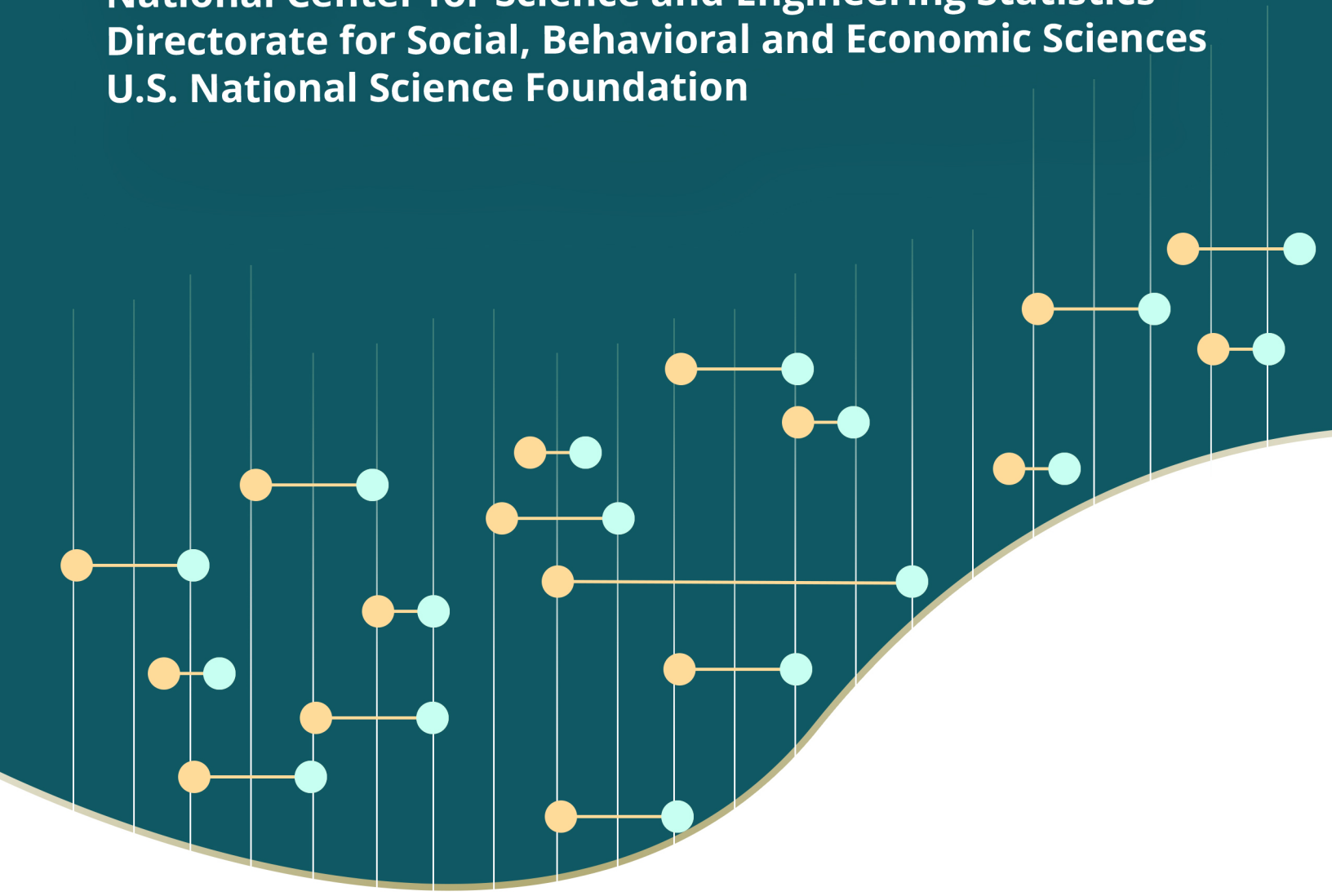
2023
Doctorate Recipients from U.S. Universities

National Center for Science and Engineering Statistics
Directorate for Social, Behavioral and Economic Sciences
U.S. National Science Foundation



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SED
Survey of Earned Doctorates

About this report

The Survey of Earned Doctorates (SED), the data source for this report, is an annual census of individuals who earn research doctoral degrees from accredited U.S. academic institutions. The survey is sponsored by the National Center for Science and Engineering Statistics (NCSES) within the U.S. National Science Foundation and by three other federal agencies: the National Institutes of Health, the Department of Education, and the National Endowment for the Humanities.

Monitoring the number of degrees awarded in science and engineering fields is an important part of the mission of NCSES, the nation's leading provider of statistical data on the U.S. science and engineering enterprise. The data from the SED are reported in several publications. The most comprehensive and widely cited publication is this summary report, *Doctorate Recipients from U.S. Universities.* This report calls attention to major trends in doctoral education and is organized into three themes that highlight important questions about doctorate recipients. Online, the reader is invited to explore trends in greater depth through detailed data tables and interactive graphics (**https://ncses.nsf.gov/sed/**). Technical notes and related resources are provided to aid in interpreting the data, and the report's content is available for downloading. The SED data are also available via an interactive data tool (**https://ncsesdata.nsf.gov/builder/sed**) and the SED Restricted Data Analysis System (**https://ncsesdata.nsf.gov/rdas**).

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Executive summary

Doctoral education trains scientists, engineers, researchers, and scholars, all of whom are critical to the nation's progress. These individuals create and share new knowledge and new ways of thinking that lead, directly and indirectly, to new products, services, and works of art. Annual counts of doctorate recipients from U.S. universities are measures of the incremental investment in human resources devoted to science, engineering, research, and scholarship, and these counts can serve as leading indicators of the capacity for knowledge creation and innovation in various domains.

Changes in the characteristics of this population over time reflect political, economic, social, technological, and demographic trends. These include the following:

- Changes in representation of doctorate recipients in different demographic groups
- Growth in science and engineering (S&E) fields and changes in their relative size
- Shifting academic employment opportunities after graduation
- Trends in the pursuit of postdoctoral research positions by field

Understanding these connections is necessary to inform policy discussions regarding this country's doctoral education system.

The data in this report cover the 2023 academic year (1 July 2022 to 30 June 2023) and were collected from doctorate students who completed the Survey of Earned Doctorates (SED) as they approached graduation.

Key takeaways from the 2023 SED data include the following:

- The number of doctorate recipients from U.S. universities increased from 57,448 in 2022 to 57,862 in 2023. This small increase contrasted with the sharp 1-year increase (10%) in 2022, which followed 2 years of decline due to the COVID-19 pandemic. This suggests that the number of doctorate recipients from U.S. universities may have stabilized following the onset of the pandemic.
- Between 2022 and 2023, the number of U.S. citizen and permanent resident doctorate recipients increased by 1% to 35,566. The number of doctorate recipients who were temporary visa holders decreased by 1% to 19,393 due to a decline in their numbers in S&E fields.
- A higher proportion of doctorate recipients indicated that the pandemic had disrupted their research in 2023 (70%) than in previous years (48% in 2021 and 67% in 2022). Of those who reported that the pandemic had disrupted their research in 2023, 81% indicated that the disruptions stemmed from having limited or no access to resources needed for research.[1]
- In 2023, 54% of doctorate recipients indicated that the timeline for completing their doctoral degree was delayed by the pandemic, similar to the 53% who reported a delayed degree in 2022 and higher than the 39% in 2021. Ten percent of doctorate recipients said funding for their doctoral studies had been reduced or suspended, a slight decrease from 2022 (12%).

- In 2023, the proportion of S&E doctorate recipients with definite postgraduation commitments was the highest in psychology (80%) and the lowest in biological and biomedical sciences (68%). Biological and biomedical sciences was the only S&E field with a lower proportion of definite commitments in 2023 than in 2003 (72%).
- In 2023, engineering had the lowest proportion (10%) of doctorate recipients with non-postdoc academic employment commitments. Conversely, engineering had the highest proportion of non-postdoc industry or business commitments (80%) and was the only field to have a higher proportion in 2023 than in 2022 (79%).
- Between 2022 and 2023, the postdoctoral study (postdoc) commitment rate declined in most fields. The largest decline was in agricultural sciences and natural resources (from 50% in 2022 to 46% in 2023).

U.S. doctorate awards

Each annual cohort of doctorate recipients augments the supply of prospective scientists, engineers, researchers, and scholars. Data on the composition of these cohorts reveal changes in the presence of different demographic groups.

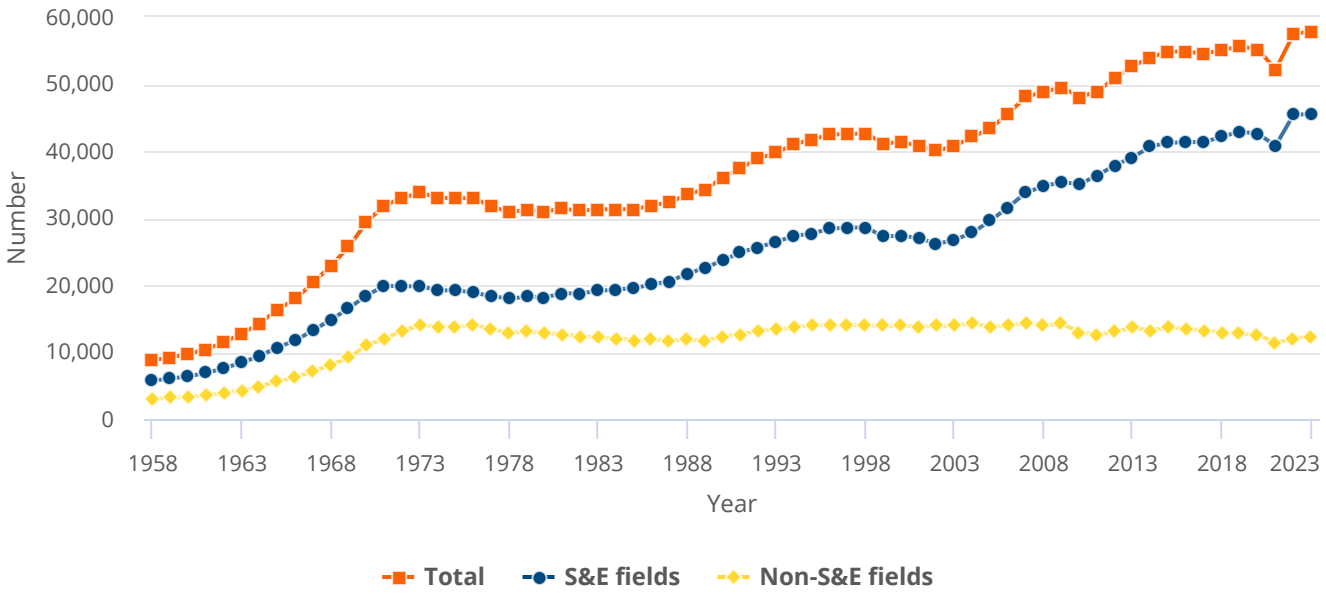
Overall trends

The number of research doctoral degrees awarded by U.S. institutions increased from 57,448 in 2022 to 57,862 in 2023, according to the Survey of Earned Doctorates (SED) (figure 1). This increase is considerably smaller than in 2022, when the number of doctorate awards grew by 5,288 after a decline of 3,043 in 2021, suggesting that the number of doctorates awarded may have stabilized following the onset of the COVID-19 pandemic. Since the survey's inception, there has been an upward trend in the number of doctorates awarded—with an average annual growth of 3.0% punctuated by periods of slower growth and some declines.

Since the SED began collecting data, the number of research doctorates awarded in science and engineering (S&E) fields has exceeded the number of non-S&E doctorates, and this gap has widened over time. From 2003 to 2023, the number of S&E doctorate recipients increased by 70%, while the number of non-S&E doctorate recipients decreased by 12%. As a result, the proportion of S&E doctorates to all doctorates climbed from 66% in 2003 to 79% in 2023.

Figure 1

Doctorates awarded by U.S. colleges and universities: 1958–2023



S&E = science and engineering.

Note(s):
The survey data collection for field of study changed in 2021, which may affect the data comparability across years. For more information, see the "Data source" section.

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023. Related detailed table 1-1.

Citizenship

Trends in citizenship

In 2023, the number of S&E doctorates awarded to temporary visa holders was 16,768, a decline of 315 from 2022 (figure 2). Overall, the number of S&E doctorates awarded to temporary visa holders has increased by 93% since 2003 and by 25% since 2013. Over the past 20 years, the proportion of S&E doctorates awarded to temporary visa holders peaked at 41% in 2007, declined to 35% in 2010, held steady at about 36% between 2011 and 2017, and grew to 39% through 2020, where it remained through 2023.[2]

Starting from a larger base, the number of S&E doctorates awarded to U.S. citizens and permanent residents experienced a slower relative increase over the past 20 years (58% since 2003 and 13% since 2013) compared with the increase in S&E doctorates awarded to temporary visa holders. In 2023, the number of S&E U.S. citizen and permanent resident doctorate recipients was 26,622, an increase of 264 from 2022.

Figure 2

Doctorates awarded in S&E and non-S&E fields, by citizenship status: 2003–23

S&E = science and engineering.

Note(s):
Excludes respondents who did not report citizenship. The survey data collection for field of study changed in 2021, which may affect the data comparability across years. For more information, see the "Data source" section.

