Most STEM PhDs, by Rank and STEM Field of Study: 2017–2021 IPEDS

| Institution  | Computer and Information Sciences | Engineering | Biological and Biomedical Sciences | Mathematics and Statistics | Physical Sciences |
|--|-----------------------------------|-------------|------------------------------------|----------------------------|-------------------|
| <b>Hispanic-Serving Institutions (in the top 20 overall)</b> |                                   |             |                                    |                            |                   |
| Nova Southeastern University                                 | rank: 8                           |             |                                    |                            |                   |
| University of California, Irvine                             | rank: 12                          |             |                                    |                            | rank: 20          |
| Texas A&M University, College Station                        |                                   | rank: 5     | rank: 18                           | rank: 12                   | rank: 10          |
| The University of Texas at Austin                            |                                   | rank: 8     |                                    |                            | rank: 8           |
| University of Arizona  |                                   |             |                                    |                            | rank: 15          |
| University of California, Santa Barbara                      |                                   |             |                                    |                            | rank: 17          |

**SOURCE:** U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Data System (IPEDS), 2017–2021.

HBCUs also award PhDs in STEM, but they do not produce the numbers to appear in the top 20, or even the top 100, institutions for any given STEM field. Between 2017 and 2021, HBCUs that produced the most STEM PhDs by field were as follows: Howard University and North Carolina A&T State University produced the most Computer and Information Sciences PhDs (14 at each school); North Carolina A&T State University also produced the most Engineering PhDs (141). Howard University produced the most Biological and Biomedical Sciences PhDs (61) and the most Mathematics and Statistics PhDs (15). Jackson State University produced the most Physical Sciences PhDs (25).

## EDUCATIONAL PATHWAYS AND EXPERIENCES

We also compared Black and Hispanic STEM PhD recipients with their counterparts on various postsecondary education pathways and experiences. In this section, we explore time-to-doctoral-degree completion, community college attendance, number of institutions attended before attaining a bachelor’s degree, whether the bachelor’s degree–granting institution was out of state, whether doctoral degree recipients applied to graduate school before completing their bachelor’s degree, and whether the doctoral program was entirely online.

One measure of time-to-degree is the number of years between bachelor’s degree completion and PhD completion. The SED data indicate that the number of years between completion of bachelor’s and doctoral degrees varied across racial and ethnic groups, with Black STEM PhDs completing their doctorate later than their Hispanic, White, and Asian counterparts (*Exhibit 9*). Some 70% of Hispanic STEM PhDs, 68% of White STEM PhDs, and 65% of Asian STEM PhDs earned their doctorate within 10 years of completing their bachelor’s degree, compared with only 42% of Black STEM PhDs.

**EXHIBIT 9**

Number of Years Between Completion of Bachelor’s and Doctoral Degrees Among STEM PhD Recipients Who Are U.S. Citizens or Permanent Residents, by Race and Ethnicity: 2021 SED

| Race/ Ethnicity | Total  |        | 10 Years or Fewer Between Bachelor’s and Doctoral Degree Completion |       | More Than 10 Years Between Bachelor’s and Doctoral Degree Completion |       |
|-----------------|--------|--------|---|-------|--|-------|
|                 | #      | %      | #   | %     | #  | %     |
| Asian           | 2,249  | 100.0% | 1,456   | 64.7% | 794  | 35.3% |
| Black           | 946    | 100.0% | 401   | 42.4% | 545  | 57.6% |
| Hispanic        | 1,520  | 100.0% | 1,067   | 70.2% | 453  | 29.8% |
| White           | 12,736 | 100.0% | 8,654   | 67.9% | 4,082  | 32.1% |

**SOURCE:** National Center for Science and Engineering Statistics, Restricted Data Analysis System (RDAS), Survey of Earned Doctorates (SED), 2021.

