National Center for Science and Engineering Statistics

Directorate Profiles: Technical Notes

Contents

Overview

The *Directorate Profiles* series presents data on research doctorate recipients from U.S. academic institutions by field of degree, using survey data from the National Center for Science and Engineering Statistics (NCSES) within the U.S. National Science Foundation (NSF). There are seven profiles, one each for the following NSF Directorates: Biological Sciences (BIO), Computer and Information Science and Engineering (CISE), STEM Education (EDU), Engineering (ENG), Geosciences (GEO), Mathematical and Physical Sciences (MPS), and Social, Behavioral and Economic Sciences (SBE).

Data Sources

The data were derived from two NCSES survey sources: the Survey of Earned Doctorates (SED) and the Survey of Doctorate Recipients (SDR). The data presented for both SED and SDR were derived by NCSES analysts from restricted-use microdata files. SED data used in these *Directorate Profiles* reflect the characteristics of research doctorate recipients at the time of their graduation in academic years 2002, 2012, and 2022. SDR data used reflect the characteristics for the population of science, engineering, or health research doctorate recipients under age 76 as of 1 February 2021.

SED

The SED is an annual census of all individuals who earned a research doctorate from an accredited U.S. institution in a given academic year. For more detailed information about the SED and its methodology, please see the survey's Technical Notes (available at https://ncses.nsf.gov/surveys/earned-doctorates/2022).

SDR

The SDR is a biennial survey that collects longitudinal data on demographic and general employment characteristics of individuals who have received a research doctorate in a science, engineering, or health field from an accredited U.S. institution. The SED provides the sampling frame for the SDR through its annual update of the longstanding Doctorate Records File (DRF), a cumulative listing of all U.S.-earned doctorate recipients dating back to 1920. For more detailed information on the SDR and its methodology, please see the survey's Technical Notes (available at https://ncses.nsf.gov/surveys/doctorate-recipients/2021#methodology).

Defining Field of Degree

The fields of degree included in each *Directorate Profile* are those related to the work of the respective NSF Directorates. Because of overlapping interests among some NSF Directorates, several degree fields were included in more than one profile. (Table 1.)

TABLE 1

Doctorate fields included in each profile, by NSF Directorate

(Fields)

Directorate	Fields
Biological Sciences (BIO)	Agricultural sciences and natural resources
	Biochemistry
	Bioinformatics, biostatistics, and computational biology
	Cell molecular biology
	Microbiology
	Neurosciences and neurobiology
	Other biological sciences
Computer and Information Science and Engineering (CISE)	Computer and information sciences
	Computer engineering
	Computer science
	Information science and systems
STEM Education (EDU)	Education administration
	Education research
	Science and math education
	Non-science and math education
	Teacher education
	Other education
Engineering (ENG)	Bioengineering and biomedical engineering
	Chemical engineering
	Civil engineering
	Electrical engineering
	Materials science engineering
	Mechanical engineering
	Other engineering
Geosciences (GEO)	Atmospheric sciences
	Earth sciences
	Environmental science
	Ocean sciences
Mathematical and Physical Sciences (MPS)	Chemistry
	Materials sciences
	Mathematics and statistics
	Physics and astronomy
Social, Behavioral and Economic Sciences (SBE)	Economics
	Political science
	Psychology
	Sociology
	Other social sciences

Source(s):
National Center for Science and Engineering Statistics.

Degree fields in visualizations based on SED data use the SED trend fields that facilitate data comparability over time amid survey field taxonomy changes. See SED 2022 Technical Notes, "Data Comparability." The SDR degree field data were based on the SDR field of study (FOS) codes.

Efforts were made to harmonize the degree fields between the two data sources. However, there are differences in the eligible degree fields for each survey (all fields in SED versus only science, engineering, or health fields in SDR), due to the respective surveys' differing target populations. The differences are most notable in the education degree data found in the profile for the Directorate for STEM Education (EDU). SDR data include only a single education field (educational psychology). SED data are available across six degree categories: 1) education administration, 2) education research (which includes the detailed field of educational psychology), 3) non-science and math education, 4) science and math education, 5) teacher education, and 6) other education.