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023. Related detailed table 1-6 and table 1-7.

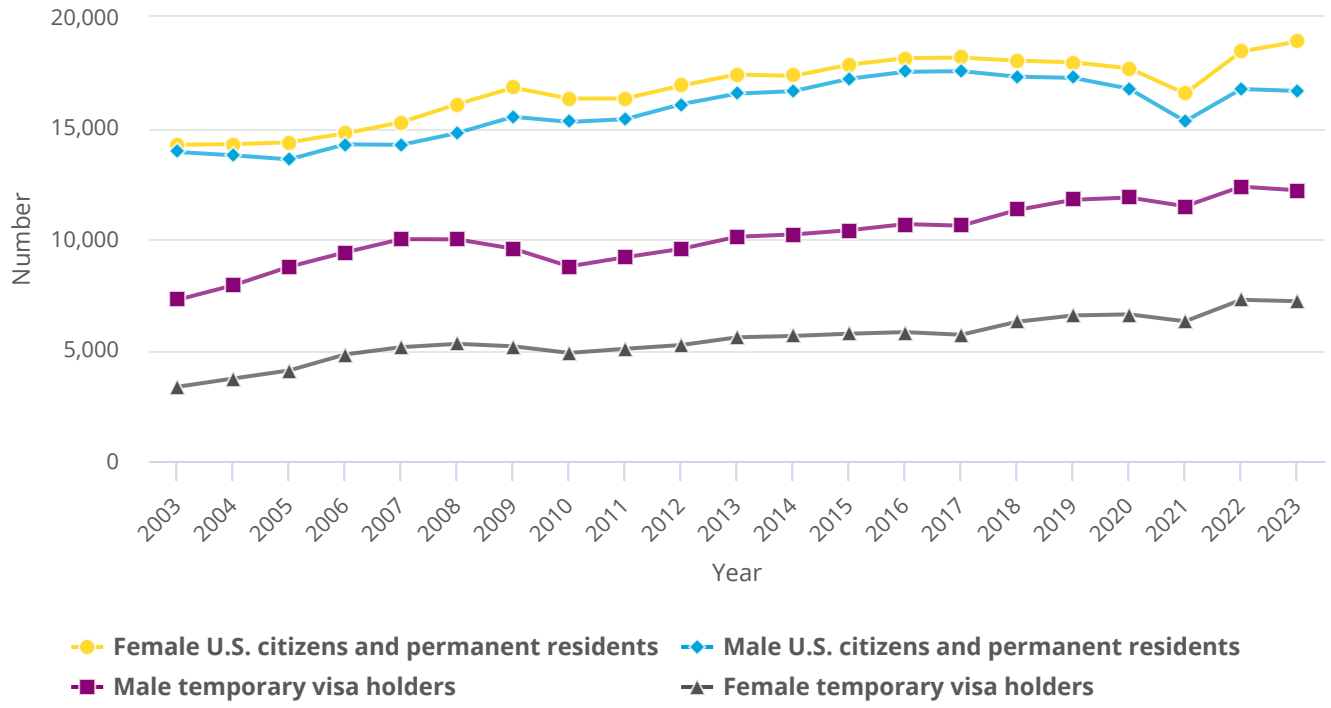
Citizenship and sex

In 2023, women earned 47% of all doctorate awards (figure 3).[3] Between 2003 and 2023, the rate of growth in doctorates awarded to female temporary visa holders was higher (116%) than the rate of growth among their U.S. citizen and permanent resident counterparts (33%), although starting from a lower base. During this period, the proportion of doctorates earned by women hovered between 51% and 53% among U.S. citizens and permanent residents and increased gradually from 32% to 37% among temporary visa holders.[4]

From 2022 to 2023, the number of female doctorate recipients who were U.S. citizens and permanent residents increased by 447, whereas the number of female doctorate recipients who were temporary visa holders and the number of male doctorate recipients regardless of citizenship status all declined slightly.

Figure 3

Doctorates awarded, by sex and citizenship: 2003–23



Note(s):
Excludes respondents who did not report sex or citizenship.

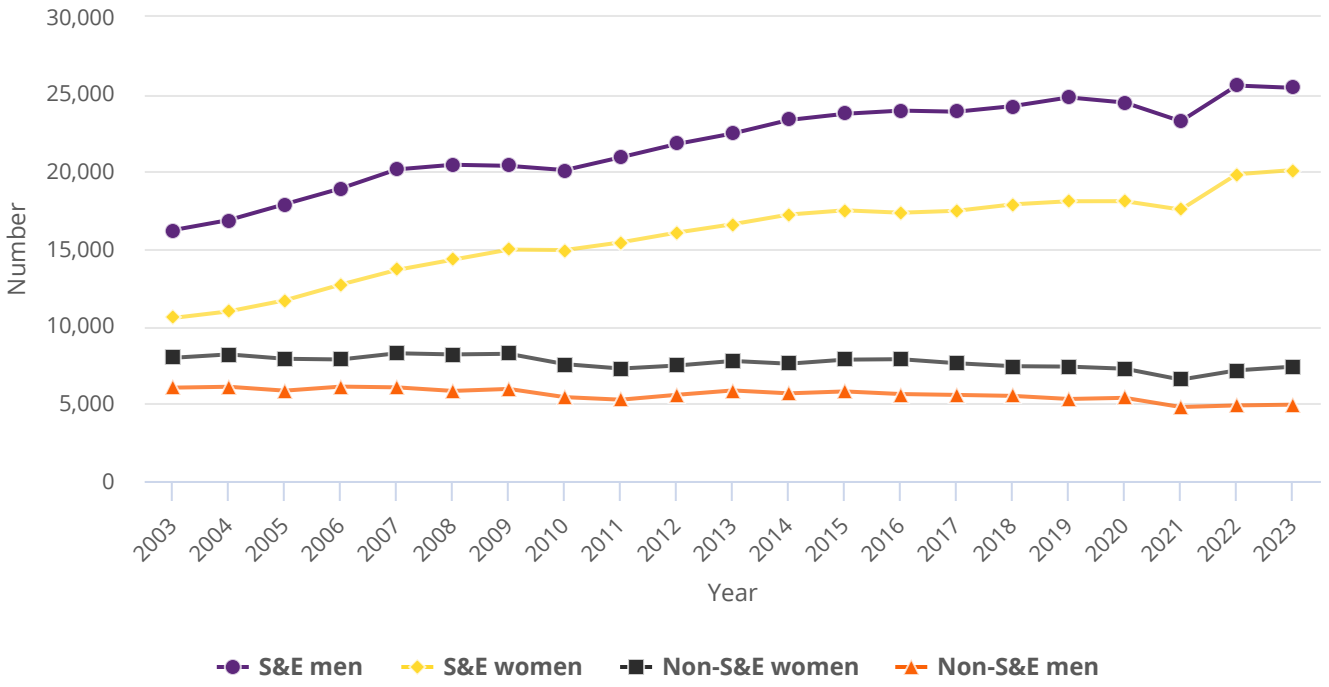
Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023. Related detailed table 1-9 and table 1-10.

Sex

In the past 20 years, there has been an increase in the number of doctorates awarded to both men and women in the S&E fields (figure 4). During this period, the number of female doctorate recipients in S&E fields increased by 91% (from 10,540 in 2003 to 20,106 in 2023), compared with a 57% increase in the number of male S&E doctorate recipients (from 16,219 in 2003 to 25,421 in 2023). The proportion of female doctorate recipients in S&E increased from 39% in 2003 to 42% in 2009, remained fairly stable through 2019, and increased to 44% by 2022, staying at this level in 2023. In non-S&E fields, women earned 60% of doctorates in 2023, a proportion that had hovered around 57%–58% since the early 2000s and increased to 59% in 2022. In the past 20 years, the number of men awarded doctorates in non-S&E fields declined by 18% (from 6,037 in 2003 to 4,935 in 2023) and women by 7% (from 7,966 to 7,393). Between 2022 and 2023, the number of women among S&E doctorate recipients increased by 274, while the number of men declined by 148; in non-S&E fields, the increase in the number of women (239) was about five times that of men (47).

Figure 4

Doctorates awarded, by sex and field: 2003–23



S&E = science and engineering.

Note(s):
Excludes respondents who did not report sex. The survey data collection for field of study changed in 2021, which may affect the data comparability across years. For more information, see the "Data source" section.

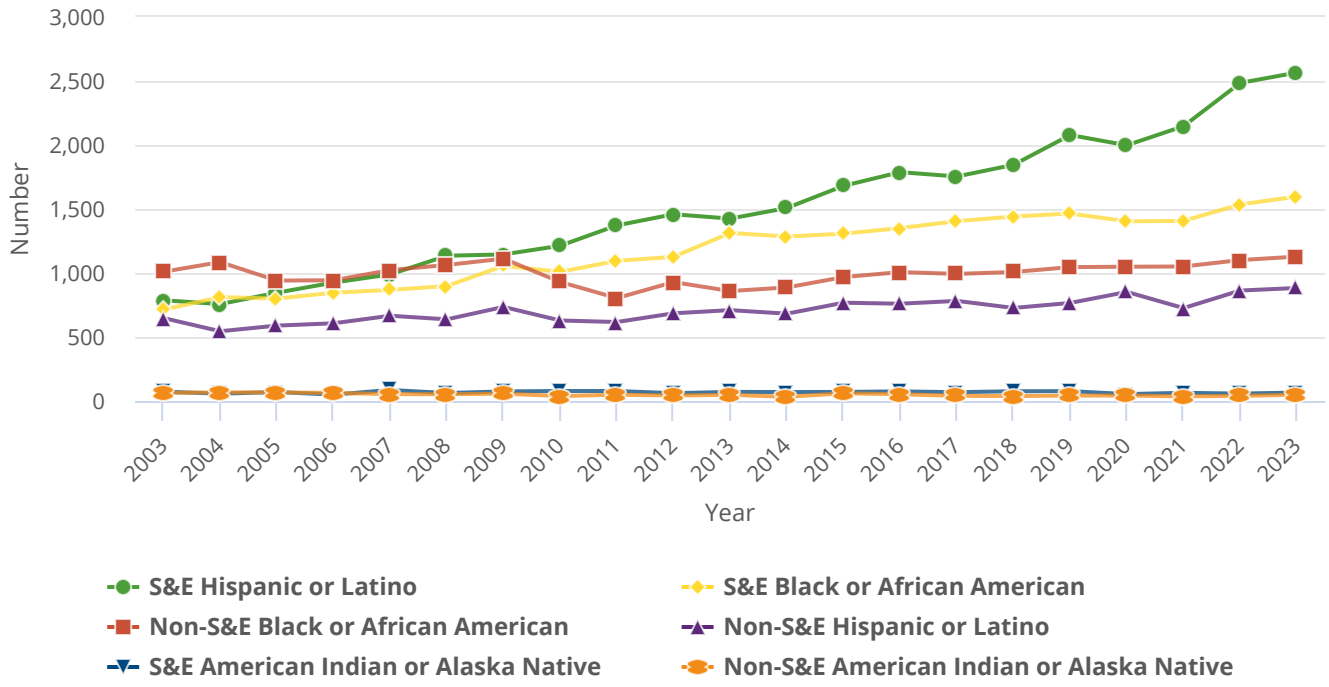
Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023. Related detailed table 1-4 and table 1-5.

Race and ethnicity

Racial and ethnic minority representation in doctorate awards has increased over time.[5] From 2003 to 2023, the proportion of doctorates earned by White U.S. citizens and permanent residents declined from 75% to 65%. The proportion earned by Asian U.S. citizens and permanent residents increased from 7% to 11%.[6] The number and proportion of doctorates earned by both Hispanic or Latino and Black or African American U.S. citizens and permanent residents also increased, although starting from a small base. In the past 20 years, the number of Hispanic or Latino doctorate recipients in S&E increased from 787 (5%) to 2,566 (10%) (figure 5).[7] The number of Black or African American doctorate recipients in S&E among U.S. citizens and permanent residents increased from 713 (4%) in 2003 to 1,597 (6%) in 2023. In the same period, the number of American Indian or Alaska Native doctorate recipients in S&E among U.S. citizens and permanent residents fluctuated between 50 and 86. Between 2022 and 2023, S&E doctorates awarded to American Indians or Alaska Natives increased from 58 to 66, remaining under 0.5% of S&E doctorates awarded to U.S. citizens and permanent residents. Between 2022 and 2023, among U.S. citizens and permanent residents, the number of Black or African American doctorate recipients in S&E increased by 61 to 1,597, and the number of Hispanic or Latino doctorate recipients in S&E increased by 81 to 2,566—the highest numbers of S&E doctorates awarded to students from these groups in the past 20 years.

Figure 5

Doctorates earned by U.S. citizen and permanent resident racial or ethnic groups underrepresented in S&E, by field: 2003–23



S&E = science and engineering.

Note(s):
Excludes U.S. citizen and permanent resident respondents who did not report race or ethnicity. The survey data collection for field of study changed in 2021, which may affect the data comparability across years. For more information, see the "Data source" section.

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023. Related detailed table 1-8 and table 1-11.

Field of doctorate

As researchers expand their understanding of the world, new fields of study emerge, and existing fields change. Observing which fields are attracting students can provide early insight into where future research breakthroughs may occur.