Another measure of time-to-degree is the elapsed time in the doctoral program itself. The SED data indicate that, in addition to Black STEM PhDs taking longer between completion of bachelor’s and doctoral degrees than their White, Asian, and Hispanic counterparts, they also take longer to complete their degrees, once they begin their doctoral program (*Exhibit 10*). Some 15% of Black STEM PhDs took more than 8 years to complete their degrees, compared with 10%, 9%, and 8% of Asian, Hispanic, and White STEM PhDs, respectively. Interestingly, the proportion of STEM PhDs who completed their doctorate in 5 or fewer years was similar across racial and ethnic groups. Some 40% of White STEM PhDs, 39% of Black STEM PhDs, 36% of Asian STEM PhDs, and 35% of Hispanic STEM PhDs completed their degree in 5 or fewer years. This indicates that the difference in completion times is primarily driven by different proportions of STEM PhDs in the 6- to 8-year completion period compared with the more-than-8-year completion period.

**EXHIBIT 10**

Total Elapsed Time in Doctoral Program Among STEM and Non-STEM PhD Recipients Who Are U.S. Citizens or Permanent Residents, by Race and Ethnicity and PhD Field: 2021 SED

| Race/ Ethnicity | Total  |        | < 5 years |       | 6–8 years |       | > 8 years |       |
|-----------------|--------|--------|-----------|-------|-----------|-------|-----------|-------|
|                 | #      | %      | #         | %     | #         | %     | #         | %     |
| <b>STEM</b>     |        |        |           |       |           |       |           |       |
| Asian           | 2,249  | 100.0% | 810       | 36.0% | 1,225     | 54.5% | 214       | 9.5%  |
| Black           | 946    | 100.0% | 369       | 39.0% | 436       | 46.1% | 142       | 15.0% |
| Hispanic        | 1,520  | 100.0% | 533       | 35.0% | 850       | 55.9% | 137       | 9.0%  |
| White           | 12,736 | 100.0% | 5,054     | 39.7% | 6,707     | 52.7% | 975       | 7.7%  |
| <b>Non-STEM</b> |        |        |           |       |           |       |           |       |
| Asian           | 890    | 100.0% | 242       | 27.2% | 452       | 50.8% | 196       | 22.0% |
| Black           | 1,416  | 100.0% | 508       | 35.9% | 576       | 40.7% | 332       | 23.4% |
| Hispanic        | 1,386  | 100.0% | 419       | 30.2% | 712       | 51.4% | 255       | 18.4% |
| White           | 9,365  | 100.0% | 2,899     | 31.0% | 4,669     | 49.9% | 1,797     | 19.2% |

**SOURCE:** National Center for Science and Engineering Statistics, Restricted Data Analysis System (RDAS), Survey of Earned Doctorates (SED), 2021.

To understand whether these differences in time-in-doctoral-program are specific to STEM PhDs, we also examined time-in-doctoral-program for non-STEM PhDs (*Exhibit 10*). For non-STEM PhDs, differences across racial and ethnic groups were much smaller. Some 23% of Black non-STEM PhDs took more than 8 years to complete their degrees, compared with 22%, 19%, and 18% of their Asian, White, and Hispanic counterparts, respectively.

The length of time it takes to complete a doctoral degree likely varies due to several contributing factors. Longer durations until doctoral degree completion may reflect a need to work after undergraduate studies and during graduate studies, pursuing a master's degree before doctoral enrollment, pursuing a doctoral degree in a field other than one's bachelor's field, or having other competing family obligations during graduate enrollment. Delaying PhD attainment ultimately reduces the amount of time in the workforce as a PhD holder, which minimizes the employment benefits of completing a PhD. Several factors that may contribute to time-to-degree are shown in *Exhibit 11*. Note that Exhibit 11 is for all PhDs in the SED data, not just STEM PhDs, due to suppression rules related to sample sizes.

**EXHIBIT 11**  
Factors That Contribute to Time-to-Degree, by Race and Ethnicity: 2021 SED

| Race/ Ethnicity | Total  |        | Primary Source of Support Was Own Resources |       | Earned a Master's Degree at Non-Doctoral Degree Institution |       | Bachelor's Degree in Same Field as Doctorate |       | Has Dependent < 18 Years Old |       |
|-----------------|--------|--------|---|-------|---|-------|--|-------|------------------------------|-------|
|                 | #      | %      | #   | %     | #   | %     | #  | %     | #                            | %     |
| Asian           | 3,022  | 100.0% | 405   | 13.4% | 1,034   | 34.2% | 1,831  | 60.6% | 635                          | 21.0% |
| Black           | 2,431  | 100.0% | 1,077                                       | 44.3% | 1,279   | 52.6% | 1,123  | 46.2% | 795                          | 32.7% |
| Hispanic        | 2,856  | 100.0% | 663   | 23.2% | 969   | 33.9% | 1,745  | 61.1% | 648                          | 22.7% |
| White           | 21,333 | 100.0% | 4,181                                       | 19.6% | 7,265   | 34.1% | 13,589                                       | 63.7% | 4,693                        | 22.0% |