Graphics: Data and Methodology

The following sections provide the data source, tabular view, and other relevant methodological information for each visualization topic presented across the *Directorate Profiles*.

Number

The *Directorates Profiles* column chart visualization for the number of research doctorate recipients for the academic years 2002, 2012, and 2022 is based on SED data. This visualization's data are also presented below in tabular form, as Table A-1.

TABLE A-1

Research doctorates: 2002, 2012, and 2022

(Number)

Directorate	2002	2012	2022
Biological Sciences (BIO)	6,704	9,558	10,602
Computer and Information Science and Engineering (CISE)	969	2,249	4,676
STEM Education (EDU)	6,459	4,802	4,509
Engineering (ENG)	5,081	8,469	11,340
Geosciences (GEO)	802	1,023	1,231
Mathematical and Physical Sciences (MPS)	4,142	6,341	7,795
Social, Behavioral and Economic Sciences (SBE)	7,594	9,169	9,441

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

Sex

The 100% stacked column chart showing the distribution of research doctorate recipients by sex for the academic years 2002, 2012, and 2022 is based on SED data. The 2022 SED has two response options for sex: male and female. The distribution calculation excludes respondents who did not report sex. (Table A-2.)

TABLE A-2

Share of research doctorates, by sex: 2002, 2012, and 2022

(Percent)

Directorate	2002		2012		2022	
	Male	Female	Male	Female	Male	Female
Biological Sciences (BIO)	57	43	48	52	46	54
Computer and Information Science and Engineering (CISE)	81	19	81	19	78	22
STEM Education (EDU)	34	66	31	69	28	72
Engineering (ENG)	82	18	78	22	73	27
Geosciences (GEO)	69	32	57	43	53	47
Mathematical and Physical Sciences (MPS)	73	27	71	29	68	32
Social, Behavioral and Economic Sciences (SBE)	45	55	42	58	39	61

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

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

Race and ethnicity

The 100% stacked column chart showing the distribution of research doctorate recipients by race and ethnicity for academic year 2022 is based on SED data. The distribution calculation excludes respondents who did not report ethnicity or race. (Table A-3.)

TABLE A-3

Share of research doctorates, by race and ethnicity: 2022

(Percent)

Directorate	White	Asian	Hispanic or Latino	Black or African American	Other
Biological Sciences (BIO)	53	27	11	5	3
Computer and Information Science and Engineering (CISE)	34	57	4	3	1
STEM Education (EDU)	57	12	11	17	3
Engineering (ENG)	41	48	6	3	2
Geosciences (GEO)	57	29	9	3	2
Mathematical and Physical Sciences (MPS)	48	41	6	3	3
Social, Behavioral and Economic Sciences (SBE)	57	19	11	9	3

Note(s):
Excludes respondents who did not report ethnicity or race. Hispanic or Latino may be of any race; race categories exclude Hispanic origin. Other includes American Indian or Alaska Native, Native Hawaiian and Other Pacific Islander, and more than one race.

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2022.

In the 2022 SED, 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 may select one or more of the following race options: American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, and White. In these profiles, respondents who indicated a single race of Asian, Black or African American, or White are reported in their respective racial groups. Respondents who indicated American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, or more than one race are reported as the category "Other."

Field of degree

The 100% stacked column chart showing the distribution of research doctorate recipients by field of degree for academic year 2022 is based on SED data. (Table A-4.) Each profile presents data on the degree fields of interest to the NSF Directorate; see "Defining Field of Degree" for more information.