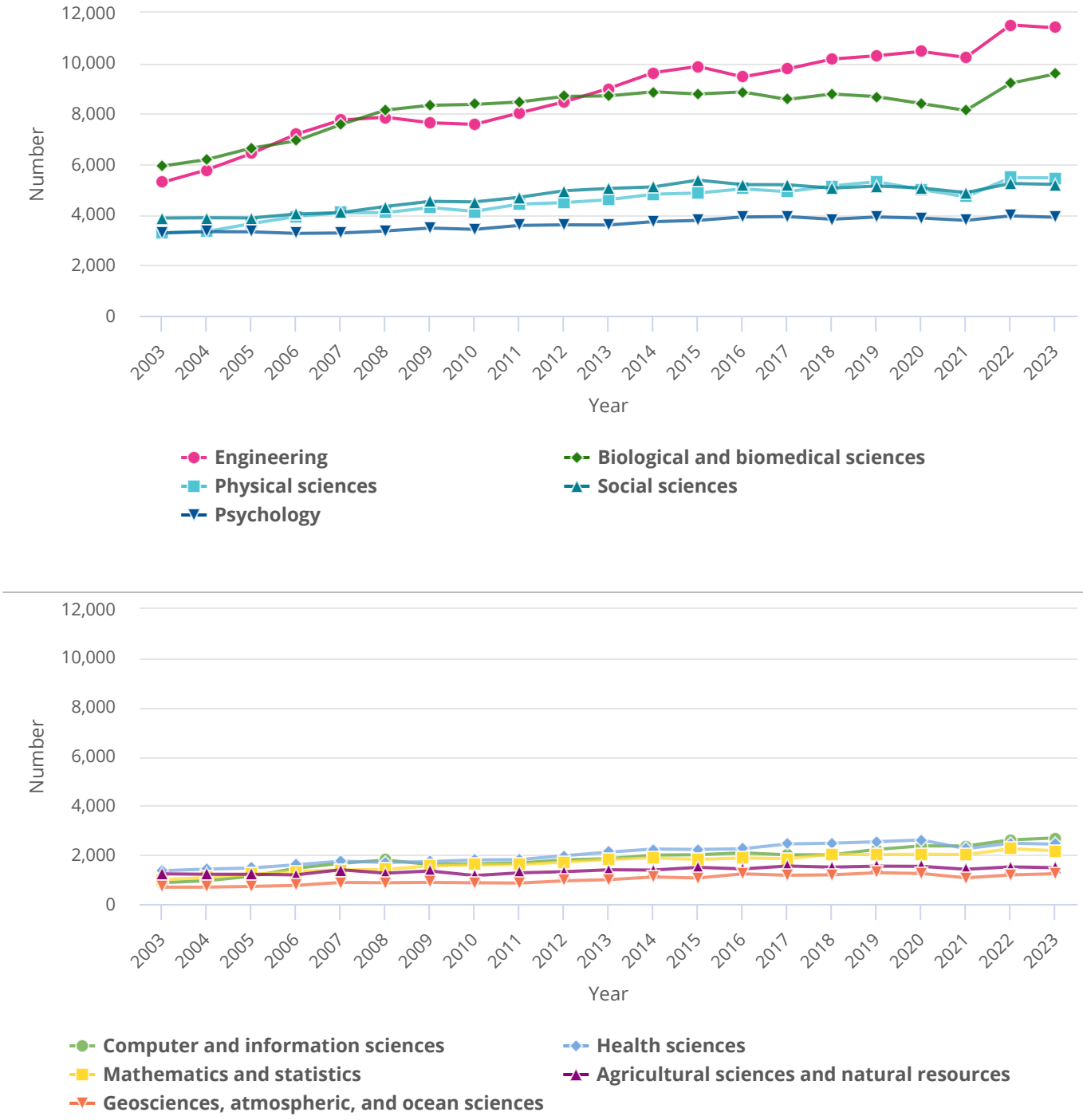
Field of doctorate trends

S&E fields

Doctorates in S&E fields are a growing share of all research doctorates awarded. Over the past 2 decades, the number of doctorate recipients has increased in every broad S&E field (**figure 6**). However, doctorates in psychology, social sciences, and agricultural sciences and natural resources have declined slightly as a proportion of all doctorate recipients, despite increases in the number awarded in each field. Engineering grew the most in terms of its share of all (S&E and non-S&E) doctorates awarded, from 13% in 2003 to 20% in 2023.[8] Between 2022 and 2023, the number of doctorate recipients grew in three S&E fields: biological and biomedical sciences (by 367, or 4%), computer and information sciences (by 80, or 3%), and geosciences, atmospheric, and ocean sciences (by 50, or 4%).[9] The number of doctorate recipients in all other fields declined slightly in 2023.

Figure 6

Doctorate recipients in S&E trend broad fields: 2003–23



S&E = science and engineering.

Note(s):
The survey data collection for field of study changed in 2021, which may affect the data comparability across years. For more information, see the "Data source" section.

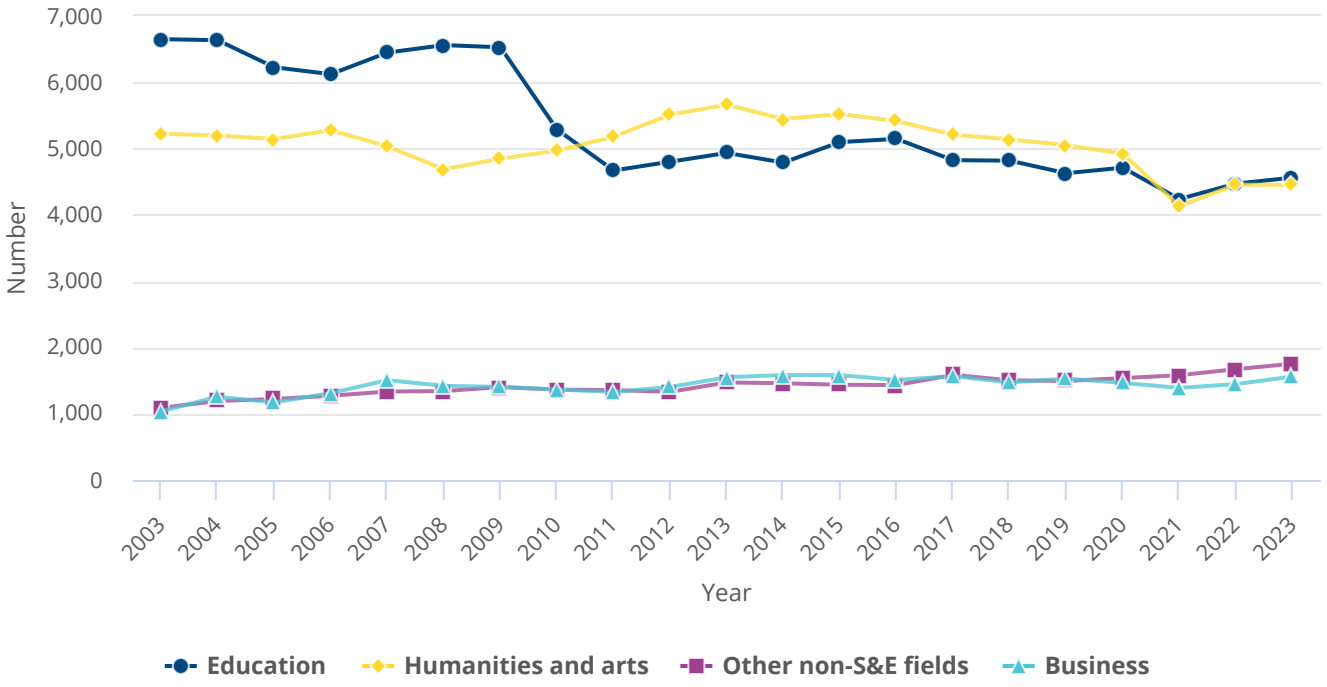
Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023. Related detailed table 1-3.

Non-S&E fields

In non-S&E broad fields in the past 20 years, the number of research doctorates awarded in humanities and arts declined while the number in business and in other non-S&E fields increased (figure 7).[10] From 2013 to 2023, the number of doctorates declined by 372 in education and by 1,209 in humanities.[11] Between 2022 and 2023, the number of doctorates increased in business, in education, and in other non-S&E fields (by 113, 91, and 82, respectively) and declined very slightly in humanities and arts (by 3). The increase in the number of doctorate recipients in business in 2023 brought the field to pre-pandemic levels. The number of doctorates in education and in the humanities and arts, however, remained lower than before the pandemic. The number of doctorate awards in other non-S&E fields grew continuously since 2019 and by 5% in 2023.[12]

Figure 7

Doctorates awarded in non-S&E trend broad fields: 2003–23



S&E = science and engineering.

Note(s):
The survey data collection for field of study changed in 2021, which may affect the data comparability across years. For more information on this and details on the drop in education doctorates between 2009 and 2011, see the "Data source" section.

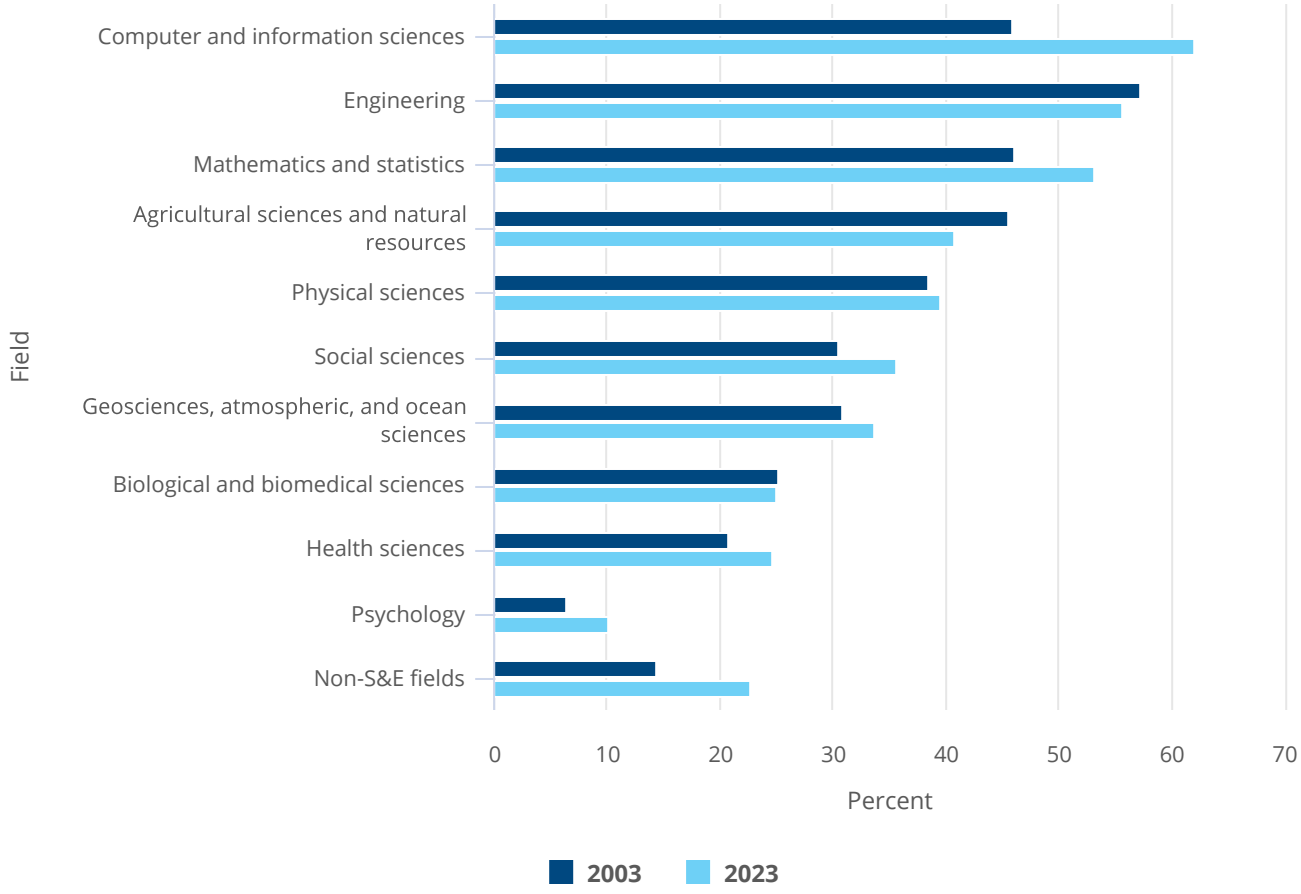
Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023. Related detailed table 1-3.

Temporary visa holders

In the past 2 decades, the number of doctorates awarded to temporary visa holders increased in every broad field except for education.[13] In 2023, temporary visa holders earned the majority of doctorates in computer and information sciences (62%), engineering (56%), and mathematics and statistics (53%) (figure 8). The largest increases in the proportion of doctorates awarded to temporary visa holders since 2003 were in computer and information sciences, mathematics and statistics, and non-S&E fields.[14] During this period, the proportion of temporary visa holder doctorate recipients declined in agricultural sciences and natural resources and in engineering.

Figure 8

Doctorate recipients on temporary visas, by trend broad field: 2003 and 2023



S&E = science and engineering.