**SOURCE:** National Center for Science and Engineering Statistics, Survey of Earned Doctorates (SED), 2021.

A measure of students' need to work before or during a doctoral program to support their studies is whether their primary source of support while enrolled was their own resources or various types of financial aid or assistance. Some 44% of Black PhD students were primarily supported by their own resources (i.e., loans, savings, earnings, and family support), compared with just 23%, 20%, and 13% of Hispanic, White, and Asian PhD students, respectively. The larger percentage of Black PhD students supported primarily by their own resources suggests that Black PhD students may be more likely to work before or during their doctoral enrollment or need to borrow more student loans while enrolled (which is explored below).

Another important factor related to time-to-degree is whether students attained a separate graduate degree before beginning their doctoral program. Some students earn a master's degree as part of their terminal PhD program, whereas others attend a separate master's program before enrolling in a doctoral program. Enrolling in a separate master's program before doctoral enrollment can increase graduate school costs and time-to-doctoral-degree completion. The SED data show large differences among all PhD earners in whether master's degrees are earned at nondoctoral degree-granting institutions. Some 53% of Black PhDs earned a master's degree at an institution other than their doctoral degree-granting institution, compared with just 34% each of Asian, White, and Hispanic PhDs. The higher percentage of Black PhDs having earned a master's degree at a different institution may be due to a tendency for Black undergraduates to be advised into a master's program instead of a doctoral program to begin their graduate education.

Another time-to-degree factor is whether individuals changed fields of study between their undergraduate and doctoral education. Getting a doctorate in a field other than their bachelor's degree field increases the likelihood that students need additional coursework in their doctoral field of study. The SED data show that Black PhD recipients were less likely than their White, Asian, and Hispanic counterparts to earn a doctorate in the same field as their bachelor's degree. Some 46% of Black PhDs earned their bachelor's degree and doctorate in the same field of study, compared with 64% of White PhDs and 61% of both Asian and Hispanic PhDs. Possible explanations for this pattern could include Black undergraduates receiving less guidance or exposure to possible fields of study before choosing one or Black PhDs taking longer between bachelor's and doctoral degree completion, which, if due to time in the labor market, could cause Black students to change fields based on this labor market experience.

A final factor that may contribute to time-to-degree is whether students have dependents. The SED data indicate that Black PhDs were more likely to care for dependents while enrolled than their Hispanic, White, and Asian counterparts. Some 33% of Black PhDs had dependents, compared with just 23%, 22%, and 21% of Hispanic, White, and Asian PhDs, respectively.



Individuals often have different pathways through their undergraduate education. For example, they may vary in whether they attend a community college and how many institutions they attend before completing their bachelor’s degree. Among STEM PhDs in the SED data, community college attendance<sup>10</sup> varied slightly across racial and ethnic groups (*Exhibit 12*). Asian STEM PhDs were less likely to have attended a community college at some time during their educational career (20%) than their Black (29%), White (30%), and Hispanic (33%) counterparts.

**EXHIBIT 12**

Community College Attendance Among STEM PhD Recipients Who Are U.S. Citizens or Permanent Residents, by Race and Ethnicity: 2021 SED

| Race/ Ethnicity | Total  |        | Attended Community College |       | Did Not Attend Community College |       |
|-----------------|--------|--------|----------------------------|-------|----------------------------------|-------|
|                 | #      | %      | #                          | %     | #                                | %     |
| Asian           | 2,249  | 100.0% | 440                        | 19.6% | 1,809                            | 80.4% |
| Black           | 946    | 100.0% | 275                        | 29.0% | 671                              | 71.0% |
| Hispanic        | 1,520  | 100.0% | 508                        | 33.4% | 1,012                            | 66.6% |
| White           | 12,736 | 100.0% | 3,843                      | 30.2% | 8,892                            | 69.8% |

**SOURCE:** National Center for Science and Engineering Statistics, Restricted Data Analysis System (RDAS), Survey of Earned Doctorates (SED), 2021.