TABLE A-4

Share of research doctorates, by field of degree: 2022

(Percent)

Directorate	Field of degree	Percent
Biological Sciences (BIO)	Agricultural sciences and natural resources	12
	Bioinformatics, biostatistics, and computational biology	11
	Biochemistry	10
	Neurosciences and neurobiology	10
	Cell molecular biology	10
	Microbiology	7
	Other biological sciences	40
Computer and Information Science and Engineering (CISE)	Computer engineering	40

TABLE A-4

Share of research doctorates, by field of degree: 2022

(Percent)

Directorate	Field of degree	Percent
	Computer science	39
	Computer and information sciences	14
	Information science and systems	7
STEM Education (EDU)	Education research	51
	Education administration	16
	Non-science and math education	14
	Science and math education	6
	Teacher education	2
	Other education	11
Engineering (ENG)	Electrical engineering	25
	Mechanical engineering	15
	Bioengineering and biomedical engineering	11
	Civil engineering	11
	Materials science engineering	10
	Chemical engineering	10
	Other engineering	18
Geosciences (GEO)	Earth sciences	54
	Atmospheric sciences	23
	Environmental science	12
	Ocean sciences	10
Mathematical and Physical Sciences (MPS)	Chemistry	39
	Mathematics and statistics	29
	Physics and astronomy	24
	Materials sciences	7
Social, Behavioral and Economic Sciences (SBE)	Psychology	42
	Economics	15
	Political science	12
	Sociology	6
	Other social sciences	24

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2022.

Citizenship status and field of degree

The 100% stacked bar chart showing the distribution of research doctorate recipients by citizenship status for academic year 2022 is based on SED data. SED data have the following options for citizenship status: U.S. citizen, permanent resident, and temporary visa holder. For these profiles, responses were collapsed into two categories: U.S. citizens and permanent residents and temporary visa holders. The distribution calculation excludes respondents who did not report citizenship. (Table A-5.)

TABLE A-5

Share of research doctorates, by citizenship status and field of degree: 2022

(Percent)

Directorate	Field of degree	U.S. citizens and permanent residents	Temporary visa holder
Biological Sciences (BIO)	Total	73	27

TABLE A-5

Share of research doctorates, by citizenship status and field of degree: 2022

(Percent)

Directorate	Field of degree	U.S. citizens and permanent residents	Temporary visa holder
	Agricultural sciences and natural resources	60	40
	Bioinformatics, biostatistics, and computational biology	63	37
	Biochemistry	69	31
	Neurosciences and neurobiology	81	19
	Cell molecular biology	76	24
	Microbiology	84	16
	Other biological sciences	76	24
Computer and Information Science and Engineering (CISE)	Total	33	67
	Computer engineering	28	72
	Computer science	38	62
	Computer and information sciences	31	69
	Information science and systems	38	62
STEM Education (EDU)	Total	86	14
	Education research	86	14
	Education administration	92	8
	Non-science and math education	84	16
	Science and math education	83	17
	Teacher education	84	16
	Other education	87	13
Engineering (ENG)	Total	43	57
	Electrical engineering	30	70
	Mechanical engineering	45	55
	Bioengineering and biomedical engineering	71	29
	Civil engineering	33	67
	Materials science engineering	50	50
	Chemical engineering	50	50
	Other engineering	42	58
Geosciences (GEO)	Total	64	36
	Earth sciences	62	38
	Atmospheric sciences	64	36
	Environmental science	67	33
	Ocean sciences	72	28
Mathematical and Physical Sciences (MPS)	Total	56	44
	Chemistry	61	39
	Mathematics and statistics	46	54
	Physics and astronomy	61	39
	Materials sciences	48	52
Social, Behavioral and Economic Sciences (SBE)	Total	76	24
	Psychology	91	9
	Economics	38	62
	Political science	72	28
	Sociology	82	18
	Other social sciences	75	25

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

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2022.

Definite non-postdoctoral employment commitments, by sector

The 100% stacked column chart showing the distribution of research doctorate recipients with definite non-postdoctoral employment commitments by employer type for academic years 2002, 2012, and 2022 is based on SED data. The 14 employer types included as response options in the employment commitments variable were collapsed to create three categories: educational institution, government, and business or industry. The educational institution category includes U.S. 4-year colleges or universities, U.S. medical schools, U.S. university-affiliated research institutes, U.S. community or 2-year colleges, U.S. elementary or secondary schools, and foreign (i.e., non-U.S.) educational institutions. Government includes U.S. federal, state, and local governments. Business or industry includes for-profit industries or businesses, not-for-profit organizations, those who are self-employed, foreign (i.e., non-U.S.) governments, and other. The distribution calculation excludes respondents who did not report employer type. (Table A-6.)