Note(s):
Percentages are based on the number of doctorate recipients who reported citizenship. The survey data collection for field of study changed in 2021, which may affect the data comparability across years. For more information, see the "Data source" section.

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023. Related detailed table 1-6.

U.S. citizens and permanent residents

Racial and ethnic minorities' representation in doctoral degrees has increased over time,[15] though White doctorate recipients continue to earn the majority of doctoral degrees among U.S. citizens and permanent residents. In 2023, 65% of the 27,010 U.S. citizen and permanent resident doctorate recipients in S&E fields identified as White; 12% identified as Asian, 10% as Hispanic or Latino, 6% as Black or African American, and 4% as more than one race (table 1). The remaining 3% identified as American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, or did not report their race or ethnicity.

Table 1

S&E doctorates awarded to U.S. citizens and permanent residents, by race or ethnicity: 2023

(Number and percent)

Race and ethnicity	Number	Percent
U.S. citizens and permanent residents	27,010	100.0
Hispanic or Latino	2,593	9.6
Not Hispanic or Latino	23,963	88.7
American Indian or Alaska Native	68	0.3
Asian	3,248	12.0
Black or African American	1,658	6.1
Native Hawaiian or Other Pacific Islander	29	0.1
White	17,585	65.1
More than one race	1,060	3.9
Race not reported	315	1.2
Ethnicity not reported	454	1.7

S&E = science and engineering.

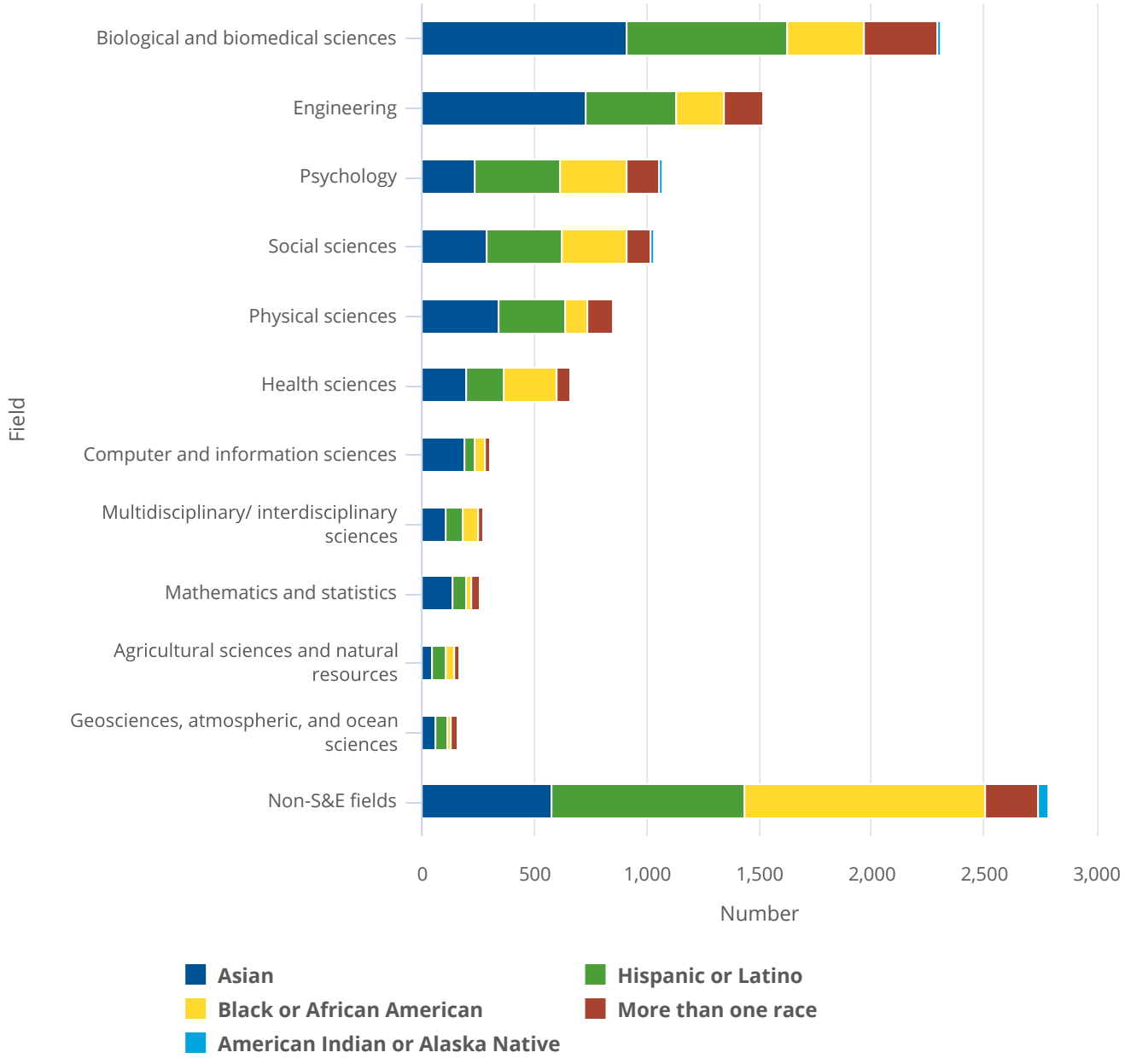
Note(s):
Percentages may not sum to 100% due to rounding.

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023. Related detailed table 1-11.

White doctorate recipients accounted for the majority of the U.S. citizens and permanent residents in each field, ranging from 58% in computer and information sciences to 77% in geosciences, atmospheric, and ocean sciences.[16] Among the other racial and ethnic groups, in 2023, Asian doctorate recipients earned the largest share of doctoral degrees in computer and information sciences, mathematics and statistics, engineering, multidisciplinary/interdisciplinary sciences, physical sciences, and biological and biomedical sciences (figure 9). Black or African American doctorate recipients were awarded more doctorates in health sciences and non-S&E fields (particularly education) than any other racial or ethnic minority group,[17] and Hispanic or Latino doctorate recipients were awarded the largest number of doctorates in agricultural sciences and natural resources, psychology, and social sciences.

Figure 9

Doctorates awarded to U.S. citizens and permanent residents, by selected minority race or ethnicity and broad field: 2023



S&E = science and engineering.

Note(s):
Excludes U.S. citizen and permanent resident respondents who did not report race or ethnicity or were Native Hawaiian or Other Pacific Islander. The survey data collection for field of study changed in 2021, which may affect the data comparability across years. For more information, see the "Data source" section.

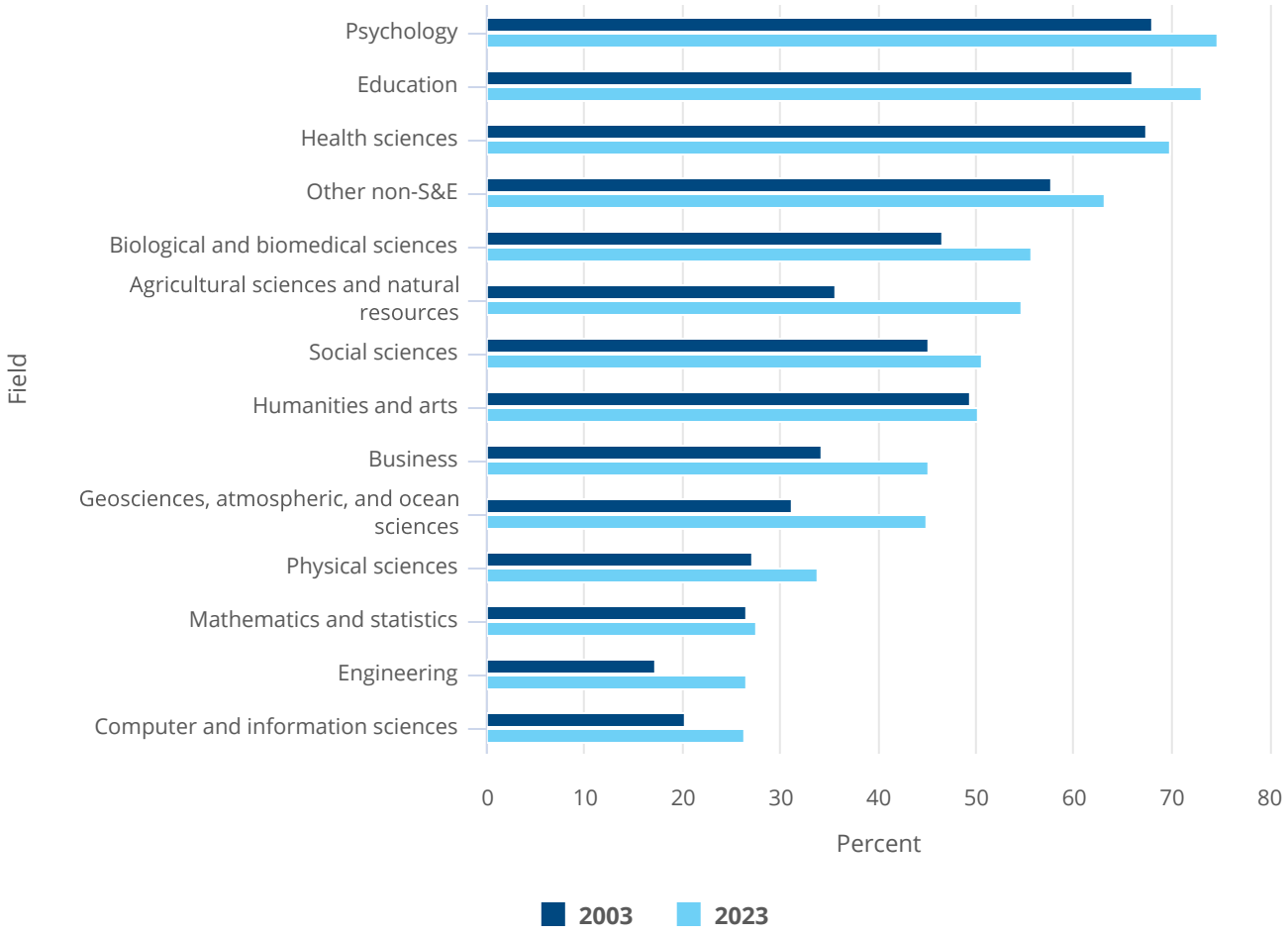
Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023. Related detailed table 3-4.

Women

Over the past 2 decades, women's share of doctorates has grown in all broad fields (figure 10). In 2023, women earned more than half of the doctorates in psychology, health sciences, biological and biomedical sciences, agricultural sciences and natural resources, social sciences, education, and other non-S&E fields.[18] Women also earned between about 26% and 45% of the doctorates awarded in computer and information sciences; engineering; mathematics and statistics; physical sciences; geosciences, atmospheric, and ocean sciences; and business. From 2003 to 2023, the proportion of female doctorate recipients grew the most in agricultural sciences and natural resources; geosciences, atmospheric, and ocean sciences; business; engineering; and biological and biomedical sciences. Women's share of awarded doctorates grew the least in health sciences, in mathematics and statistics, and in humanities and arts.

Figure 10

Doctorates awarded to women, by trend broad field: 2003 and 2023



S&E = science and engineering.

Note(s):
The survey data collection for field of study changed in 2021, which may affect the data comparability across years. For more information, see the "Data source" section.

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023. Related detailed table 1-4 and table 1-5.