Greater differences were observed in the number of institutions attended before earning a bachelor’s degree across racial and ethnic groups (*Exhibit 13*). According to B&B:08/18 data, Black or Hispanic STEM PhDs were more likely than their White counterparts to attend a single institution before completing their bachelor’s degree (78% vs. 62%). Interestingly, Black or Hispanic STEM PhDs were also more likely than their White counterparts to attend three or more institutions (14% vs. 8%). White STEM PhDs were more likely than Black or Hispanic STEM PhDs to attend two institutions before completing their bachelor’s degree (30% vs. 8%).

**EXHIBIT 13**

Number of Institutions Attended Before Bachelor’s Degree Completion Among STEM PhD Recipients: B&B:08/18

| Race/Ethnicity    | 1     | 2     | 3+    |
|-------------------|-------|-------|-------|
| Black or Hispanic | 78.3% | 7.6%  | 14.1% |
| White             | 62.0% | 30.3% | 7.8%  |

**NOTE:** Some estimates in this table, especially in the Black or Hispanic row, have large standard errors due to small samples sizes and should be viewed with caution.

**SOURCE:** U.S. Department of Education, National Center for Education Statistics, Baccalaureate and Beyond: 2008/2018 (B&B:08/18).

Earning a bachelor’s degree at an out-of-state institution may affect an individual’s undergraduate experience in several ways. Out-of-state institutions are typically more expensive than in-state institutions, and attending an out-of-state school likely means that family and friends are farther away. According to B&B:08/18 data, Black or Hispanic STEM PhDs were more likely than White STEM PhDs to earn their bachelor’s degree at an out-of-state school (40% vs. 33%) (*Exhibit 14*).

<sup>10</sup> SED asks respondents, “Did you earn college credit from a community or two-year college?”

**EXHIBIT 14**

Whether Bachelor's Degree Was Earned from an In- or Out-of-State Institution Among STEM PhD Recipients: B&amp;B:08/18

| Race/Ethnicity    | In-State | Out-of-State |
|-------------------|----------|--------------|
| Black or Hispanic | 60.0%    | 40.0%        |
| White             | 67.5%    | 32.5%        |

**NOTE:** Some estimates in this table, especially in the Black or Hispanic row, have large standard errors due to small samples sizes and should be viewed with caution.**SOURCE:** U.S. Department of Education, National Center for Education Statistics, Baccalaureate and Beyond: 2008/2018 (B&B:08/18).

Applying to graduate school in the senior year of one's undergraduate education signals an early interest in pursuing graduate education and decreases the time before an individual enters the workforce with a graduate degree. The B&B:08/18 data indicate that White STEM PhDs were significantly more likely to apply to graduate school in their senior year of college, compared with their Black or Hispanic counterparts (*Exhibit 15*). Some 72% of White STEM PhDs applied to graduate school before completing their bachelor's degree, compared with only 31% of Black or Hispanic STEM PhDs.

**EXHIBIT 15**

Whether STEM PhD Recipients Applied to Graduate School Before Bachelor's Degree Completion: B&amp;B:08/18

| Race/Ethnicity    | Did Not Apply to Graduate School Before Completing Bachelor's Degree | Applied to Graduate School Before Completing Bachelor's Degree |
|-------------------|--|--|
| Black or Hispanic | 68.9%  | 31.1%  |
| White             | 27.6%  | 72.4%  |

**NOTE:** Some estimates in this table, especially in the Black or Hispanic row, have large standard errors due to small samples sizes and should be viewed with caution.**SOURCE:** U.S. Department of Education, National Center for Education Statistics, Baccalaureate and Beyond: 2008/2018 (B&B:08/18).

Although only a small share of STEM PhD programs are entirely online, the proportion of White STEM PhDs whose doctoral program was entirely online was 6 times higher than the proportion of Black or Hispanic STEM PhDs (*Exhibit 16*). Some 3.9% of White STEM PhDs earned their doctorate in a program that was completely online, compared with 0.6% of their Black or Hispanic counterparts.