TABLE A-6

Share of research doctorates with definite non-postdoctoral employment commitments, by sector: 2002, 2012, and 2022
(Percent)

Directorate	Year	Educational institution[a]	Government[b]	Business and industry[c]
Biological Sciences (BIO)	2002	46	12	42
	2012	41	13	47
	2022	22	7	71
Computer and Information Science and Engineering (CISE)	2002	43	4	53
	2012	24	4	72
	2022	18	3	79
STEM Education (EDU)	2002	85	5	11
	2012	85	3	12
	2022	78	4	17
Engineering (ENG)	2002	21	9	70
	2012	17	8	75
	2022	13	6	81
Geosciences (GEO)	2002	36	19	45
	2012	40	18	42
	2022	27	22	50
Mathematical and Physical Sciences (MPS)	2002	38	5	57
	2012	39	6	55
	2022	18	4	78
Social, Behavioral and Economic Sciences (SBE)	2002	63	9	28
	2012	65	9	26
	2022	48	11	41

[a] Educational institution includes U.S. 4-year colleges or universities, U.S. medical schools, U.S. university-affiliated research institutes, U.S. community or 2-year colleges, U.S. elementary or secondary schools, and foreign (i.e., non-U.S.) educational institutions.

[b] Government includes U.S. federal, state, and local governments.

[c] Business or industry includes for-profit industries or businesses, not-for-profit organizations, those who are self-employed, foreign (i.e., non-U.S.) governments, and other.

Note(s):
Excludes respondents who did not report employer type.

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2022.

Percentage with no graduate education-related debt

The highlighted percent of academic year 2022 research doctorate recipients with no graduate education-related debt at the time of graduation is based on SED data. The percentage calculation excludes respondents who did not report debt information.

Graduate education-related debt among those with graduate debt

The pie chart showing the distribution by amount of debt for academic year 2022 doctorate recipients who reported graduate education-related debt is based on SED data. The distribution calculation excludes respondents who did not report debt information. (Table A-7.)

TABLE A-7

Share of research doctorates with graduate education-related debt among those with graduate debt: 2022

(Percent)

Directorate	$10,000 or less	$10,001–$30,000	$30,001–$60,000	$60,001 or more
Biological Sciences (BIO)	28	26	19	27
Computer and Information Science and Engineering (CISE)	31	30	17	22
STEM Education (EDU)	12	19	20	49
Engineering (ENG)	33	30	18	19
Geosciences (GEO)	32	25	20	22
Mathematical and Physical Sciences (MPS)	34	28	16	21
Social, Behavioral and Economic Sciences (SBE)	14	21	18	47

Note(s):
Excludes respondents who did not report debt.

Source(s):
National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2022.

Employment sector, by field of degree

The 100% stacked bar chart showing the distribution of the population of research doctorate recipients under age 76 by employment sector and field of degree as of 2021 is based on SDR data. (Table A-8.) The SDR includes data on three employment sectors: 1) education institution, 2) business or industry, and 3) government. Educational institution includes 4-year colleges or universities, medical schools (including university-affiliated hospital or medical centers), university-affiliated research institutes, 2-year colleges, community colleges, technical institutes, precollege institutions, and other educational institutions. Business or industry includes private for profit, private not for profit, self-employed or business owners in incorporated or nonincorporated business, non-U.S. governments, and employers not broken out separately. Government includes U.S. federal, state, and local governments.