SIDEBAR

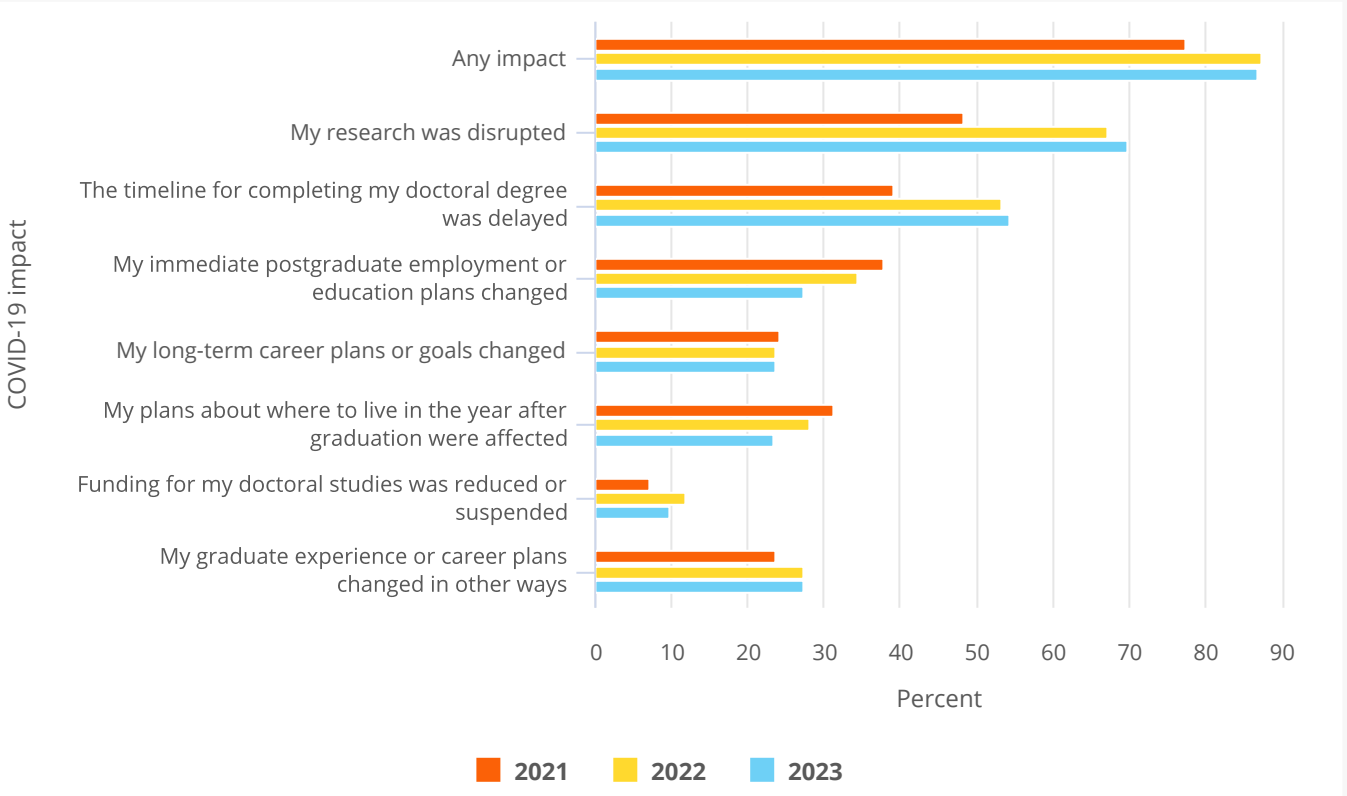
COVID-19 pandemic impacts on doctorate recipients

The COVID-19 pandemic that began in 2019 and spread rapidly in the United States in the first quarter of 2020 disrupted many aspects of the education and training of 2023 doctorate recipients.* Doctorate recipients were asked whether they experienced one of six impacts as a result of the pandemic: delay in their doctoral degree completion timeline; disruption in their research; reduction or suspension of funding for their doctoral studies; change in their immediate postgraduate employment or education plans; change in longer-term career plans or goals; and change in their plans about where to live in the year after graduation. Doctorate recipients were also asked to report any other changes in their graduate experience or career plans. This section summarizes the impacts of COVID-19 on doctorate recipients and is limited to the 51,173 doctorate recipients in 2023 who were asked the COVID-19 questions.

In 2023, the vast majority of doctorate recipients (87%) reported that their graduate experience and career plans were affected by at least one of the impacts listed above—comparable to the proportion in 2022 (87%) and higher than the proportion in 2021, when 77% reported at least one impact (figure A).

Figure A

COVID-19 pandemic impacts among doctorate recipients: 2021–23



Note(s):
Percentages are based on the number of doctorate recipients who were asked about the COVID-19 impact questions (42,030 of 52,160 doctorate recipients in 2021; 50,948 of 57,448 doctorate recipients in 2022; and 51,173 of 57,862 doctorate recipients in 2023).

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023.

Some impacts of the COVID-19 pandemic reported by 2023 doctorate recipients were more prevalent in 2023 than in previous years, while others remained stable or even abated. Disruption in research was the most frequent impact, cited by 70% of doctorate recipients—an increase from 48% in 2021 and 67% in 2022 (figure A). Among doctorate recipients who reported their research had been disrupted, 81% indicated having had limited or no access to resources needed for research and 68% reported having had to make changes to their research plan (table A).† The second most frequently reported impact was a delayed timeline for completing the doctoral degree, cited by 54% of 2023 doctorate recipients—a higher percentage than in 2021 (39%) and close to the proportion in 2022 (53%).

Table A

Doctorate recipients who said their research was disrupted as a result of the COVID-19 pandemic, by type of disruption: 2023

(Percent)

Type of disruption	Percent
My research was disrupted (number)	35,707
Limited or no access to resources	80.5
Changed my research plan	68.2
Disrupted in other ways	17.6

Note(s):
Multiple responses allowed.

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023.

The impacts of the COVID-19 pandemic on short-term postgraduation plans eased in 2023. About a quarter (27%) of the 2023 doctorate recipients indicated that their immediate postgraduation employment or education plans were affected by the pandemic in 2023—a decrease from 2022 (35%) and 2021 (38%) (figure A). Of the doctorate recipients who reported changes in their immediate postgraduate employment or education plans in 2023, 77% attributed the change to limited job opportunities and 38% to having had to accept a less-desirable job (table B).‡ About a quarter (23%) of the 2023 doctorate recipients also reported that their plans about where to live in the year after graduation were affected—a decrease from 2022 (28%) and 2021 (31%).

Table B

Doctorate recipients who said their immediate postgraduate employment or education plans changed as a result of the COVID-19 pandemic, by type of change: 2023

(Percent)

Type of change	Percent
My immediate postgraduate employment or education plans changed (number)	13,913
Limited job opportunities	76.6
Had to accept a less-desirable job	37.7
Changed plans in other ways	19.6

Note(s):
Multiple responses allowed.

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023.

The impact of the pandemic on long-term career plans or goals remained relatively stable over the past 3 years (24%). In 2023, over half of doctorate recipients responded that their long-term plans changed because they had to find a different type of employer (59%) or a different job or field (55%). For some, their long-term plans or goals changed because the pandemic provided new opportunities (46%) (table C).

Table C

Doctorate recipients who said their long-term career plans or goals changed as a result of the COVID-19 pandemic, by type of change: 2023

(Percent)

Type of change	Percent
My long-term career plans or goals changed (number)	12,136
Different type of employer	58.7
Different type of job or field	55.1
New opportunities	45.5
Changed plans in other ways	13.1

Note(s):
Multiple responses allowed.

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023.

Compared to the other measures, the financial impact of the pandemic on respondents—reduced or suspended funding for doctoral studies—was relatively small. This was the least reported impact in all 3 years the questions about pandemic impacts have been fielded. The proportion of doctorate recipients reporting an impact on funding was lower in 2023 than in 2022, but still higher than in 2021.

Sidebar footnotes

* To measure the impacts of the COVID-19 pandemic on new doctorate recipients' graduate experiences and postgraduation plans, a set of questions was designed, tested, and included as a new module starting with the 2021 Survey of Earned Doctorates (SED). See the SED 2022 "Technical Notes" for details about slight changes in the wording of the COVID-19 module questions between 2021 and 2022.

† Doctorate recipients were allowed to provide multiple responses as to how their research was disrupted.

‡ Doctorate recipients were allowed to provide multiple responses as to how their postgraduation employment or education plans changed.

Postgraduation trends

A graduate's first position after earning a doctoral degree may reflect broad economic conditions and can shape later career opportunities, earnings, and choices. Over the longer term, the early career patterns of doctorate recipients may influence the decisions of future students considering careers as scientists, engineers, scholars, and researchers.

Definite commitments at graduation

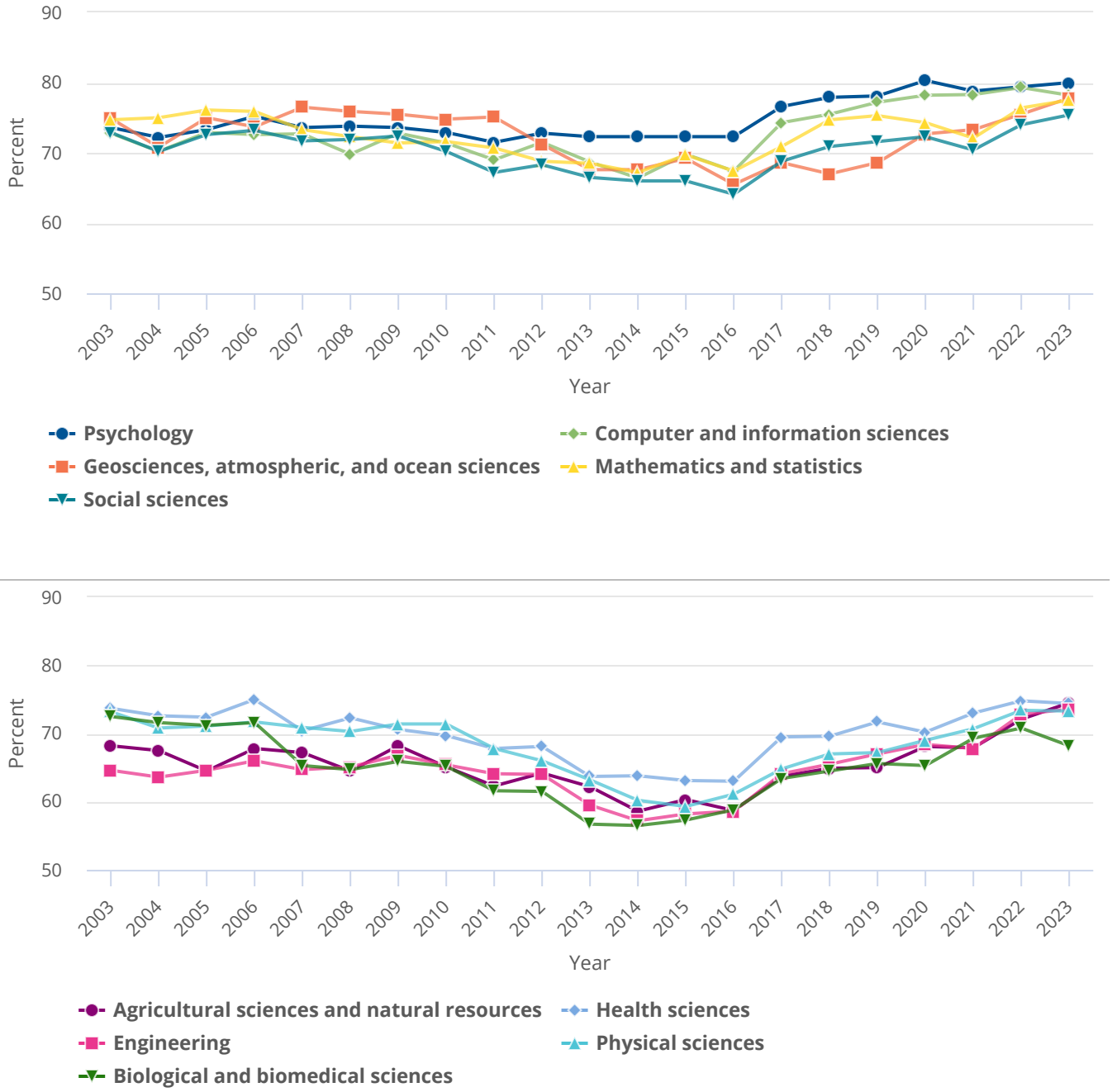
At any given time, the job market outlook for new doctorate recipients will be better in some doctorate fields than in others. In general, doctorate recipients in S&E fields tend to have robust postgraduation career prospects. Of the 45,533 S&E doctorate recipients in 2023, 41,273 responded to the postgraduation commitment questions. Of those who responded to this question, 30,450 (74%) had definite commitments for employment or postdoctoral study or training (postdoc) positions; 10,823 (26%) did not. The focus of this section is doctorate recipients with definite commitments for employment or postdoc positions.[19]

The proportions of 2023 doctorate recipients in S&E with definite commitments for employment or postdoc positions ranged from 68% in biological and biomedical sciences to 80% in psychology (**figure 11**). The overall proportion of S&E doctorate recipients with definite commitments was higher in 2023 (74%) than in 2003 (71%).[20] Compared to 2003, in 2023 the proportion of recipients with definite commitments was higher in most broad fields. The fields with the largest percentage-point growth in definite commitments in the past 20 years were engineering (9 percentage points), psychology (6 percentage points), agricultural sciences and natural resources (6 percentage points), and computer and information sciences (5 percentage points). Biological and biomedical sciences was the only field to experience a decline in definite commitments in the past 20 years, from 72% to 68%, although it has rebounded from a low of 57% in the mid-2010s. The 2023 proportions of doctorate recipients in health sciences and in physical sciences with definite commitments were similar to those in 2003.

Between 2022 and 2023, the proportion of doctorate recipients with definite commitments increased in most fields except physical sciences; health sciences; computer and information sciences; and biological and biomedical sciences. The largest percentage-point increases in definite commitments were in geosciences, atmospheric, and ocean sciences and in agricultural sciences and natural resources (2 percentage points). The largest decrease was in biological and biomedical sciences (3 percentage points).

Figure 11

Definite commitments among doctorate recipients, by S&E trend broad field: 2003–23



S&E = science and engineering.