**EXHIBIT 16**

Whether Doctoral Program Was Entirely Online Among STEM PhD Recipients: B&amp;B:08/18

| Race/Ethnicity    | PhD Program Was Not Entirely Online | PhD Program Was Entirely Online |
|-------------------|-------------------------------------|---------------------------------|
| Black or Hispanic | 99.4%                               | 0.6%                            |
| White             | 96.1%                               | 3.9%                            |

**NOTE:** Some estimates in this table, especially in the Black or Hispanic row, have large standard errors due to small samples sizes and should be viewed with caution.**SOURCE:** U.S. Department of Education, National Center for Education Statistics, Baccalaureate and Beyond: 2008/2018 (B&B:08/18).

## SOURCE OF FINANCIAL SUPPORT FOR GRADUATE EDUCATION

The amount of debt incurred by postsecondary students in the United States is an ongoing concern, as this debt can be a substantial burden on recent graduates to repay. Debt accumulation can be a particular concern for graduate education, as graduate programs, especially doctoral programs, can be expensive and lengthy to complete.

Doctoral programs offer several ways to receive financial support to reduce the out-of-pocket cost of the degree. Grants and scholarships are typically monetary gifts students receive to offset the cost of their doctoral studies. Assistantships and fellowships often include monetary compensation and tuition waivers that are tied to students working, teaching, or conducting research. Employer assistance is when employers contribute to tuition costs of their employees attending school to earn additional credentials.

The B&B:08/18 data indicate that Black or Hispanic STEM PhDs were more likely than their White counterparts to receive grant and scholarship aid (99% vs. 76%) but less likely to receive other types of financial support (*Exhibit 17*). Some 95% of White STEM PhDs received assistantships or fellowships, compared with 64% of their Black or Hispanic counterparts. Similarly, 9% of White STEM PhDs received employer assistance, compared with 5% of their Black or Hispanic counterparts. One explanation for the lower rates of assistantships and fellowships among Black or Hispanic STEM PhDs is the fact that Black STEM PhDs are considerably more likely to attend for-profit institutions, and for-profit institutions have significantly fewer assistantships and fellowships.<sup>11</sup>

### EXHIBIT 17

Types of Financial Support Received in Doctoral Program Among STEM PhD Recipients: B&B:08/18

| Race/Ethnicity    | Received Grants or Scholarships in PhD Program | Received Assistantships or Fellowships in PhD Program | Received Employer Assistance in PhD Program |
|-------------------|--|---|---|
| Black or Hispanic | 99.2%  | 64.3%   | 4.6%  |
| White             | 76.4%  | 94.9%   | 8.6%  |

**NOTE:** All types of financial support are included in each category, regardless of source of support (e.g., institution, state, federal). Some estimates in this table, especially in the Black or Hispanic row, have large standard errors due to small samples sizes and should be viewed with caution.

**SOURCE:** U.S. Department of Education, National Center for Education Statistics, Baccalaureate and Beyond: 2008/2018 (B&B:08/18).

Racial and ethnic disparities are also apparent with respect to graduate debt (*Exhibit 18*). The B&B:08/18 data indicate that 81% of Black or Hispanic STEM PhDs borrowed more than \$40,000 in federal loans for their graduate education, compared with only 6% of White STEM PhDs. White STEM PhDs were considerably more likely than their Black or Hispanic counterparts to not accumulate any federal graduate debt (79% vs. 13%) and to accumulate less than \$40,000 in federal graduate debt (15% vs. 6%). Note these data include all borrowing toward a graduate education, so they may include borrowing for master's degrees earned before doctoral program enrollment.

### EXHIBIT 18

Amount Borrowed for Graduate Education in Federal Loans Among STEM PhD Recipients: B&B:08/18

| Race/Ethnicity    | \$0   | \$1–\$40,000 | > \$40,000 |
|-------------------|-------|--------------|------------|
| Black or Hispanic | 12.9% | 6.3%         | 80.8%      |
| White             | 78.8% | 15.1%        | 6.1%       |

**NOTE:** Some estimates in this table, especially in the Black or Hispanic row, have large standard errors due to small samples sizes and should be viewed with caution.