TABLE A-8

Share of research doctorates, by employment sector and field of degree: 2021

(Percent)

Directorate	Field of degree	Educational institution[a]	Government[b]	Business and industry[c]
Biological Sciences (BIO)	Total	47	10	43
	Agricultural sciences and natural resources	49	15	36
	Bioinformatics, biostatistics, and computational biology	36	6	57
	Biochemistry	44	8	49
	Neurosciences and neurobiology	52	7	41
	Cell molecular biology	42	9	49
	Microbiology	43	14	43
	Other biological sciences	49	10	41
Computer and Information Science and Engineering (CISE)	Total	38	4	58
	Computer engineering	34	4	61

TABLE A-8

Share of research doctorates, by employment sector and field of degree: 2021

(Percent)

Directorate	Field of degree	Educational institution[a]	Government[b]	Business and industry[c]
	Computer science	37	4	59
	Computer and information sciences	49	5	46
	Information science and systems	50	7	43
STEM Education (EDU)	Educational psychology	63	5	32
Engineering (ENG)	Total	33	8	60
	Electrical engineering	29	5	66
	Mechanical engineering	34	7	59
	Bioengineering and biomedical engineering	35	6	59
	Civil engineering	40	11	48
	Materials science engineering	25	7	68
	Chemical engineering	25	9	66
	Other engineering	39	11	51
Geosciences (GEO)	Total	49	19	32
	Earth sciences	50	15	35
	Atmospheric sciences	45	25	29
	Environmental science	51	17	32
	Ocean sciences	50	25	25
Mathematical and Physical Sciences (MPS)	Total	43	7	50
	Chemistry	37	7	56
	Mathematics and statistics	63	4	33
	Physics and astronomy	43	11	46
	Materials sciences	30	8	62
Social, Behavioral and Economic Sciences (SBE)	Total	54	10	36
	Psychology	41	10	49
	Economics	58	12	30
	Political science	67	10	23
	Sociology	76	6	18
	Other social sciences	71	8	21

[a] Educational institution includes 4-year colleges or universities, medical schools (including university-affiliated hospital or medical centers), university-affiliated research institutes, 2-year colleges, community colleges, technical institutes, precollege institutions, and other educational institutions.

[b] Government includes U.S. federal, state, and local governments.

[c] Business or industry includes private for profit, private not for profit, self-employed or business owners in incorporated or nonincorporated business, non-U.S. governments, and employers not broken out separately.

Note(s):
Educational psychology is the only detailed education field of degree available in the Survey of Doctorate Recipients.

Source(s):
National Center for Science and Engineering Statistics, Survey of Doctorate Recipients, 2021.

Median salary, by field of degree

The bar chart showing the median salary for the population of research doctorate recipients under age 76 by field of degree as of 2021 is based on SDR data. (Table A-9.)

TABLE A-9

Median salary of research doctorates, by field of degree: 2021

(Dollars)

Directorate	Field of degree	Median salary
Biological Sciences (BIO)	Total	105,000
	Agricultural sciences and natural resources	92,000
	Bioinformatics, biostatistics, and computational biology	140,000
	Biochemistry	115,000
	Neurosciences and neurobiology	107,000
	Cell molecular biology	113,000
	Microbiology	113,000
	Other biological sciences	100,000
Computer and Information Science and Engineering (CISE)	Total	150,000
	Computer engineering	150,000
	Computer science	150,000
	Computer and information sciences	125,000
	Information science and systems	124,000
STEM Education (EDU)	Educational psychology	88,000
Engineering (ENG)	Total	130,000
	Electrical engineering	150,000
	Mechanical engineering	121,000
	Bioengineering and biomedical engineering	126,000
	Civil engineering	110,000
	Materials science engineering	135,000
	Chemical engineering	135,000
	Other engineering	125,000
Geosciences (GEO)	Total	97,000
	Earth sciences	98,000
	Atmospheric sciences	100,000
	Environmental science	88,000
	Ocean sciences	97,000
Mathematical and Physical Sciences (MPS)	Total	117,000
	Chemistry	115,000
	Mathematics and statistics	100,000
	Physics and astronomy	120,000
	Materials sciences	130,000
Social, Behavioral and Economic Sciences (SBE)	Total	97,000
	Psychology	98,000
	Economics	120,000
	Political science	98,000
	Sociology	90,000
	Other social sciences	82,000

Note(s):
Educational psychology is the only detailed education field of degree available in the Survey of Doctorate Recipients.

Source(s):
National Center for Science and Engineering Statistics, Survey of Doctorate Recipients, 2021.

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