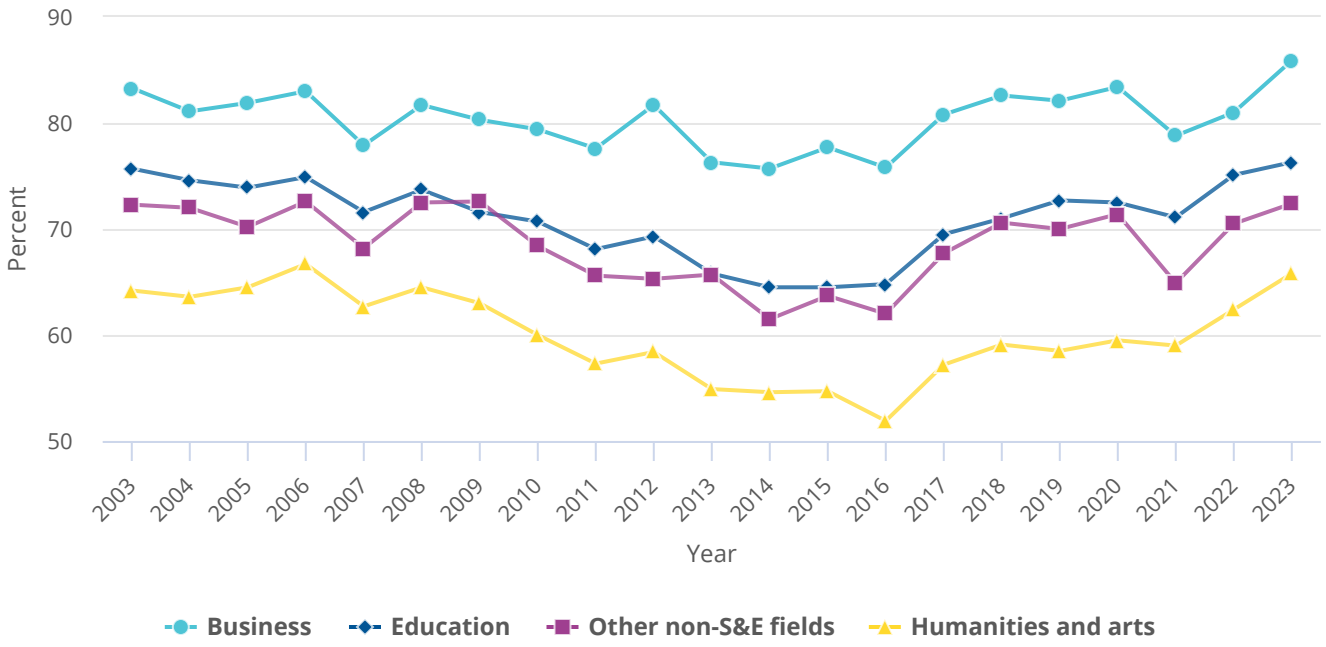
Note(s):
Definite commitment refers to a doctorate recipient who is either returning to predoctoral employment or has signed a contract (or otherwise made a definite commitment) for employment or postdoctoral study in the coming year. Percentages are based on the number of doctorate recipients who responded to the postgraduation status item. The postgraduation status question was changed in 2017 to capture postgraduation employment plans more accurately; some of the increase between 2016 and 2017 may be partly attributable to this change. The survey data collection for field of study changed in 2021, which may affect the data comparability across years. For more information, see the "Data source" section.

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023. Related detailed table 2-1.

Overall, the proportion of non-S&E doctorate recipients reporting definite commitments was 73% in 2023 compared with 72% in 2003.[21] Since 2003, the proportion of doctorate recipients reporting definite commitments increased or stayed the same in each of the non-S&E broad fields, with each field reaching a low from 2014 to 2016 (figure 12). Doctorate recipients in non-S&E fields experienced drops in commitments in 2021 during the COVID-19 pandemic, but commitments rebounded in 2022 for each broad field and continued to climb in 2023. In the past 20 years, percentage-point growth in definite commitments in non-S&E broad fields was not as high as in some S&E broad fields, with business growing the most (3 percentage points). In 2023, business had the highest proportion of definite commitments of all S&E and non-S&E fields (86%). Humanities and arts had the lowest proportion among all S&E and non-S&E fields (66%).

Figure 12

Definite commitments among doctorate recipients, by non-S&E trend broad field: 2003–23



S&E = science and engineering.

Note(s):
Definite commitment refers to a doctorate recipient who is either returning to predoctoral employment or has signed a contract (or otherwise made a definite commitment) for employment or postdoctoral study in the coming year. Percentages are based on the number of doctorate recipients who responded to the postgraduation status item. The postgraduation status question was changed in 2017 to capture the postgraduation employment plans more accurately. As a result, some of the increase between 2016 and 2017 may be partly attributable to this change. The survey data collection for field of study changed in 2021, which may affect the data comparability across years. For more information, see the "Data source" section.

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023. Related detailed table 2-1.

First postgraduate positions in the United States

In 2023, 22,462 doctorate recipients reported non-postdoc employment commitments in the United States.[22] Of these recipients with non-postdoc employment commitments, 34% (7,672) were in academia; 47% (10,495) were in industry or business; 7% (1,535) were in government; 7% (1,462) in nonprofits; and 6% (1,298) in other or did not report the sector. In addition, 12,818 doctorate recipients reported having a postdoc commitment in the United States in 2023.

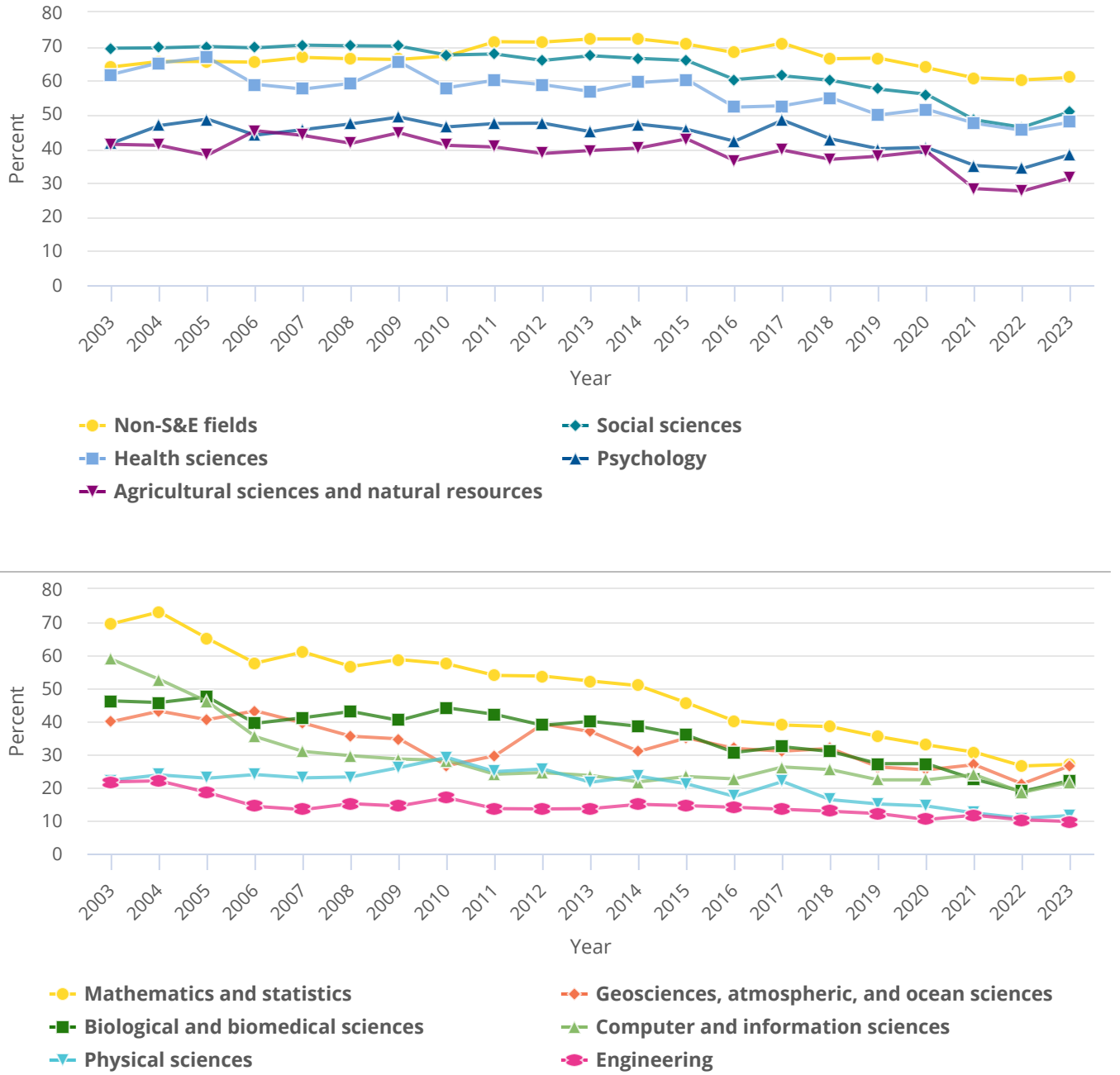
Academic employment

Doctorate recipients have shifted away from non-postdoc academic employment over time. In 2023, 34% of doctorate recipients with definite non-postdoc employment commitments in the United States reported that their principal job would be in academia,[23] down from 54% in 2003. The proportion of doctorate recipients who reported non-postdoc employment commitments in academia in 2023 was highest in non-S&E fields (61%) and lowest in engineering (10%) and physical sciences (12%) (**figure 13**).

In the past 20 years, the proportion of non-postdoc academic employment commitments in the United States declined in all S&E fields. The largest percentage-point declines between 2003 and 2023 were in mathematics and statistics, dropping from 70% to 27%, followed by computer and information sciences, dropping from 59% to 22%.[24] Between 2022 and 2023, the proportion of doctorate recipients with non-postdoc academic employment commitments increased in all S&E fields except engineering. The largest increases were in geosciences, atmospheric, and ocean sciences and in social sciences (5 percentage points each).

Figure 13

Definite non-postdoc employment commitments in academe in the United States, by trend broad field: 2003–23



S&E = science and engineering.

Note(s):
Definite employment commitment refers to a doctorate recipient who is either returning to predoctoral employment or has signed a contract (or otherwise made a definite commitment) for employment (excludes postdoctoral study) in the coming year. Percentages are based on the number of doctorate recipients who reported definite employment commitments (including those missing employer type) and plans to stay in the United States. The survey data collection for field of study changed in 2021, which may affect the data comparability across years. For more information, see the "Data source" section.

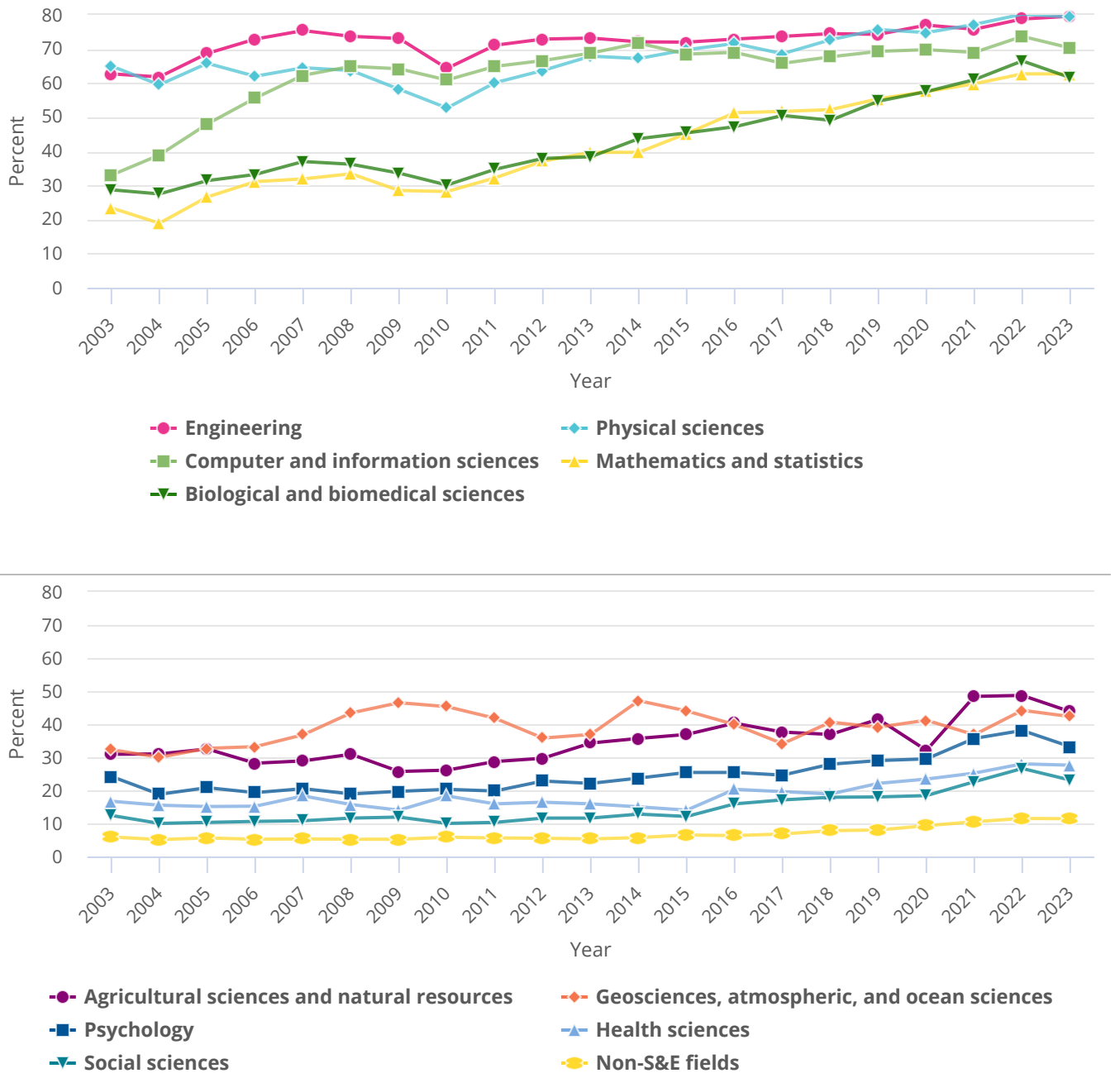
Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023. Related detailed table 2-6.