**SOURCE:** U.S. Department of Education, National Center for Education Statistics, Baccalaureate and Beyond: 2008/2018 (B&B:08/18).

<sup>11</sup> For example, the National Postsecondary Student Aid Study:2020 (NPSAS:20) indicates that, among all research doctoral students, the percentage of students who received an assistantship was 50% at public institutions, 31% at private nonprofit institutions, and less than 1% at private for-profit institutions. Similarly, the NPSAS:20 data indicate that, among all research doctoral students, the percentage of students who received a fellowship was 31% at public institutions, 35% at private nonprofit institutions, and 6% at private for-profit institutions.

The fact that Black STEM PhD students borrow more for their graduate education may be driven by a number of factors. First, Black STEM PhD students are more likely to earn their doctorates from private for-profit institutions. Black PhDs are also more likely to earn their doctorates from moderate research activity doctoral institutions, which generally have less funding for students than high and highest research activity institutions. For example, SED data on all PhDs indicate that just 4% of all doctoral recipients earned their doctoral degree at a moderate research activity institution, but 21% of all students with \$80,000 or more in graduate debt earned their doctorate at a moderate research activity institution.<sup>12</sup> Second, it takes Black STEM PhDs longer to complete their doctoral degree on average, which means the total cost of the degree is likely higher. Black STEM PhDs are also more likely to earn a master's degree before doctoral enrollment, which adds the cost of paying for a separate graduate degree. Additionally, Black and Hispanic STEM PhDs are less likely than their White counterparts to receive assistantships or fellowships and employer assistance, which also may explain why they borrow larger amounts.

Such large differences in borrowing for Black and Hispanic students for their doctoral education warrant investigating whether these trends are unique to STEM PhDs or hold for all PhDs, regardless of field. SED data show large racial and ethnic disparities with respect to graduate debt among all PhD recipients (*Exhibit 19*).<sup>13</sup> The racial and ethnic patterns found for STEM PhDs are largely replicated when exploring PhDs students across all fields.

Nearly half (49%) of Black PhDs and 24% of Hispanic PhDs borrowed more than \$50,000 for their graduate education, compared with only 15% of White PhDs and 8% of Asian PhDs. Asian PhDs were considerably more likely than their White, Hispanic, or Black counterparts to accumulate no graduate debt (81% vs. 68%, 55%, and 29%, respectively). Note that these data include all borrowing toward a graduate education, so they may include borrowing for master's degrees earned before doctoral program enrollment.

#### EXHIBIT 19

Graduate Debt Among PhD Recipients Who Are U.S. Citizens or Permanent Residents, by Race and Ethnicity: 2021 SED

| Race/ Ethnicity | Total  |      | None   |       | \$50,000 or less |       | \$50,001 or more |       |
|-----------------|--------|------|--------|-------|------------------|-------|------------------|-------|
|                 | #      | %    | #      | %     | #                | %     | #                | %     |
| Asian           | 3,314  | 100% | 2,697  | 81.4% | 352              | 10.6% | 266              | 8.0%  |
| Black           | 2,716  | 100% | 782    | 28.8% | 596              | 21.9% | 1338             | 49.3% |
| Hispanic        | 3,030  | 100% | 1,661  | 54.8% | 649              | 21.4% | 718              | 23.7% |
| White           | 23,152 | 100% | 15,776 | 68.1% | 3897             | 16.8% | 3479             | 15.0% |

**SOURCE:** National Center for Science and Engineering Statistics, Restricted Data Analysis System (RDAS), Survey of Earned Doctorates (SED), 2021.

Like the patterns seen in the amount borrowed, use of different types of financial support among STEM PhDs was also similar to all PhDs. For all PhD fields, the SED data indicate that the primary source of support during graduate school for 48% of Black PhDs was their own resources (e.g., loans, savings, earnings, family support), compared with 24% of Hispanic PhDs, 21% of White PhDs, and 15% of Asian PhDs (*Exhibit 20*). Only 21% of Black PhDs reported teaching or research assistantships as their main source of support, compared with 49% of Asian PhDs, 48% of White PhDs, and 37% of Hispanic PhDs. A greater proportion of Hispanic PhDs (35%) and Asian PhDs (33%) reported fellowships, grants, or internships as their primary source of support than did White PhDs (26%) and Black PhDs (25%). Few PhDs named their employer as the primary source of support, but Black PhDs did so slightly more often (6%) than their White, Hispanic, and Asian counterparts (5%, 3%, and 3%, respectively). This is the one pattern among STEM PhDs that is not found when looking at all PhDs (Black and Hispanic STEM PhDs were less likely to get employer support than their White counterparts; see *Exhibit 17*).