Industry or business employment

In contrast to the decline in definite non-postdoc employment commitments in academia, the proportion of doctorate recipients with non-postdoc commitments in industry or business in the United States more than doubled since 2003, comprising close to half (47%) of all 2023 doctorate recipient employment commitments.[25] Definite commitments in industry or business have become more prevalent in all fields. In 2003, only physical sciences (65%) and engineering (63%) had more than half of their doctorate recipients commit to non-postdoc employment positions in industry or business (figure 14). By 2023, several more fields had 50% or more of their doctorate recipients commit to industry or business positions: computer and information sciences; mathematics and statistics; and biological and biomedical sciences. In comparison, only about a quarter of doctorate recipients in health sciences and in social sciences had definite commitments in industry or business—the lowest among S&E fields. While employment commitments in industry or business increased across all fields over the past 20 years, between 2022 and 2023, they declined in every field but engineering.[26]

Figure 14

Definite non-postdoc employment commitments in industry or business in the United States, by trend broad field: 2003–23



S&E = science and engineering.

Note(s):
Definite employment commitment refers to a doctorate recipient who is either returning to predoctoral employment or has signed a contract (or otherwise made a definite commitment) for employment (excludes postdoctoral study) in the coming year. Definite commitments in industry or business includes doctorate recipients who are self-employed. Percentages are based on the number of doctorate recipients who reported definite employment commitments (including those missing employer type) and plans to stay in the United States. The survey data collection for field of study changed in 2021, which may affect the data comparability across years. For more information, see the "Data source" section.

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023. Related detailed table 2-6.

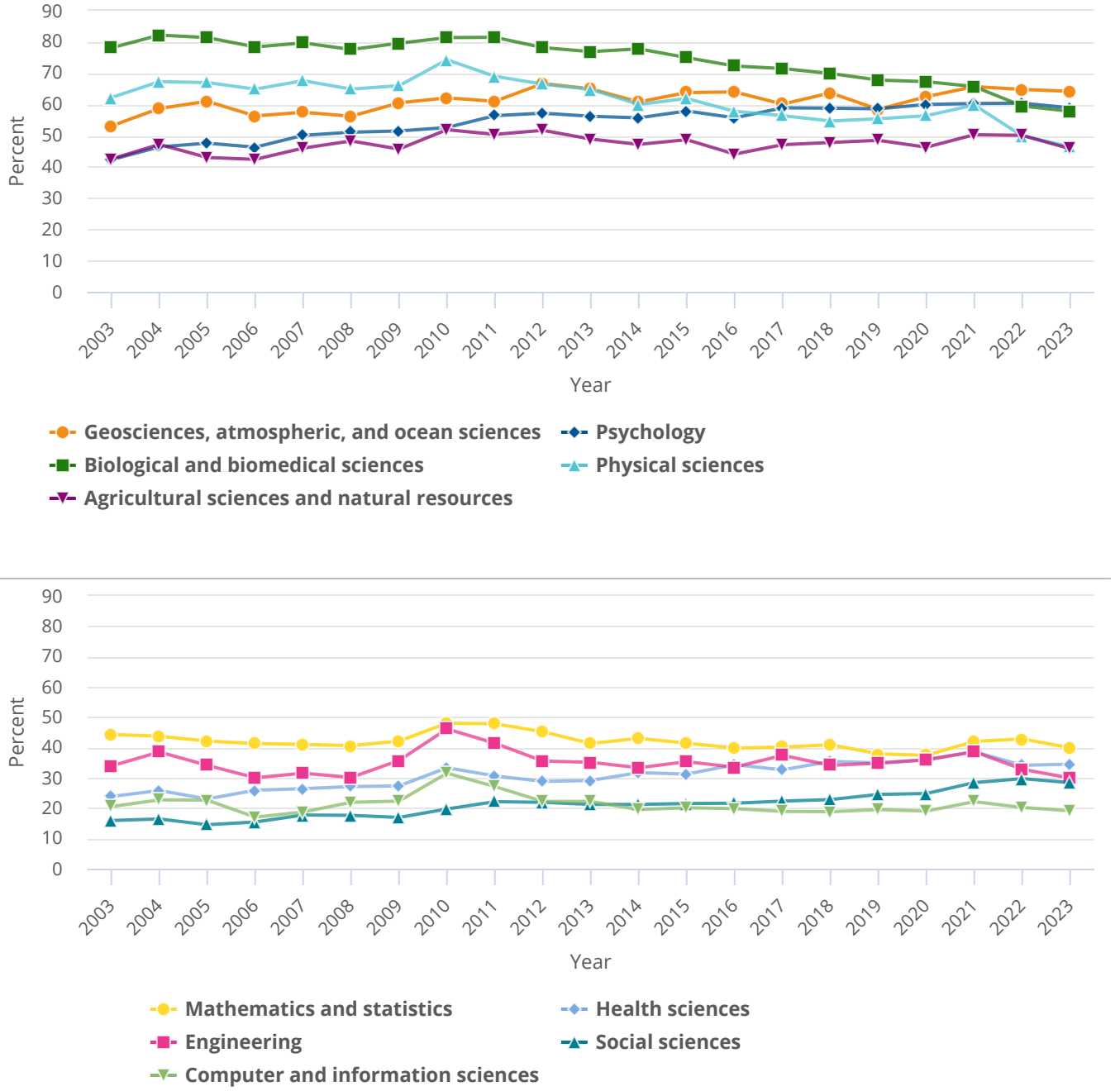
Postdoc positions

Twenty-year trends in postdoc commitments varied by field. Historically, postdoc positions have been a customary part of the early career paths of doctorate recipients in biological and biomedical sciences; physical sciences; and geosciences, atmospheric, and ocean sciences—comprising over half of definite commitments. Since 2007, the postdoc rates in psychology have also exceeded 50% (**figure 15**).

In the past 20 years, 5 of the 10 S&E broad fields experienced increases in postdoc rates. The largest increases in postdoc rates were in psychology (17 percentage points); social sciences (13 percentage points); geosciences, atmospheric, and ocean sciences (11 percentage points); and health sciences (11 percentage points). Although over half of the doctorate recipients with definite commitments in biological and biomedical sciences and close to half of those with definite commitments in the physical sciences pursued a postdoc position in 2023, these fields experienced a decline of 20 and 16 percentage points, respectively, in the past 2 decades. Between 2022 and 2023, the postdoc rate decreased in most of the S&E broad fields. The largest declines were in agricultural sciences and natural resources (4 percentage points), followed by physical sciences, mathematics and statistics, and engineering (3 percentage points each).

Figure 15

S&E U.S. postdoc rate for doctorate recipients, by trend broad field: 2003–23



S&E = science and engineering.

Note(s):
Percentages are based on the number of doctorate recipients who reported definite commitments in the coming year, who reported whether their commitment was for employment or postdoctoral study, and who plan to live in the United States. The survey data collection for field of study changed in 2021, which may affect the data comparability across years. For more information, see the "Data source" section.

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023. Related detailed table 2-3.

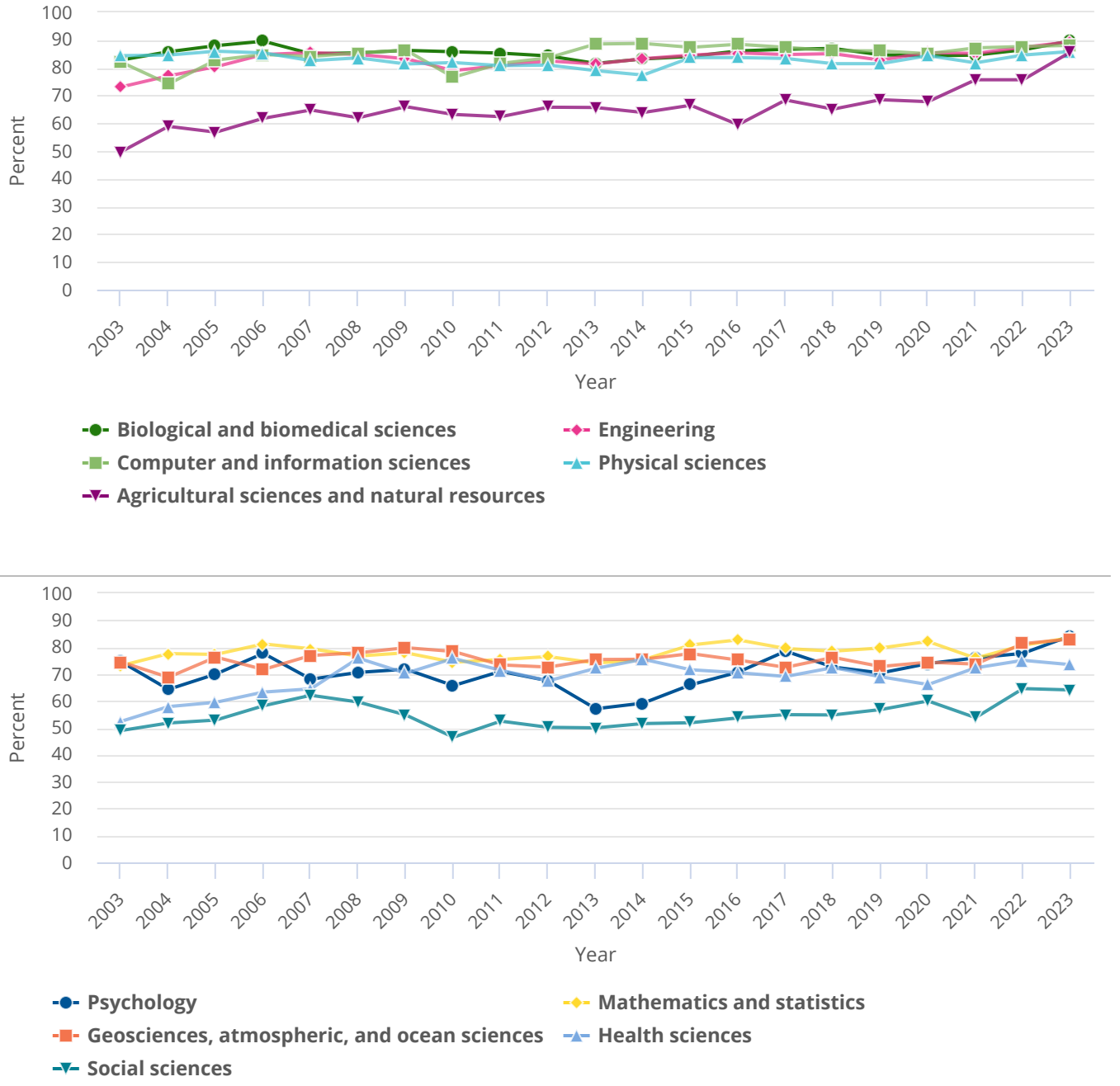
Temporary visa holders

Among S&E doctorate recipients who are temporary visa holders, working in the United States after earning a doctoral degree has become more prevalent, though uneven through the years. In 2023, 85% of S&E temporary visa holder doctorate recipients with definite commitments reported that the location of their postdoc or employment position was in the United States, up from 72% in 2003.[27] Between 2003 and 2023, the largest increases in expected stay rates were among doctorate recipients in agricultural sciences and natural resources and in health sciences (36 percentage points each); the smallest was among those in physical sciences (2 percentage points) (**figure 16**).

In 2023, in all S&E fields, the majority of temporary visa holder doctorate recipients expected to stay in the United States. Expected stay rates were over 80% in all S&E fields except health sciences (74%) and social sciences (64%). Similarly, between 2022 and 2023, the proportion of temporary visa holder doctorate recipients with definite commitments in the United States grew in all fields except health sciences and social sciences. The largest increases from 2022 to 2023 were in agricultural sciences and natural resources (10 percentage points) and psychology (7 percentage points).

Figure 16

S&E temporary visa holder doctorate recipients with definite commitments in the United States, by trend broad field: 2003–23



S&E = science and engineering.

Note(s):
Definite commitment refers to a doctorate recipient who is either returning to predoctoral employment or has signed a contract (or otherwise made a definite commitment) for employment or postdoctoral study in the coming year. Percentages are based on the number of S&E temporary visa holder doctorate recipients who reported definite commitments. The survey data collection for field of study changed in 2021, which may affect the data comparability across years. For more information, see the "Data source" section.

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2023. Related detailed table 6-3.

Glossary

Academia. Employment in academia includes 4-year colleges or universities; medical schools; university-affiliated research institutes; community or 2-year colleges; and foreign educational institutions.

Definite commitment. A commitment, through a contract or other method, by doctorate recipients to accept employment or a postdoctoral study or training (postdoc) position in the coming year or to return to predoctoral employment.

Definite non-postdoc employment commitment. A definite commitment by doctorate recipients for employment (excluding postdocs) in the coming year.

Expected stay rates. The proportion of temporary visa holder doctorate recipients with definite commitments in the United States at graduation among all temporary visa holders.

Field. Beginning in 2021, the SED collects over 1,600 fields for reporting of field of research doctorate, using a modified version of the 2020 Classification of Instructional Programs (CIP)—compared to 334 fields collected in 2020 and previous years. The SED-CIP codes were then aggregated into 306 detailed field codes nested into 68 major fields and 16 broad fields and are used to report field of doctorate data in the detailed data tables.

> **Trend broad field.**
>
> To facilitate trend data comparisons, historical field data were estimated based on a crosswalk of the new 2021 SED-CIP codes to the SED field of study codes used in prior survey years. The trend data reported in this report use 14 trend broad fields (excluding multidisciplinary/interdisciplinary sciences)—10 S&E fields: agricultural sciences and natural resources; biological and biomedical sciences; computer and information sciences; engineering; geosciences, atmospheric, and ocean sciences; health sciences; mathematics and statistics; physical sciences; psychology; social sciences; and 4 non-S&E fields: business, education, humanities and arts, and other non-S&E fields. (See “Field” under “Time series data changes” in the “Data source” section.)

Industry or business. Employment in industry or business includes positions where the principal employer is either a for-profit company or organization or self-employment.

NCSES. National Center for Science and Engineering Statistics.

Non-S&E. Non-science and engineering: Trend non-S&E broad fields used to compare data over time are based on historical fields that included business; education; humanities and arts (combined); and other non-S&E fields, such as communications.

Postdoctoral study or training (postdoc) position. A temporary position primarily for gaining additional education and training in research, usually awarded in academe, industry, government, or a nonprofit organization. Postdoc positions include fellowships; research apprenticeships; traineeships; internships (clinical residency); other training; and unspecified further training or study.

Race and ethnicity. Doctorate recipients who report Hispanic or Latino heritage, regardless of racial designation, are counted as Hispanic or Latino, and those who do not answer the Hispanic or Latino ethnicity question are counted as “ethnicity not reported.” Respondents who indicate that they are not Hispanic or Latino and indicate a single race are reported in their respective racial groups. Respondents who indicate they are not Hispanic or Latino and select two or more races are reported as "More than one race."

Research doctorate. A doctoral degree that is oriented toward preparing students to make original intellectual contributions in a field of study and that is not primarily intended for the practice of a profession. Research doctorates require the completion of a dissertation or equivalent project. In this report, the terms “doctorate” and “doctoral degree” are used to represent any of the research doctoral degrees covered by the SED. Professional doctoral degrees, such as the MD, DDS, JD, and PsyD, are not covered by the survey.

S&E. Science and engineering: Trend S&E broad fields used to compare data over time are based on 10 fields that include agricultural sciences and natural resources; biological and biomedical sciences; computer and information sciences; engineering; geosciences, atmospheric, and ocean sciences; health sciences; mathematics and statistics; physical sciences; psychology; and social sciences. The trend broad fields do not include multidisciplinary/ interdisciplinary sciences, which was added to the SED field of study taxonomy in 2021.

Underrepresented minority. Demographic groups that are underrepresented in science and engineering, relative to their numbers in the U.S. population: American Indian or Alaska Native, Black or African American, and Hispanic or Latino. For detailed data on racial and ethnic representation, see the 2023 NCSES report ***Diversity and STEM: Women, Minorities, and Persons with Disabilities: 2023***.

Data source

The Survey of Earned Doctorates (SED) is the sole data source for *Doctorate Recipients from U.S. Universities: 2023*. The principal elements of the 2023 SED data collection are described in the sections that follow. More detailed information, including the "Technical Notes" and related technical tables, are available at https://ncses.nsf.gov/surveys/earned-doctorates/2023.

This product has been reviewed for unauthorized disclosure of confidential information under NCSES-DRN24-017.

Survey eligibility. The SED collects information on research doctorate recipients only. Research doctorates require the completion of a dissertation or equivalent project, are oriented toward preparing students to make original intellectual contributions in a field of study and are not primarily intended for the practice of a profession. The 2023 SED recognized 18 distinct types of research doctorates. In 2023, 98.6% of research doctorate recipients earned a PhD.

The population eligible for the 2023 survey consisted of all individuals who received a research doctorate from an accredited U.S. academic institution in the 12-month period from 1 July 2022 to 30 June 2023.

Survey universe. The total universe consisted of 57,862 persons in 459 institutions that conferred research doctorates in academic year 2023.

Data collection. Institutional coordinators at each doctorate-awarding institution distributed the SED Web survey link to individuals receiving a research doctorate. The self-administered Web survey is the primary mode of SED completion. Nonrespondents were contacted by e-mail, mail, and text message to complete the Web survey. If the series of follow-up e-mails, mailings, and text messages was unsuccessful, the survey contractor attempted to reach nonrespondents to complete an abbreviated survey by computer-assisted telephone interviewing. RTI International served as the 2023 SED data collection contractor on behalf of NCSES.

Survey response rates. In 2023, 91.2% of research doctorate recipients completed the survey. Limited records (field of study, doctoral institution, and sex) are constructed for nonrespondents from administrative records of the university—commencement programs, graduation lists, and other public records—and are included in the reported total of doctorate recipients. The survey response rates for 1970–2023 and the item response rates for 2017–23 are provided in table A-2 and table A-3 of the survey's 2023 "Technical Notes."

Time series data changes.

EdD program reclassification. After a multiyear review of Doctor of Education (EdD) degree programs participating in the SED, 143 programs were reclassified from research doctorate to professional doctorate over the 2010–11 period. No additional reclassifications of EdD degree programs are planned. SED data are no longer being collected from graduates earning degrees from the reclassified EdD programs, and this has affected the reporting of the number of doctorates awarded by sex, citizenship, race, and ethnicity. Figure 7 in this report shows the impact of the decline in the number of doctoral degrees awarded in education from 2009 to 2011. Readers should note that the declines from 2009 to 2010 and from 2010 to 2011 are at least partly attributable to the EdD reclassification.

Field. Beginning in 2021, field of doctorate data are collected using a modified version of the 2020 Classification of Instructional Programs (CIP) codes and reported using a new SED-specific taxonomy (table A-4). Adjustments to the 2020 CIP for the SED data collection (SED-CIP) included, among other changes, the addition of over 50 fields of study codes collected in the SED but not covered in the 2020 CIP. The SED-CIP now collects over 1,650 fields for field of study reporting, compared to the 334 field codes collected in 2020 SED and prior years. The SED-CIP codes collected are then aggregated into 306 detailed fields nested under 68 major fields and 16 broad fields, which are used for reporting in the 2023 detailed data tables. This field structure is aligned with the NCSES Taxonomy of Disciplines (TOD) to facilitate comparison with other NCSES surveys as well as with the Integrated Postsecondary Education Data

System (IPEDS) Completions survey. A crosswalk of the SED-CIP codes to the new SED broad, major, and detailed fields of study is shown in table A-5 of the 2023 "Technical Notes." To facilitate the trend data comparison with prior years, table A-6 presents a crosswalk of the SED-CIP codes to the SED trend broad, major, and fine fields of study which can be used to construct the comparable 2021, 2022, and 2023 data.

Data license. Microdata from the Doctorate Records File (cumulative SED data file) may be obtained through a restricted-use data license. (See https://ncses.nsf.gov/licensing.)

Notes

1 The analysis on the effect of the COVID-19 pandemic on doctorate recipients is limited to the 51,173 doctorate recipients in 2023 who were asked about the impact of the pandemic on their graduate experience.

2 The calculation of these proportions excluded doctorate recipients who did not report citizenship. Counts of unreported citizenship fluctuated between 610 and 3,022.

3 The exact percentage of women among all doctorate awards in **figure 3**, which excludes respondents who did not report sex or citizenship, is 47.48%.

4 The calculation of these proportions excluded respondents who did not report sex or citizenship.

5 For detailed data on racial and ethnic representation, see National Center for Science and Engineering Statistics. 2023. *Diversity and STEM: Women, Minorities, and Persons with Disabilities: 2023*. NSF 23-315. Alexandria, VA: U.S. National Science Foundation. Available at **https://ncses.nsf.gov/pubs/nsf23315**.

6 For additional data on the race and ethnicity of doctorate recipients, see SED 2023 related detailed **table 1-11**. Race categories exclude Hispanic origin; Hispanic may be any race. From 2003 to 2023, counts of unreported race or ethnicity fluctuated between 434 and 982.

7 In 2003, there were 16,867 S&E U.S. citizen and permanent resident doctorate recipients; in 2023, there were 26,622 (see **figure 2**).

8 The proportion of doctorate recipients by trend broad field out of all doctorate recipients can be derived using data from **figure 1** and **figure 6**.

9 Beginning in 2021, field of doctorate data are collected using a modified version of the 2020 Classification of Instructional Programs (CIP) codes and reported using a new SED-specific taxonomy (**table A-4**). For more details on data comparability, see the 2023 "**Technical Notes**" and the **SED 2021 Taxonomy Changes Working Paper**.

10 Other non-S&E fields include fields such as communications and journalism, public administration and social services, and multidisciplinary/interdisciplinary studies. Some of the overall increase in "other non-S&E fields" after 2021 may be due to the changes in the SED taxonomy in 2021 (see "**Data source**" section for details).

11 The drop in the number of doctorate recipients in the field of education between 2009 and 2011 is at least partly attributable to the reclassification of Doctor of Education (EdD) programs. For details, see "Time series data changes" in the "**Data source**" section.

12 The data in this section are based on the trend broad fields, that is, the set of broad fields used for trend data across all years that offer data that are generally comparable across years. However, the increase in the number of doctorate recipients in non-S&E fields between 2021 and 2023 can also be observed when comparing the data on non-S&E fields using the SED-CIP taxonomy implemented since the 2021 SED.

13 For additional data by citizenship status of doctorate recipients, see related detailed **table 1-6**.

14 In non-S&E fields, the proportion of temporary visa holders increased the most in business, from 37% in 2003 to 53% in 2023. See detailed **table 1-6.**

15 For detailed data on racial and ethnic representation, see ***Diversity and STEM: Women, Minorities, and Persons with Disabilities: 2023***.

16 In 2023, the count of White doctorate recipients in each field is as follows: biological and biomedical sciences (4,549); engineering (2,875); physical sciences (2,183); social sciences (1,950); psychology (2,005); health sciences

(1,199); mathematics and statistics (648); geosciences, atmospheric, and ocean sciences (597); computer and information sciences (475); multidisciplinary/interdisciplinary sciences (526); agricultural sciences and natural resources (578); non-S&E fields (5,472). See also SED 2023 related detailed **table 3-4**.

17 For additional details by field, see SED 2023 related detailed **table 1-11**.

18 For additional data on the fields of education, humanities and arts, and other non-S&E fields, see SED 2023 related detailed **table 1-4**.

19 For data on doctorate recipients with definite postgraduation commitments for employment or postdoctoral training, see SED 2023 related detailed **table 2-1**.

20 See SED 2023 related detailed **table 2-1**.

21 See SED 2023 related detailed **table 2-1**.

22 In 2023, 35,280 of the 57,862 doctorate recipients had definite employment or postdoctoral training commitments in the United States; 13,176 of those reporting their postgraduation location as the United States either did not have definite commitments or did not report their status. Of the 35,280 who reported definite employment or postdoctoral training, 22,462 (64%) had definite commitments in employment, and 12,818 (36%) in postdoc positions.

23 For data on doctorate recipients with definite postgraduation employment commitments in academia, see SED 2023 related detailed **table 2-6**. Academia includes 4-year colleges or universities; medical schools; university-affiliated research institutes; community or 2-year colleges; and foreign educational institutions.

24 In 2003, 226 of 325 doctorate recipients in mathematics and statistics had non-postdoc academic employment commitments, compared to 220 out of 814 doctorate recipients in 2023. In 2003, 235 out of 400 doctorate recipients in computer and information sciences had non-postdoc academic employment commitments, compared to 299 out of 1,385 doctorate recipients. These counts are the underlying numbers used to calculate the percentages in related detailed **table 2-6**.

25 For data on doctorate recipients with definite postgraduation employment commitments in industry or business, see related detailed **table 2-6**.

26 For a discussion on recent trends in employment commitment, please see Heuer R, Einaudi P, Kang K; National Center for Science and Engineering Statistics (NCSES). 2023. *Research Doctorate Conferrals Rebound, Leading to Record Number of U.S. Doctorate Recipients in 2022.* NSF 23-353. Alexandria, VA: U.S. National Science Foundation. Available at **https://ncses.nsf.gov/pubs/nsf23353/**.

27 In 2023, 10,212 of 12,041 S&E temporary visa holder doctorate recipients reported that the location of their postdoc or employment position was in the United States, compared with 4,063 of 5,676 S&E temporary visa holder doctorate recipients in 2003.

Acknowledgments and citation

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Under NCSES contract, staff at RTI International conducted the 2023 survey and played a valuable role in the resulting publications. The following staff provided especially notable contributions: Caren Arbeit, Taylor Campbell, Alex Cone, Peter Einaudi, Jamie Friedman, August Gering, Jonathan Gordon, Jane Griffin, Robin Henke, Ruth Heuer, Saki Kinney, Susan Rotermund, Zach Smith, and Robert Steele.

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