<sup>12</sup> The source of this statistic is the National Center for Science and Engineering Statistics, Restricted Data Analysis System (RDAS), Survey of Earned Doctorates (SED), 2021

<sup>13</sup> It is not possible to limit the SED tables on financial support in graduate school (Exhibits 19–21) to just STEM PhDs; due to small sample sizes, the results are suppressed.



**EXHIBIT 20**

Primary Source of Support Among PhD Recipients Who Are U.S. Citizens or Permanent Residents, by Race and Ethnicity: 2021 SED

| Race/Ethnicity | Total  |      | Teaching/Research Assistantships |       | Fellowships/Grants/ Internships/Other Assistantships |       | Own Resources (Loans, Savings, Earnings, Family Support) |       | Employer or other |      |
|----------------|--------|------|----------------------------------|-------|--|-------|--|-------|-------------------|------|
|                | #      | %    | #                                | %     | #  | %     | #  | %     | #                 | %    |
| Asian          | 3,314  | 100% | 1,635                            | 49.3% | 1,098  | 33.1% | 485  | 14.6% | 96                | 2.9% |
| Black          | 2,716  | 100% | 563                              | 20.7% | 677  | 24.9% | 1,305  | 48.0% | 171               | 6.3% |
| Hispanic       | 3,030  | 100% | 1,129                            | 37.3% | 1,070  | 35.3% | 728  | 24.0% | 103               | 3.4% |
| White          | 23,152 | 100% | 11,145                           | 48.1% | 6,092  | 26.3% | 4,793  | 20.7% | 1,123             | 4.9% |

**NOTE:** In contrast to Exhibit 17 with B&B:08/18 data, which shows types of financial support, this table shows the primary support that students used (i.e., students were only able to select one type of support). All types of financial support are included in each category, regardless of source of support (e.g., institution, state, federal). "Teaching/research assistantships" includes teaching assistantships, research assistantships, and traineeships. "Fellowships/grants/ internships/ other assistantships" includes fellowships, scholarships, dissertation grants, assistantships other than teaching and research, internships, and clinical residency. "Own resources" includes loans from any source; personal savings; personal earnings during graduate school; and spouse's, partner's, or family's earnings or savings. "Employer or other" includes employer reimbursement/assistance, foreign (non-U.S.) support, and other support not listed.

**SOURCE:** National Center for Science and Engineering Statistics, Restricted Data Analysis System (RDAS), Survey of Earned Doctorates (SED), 2021.

As mentioned earlier, assistantships and fellowships often include tuition waivers. A tuition waiver means that the student is not responsible for paying the cost of their tuition. Given that fewer Black PhDs reported assistantships and fellowships as their primary source of support, it should not be surprising that a larger share of Black PhDs reported receiving no tuition remission during graduate school, compared with their Hispanic, White, and Asian PhD counterparts (35% vs. 20%, 16%, and 15%, respectively) (**Exhibit 21**). Some 70% of Asian PhDs and 68% of White PhDs reported receiving full tuition waivers, compared with 61% of Hispanic PhDs and 41% of Black PhDs.

**EXHIBIT 21**

Tuition Remission Among PhD Recipients Who Are U.S. Citizens or Permanent Residents, by Race and Ethnicity: 2021 SED

| Race/ Ethnicity | Total  |      | No Tuition Remission |       | Some Tuition Remission |       | Full Remission |       |
|-----------------|--------|------|----------------------|-------|------------------------|-------|----------------|-------|
|                 | #      | %    | #                    | %     | #                      | %     | #              | %     |
| Asian           | 3,314  | 100% | 490                  | 14.8% | 511                    | 15.4% | 2,313          | 69.8% |
| Black           | 2,716  | 100% | 962                  | 35.4% | 642                    | 23.6% | 1,112          | 40.9% |
| Hispanic        | 3,030  | 100% | 609                  | 20.1% | 567                    | 18.7% | 1,854          | 61.2% |
| White           | 23,152 | 100% | 3,635                | 15.7% | 3,781                  | 16.3% | 15,736         | 68.0% |

**SOURCE:** National Center for Science and Engineering Statistics, Restricted Data Analysis System (RDAS), Survey of Earned Doctorates (SED), 2021.



## DISCUSSION AND CONCLUSIONS

Overall, Black, and to some extent Hispanic, students have very different experiences than their White and Asian counterparts when earning PhDs in STEM fields. Black and Hispanic STEM PhDs attend different types of bachelor's degree-granting institutions. Black STEM PhDs are less likely than their counterparts to attend a doctoral degree-granting institution when earning their bachelor's degree. Additionally, Black or Hispanic STEM PhDs are more likely than White STEM PhDs to have earned their bachelor's degree from a small bachelor's degree-granting institution (5,000 students or less).

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Black or Hispanic STEM PhDs borrow significantly more for their graduate education than their White counterparts.

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Black STEM PhDs also earn their doctoral degrees from different types of institutions. Black STEM PhDs are considerably more likely than their counterparts to earn their doctorate from a private for-profit institution. Black PhDs are also more likely to earn their doctorate from a moderate research activity institution, compared to a highest research activity institution, where their counterparts are more likely to attend.

The educational pathways and experiences of Black STEM PhDs also vary from those of their counterparts. Black STEM PhDs experience more elapsed time from bachelor's degree completion to doctoral degree completion as well as more time in the doctoral program itself. Some possible explanations for these time-to-degree differences include the fact that Black PhDs are (a) more likely to use their own resources as their primary source of support during their doctoral training (indicating that they may need to work more), (b) more likely to have earned a master's degree before doctoral enrollment, (c) less likely to have a doctoral degree in the same field as their bachelor's degree, and (d) more likely to have dependents while enrolled in their doctoral program. Interestingly, the time-to-degree differences for Black PhDs relative to their Asian, Hispanic, and White counterparts across all fields are not nearly as large as they are for STEM PhDs, specifically.

Educational experiences of Black and Hispanic STEM PhDs vary in other ways from those of their counterparts. Black or Hispanic STEM PhDs are more likely to earn their bachelor's degree from an out-of-state school, less likely to apply to graduate school in their senior year of their bachelor's program, and less likely to attend a doctoral program entirely online.

Finally, Black and Hispanic STEM PhDs differ from their counterparts in how they finance their doctoral studies. Black or Hispanic STEM PhDs borrow significantly more for their graduate education than their White counterparts. A possible reason for this increased borrowing among Black STEM PhDs is that they are more likely to attend private for-profit doctoral-granting institutions and moderate research activity doctoral-granting institutions (which generally have less funding for students). Black STEM PhDs also take longer to earn the doctoral degree and are more likely to earn a master's degree from an institution other than their doctoral-granting institution, both of which add to graduate school costs. Black or Hispanic STEM PhDs are also less likely than their counterparts to receive assistantships or fellowships and employer assistance, although they are more likely to receive grants or scholarships. Interestingly, these large differences in amount borrowed for graduate school for Black, and to some extent Hispanic, PhDs can be found across all fields, not just in STEM fields specifically.

This research also shows that HSIs, and to a lesser extent HBCUs, serve an important role as bachelor's degree-granting institutions of future STEM PhDs and as doctoral degree-granting institutions for STEM PhDs. For both HSIs and HBCUs, several specific institutions are most likely to serve as bachelor's degree-granting or doctoral degree-granting institutions for STEM PhDs.

Taken together, this research indicates that significant work remains to be done in supporting Black and Hispanic STEM PhDs and encouraging additional students of color to earn doctorates in STEM. Certain types of institutions are more likely to be bachelor's degree-granting institutions for STEM PhDs, and much of the work supporting future STEM PhDs could be done at these institutions. Additionally, Black STEM PhDs face specific challenges that add to degree costs and time-to-degree that should also be investigated further to understand how best to support Black STEM PhD students.



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