



Higher Education R&D Expenditures Increased 4.7%, Exceeded \$75 Billion in FY 2017

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Funding of higher education research and development increased across all funding sources for a consecutive year in FY 2017. Total R&D expenditures reached \$75.3 billion, up 4.7% from \$71.9 billion in FY 2016 (table 1). Federal funding of R&D increased in both current and constant dollars for two straight years for the first time since FYs 2009–2011, according to data from the Higher Education Research and Development (HERD) Survey conducted by the National Center for

Science and Engineering Statistics (NCSES) within the National Science Foundation (NSF).

The FY 2017 \$75.3 billion total represents 903 degree-granting institutions that spent at least \$150,000 in R&D during the fiscal year. The remainder of this InfoBrief will focus on the 644 institutions included in the full version of the HERD Survey (standard form) that had at least \$1 million in R&D performance during their

previous fiscal year. These institutions accounted for 99.8% of the total R&D expenditures reported for FY 2017. For more information, see “Data Sources, Limitations, and Availability.”

R&D Expenditures, by Source of Funding

When adjusted for inflation, federal funding for higher education R&D increased 1.7% between FY 2016 and FY 2017 (figure 1). Funding from nonfederal sources also increased from FY 2016, rising 3.7% in constant dollars. The overall share of higher education R&D supported by federal government funding in FY 2017 (53.5%) was nearly the same as in FY 2016 (54.0%) and the lowest share since the survey began in 1953. Federal funding in current dollars increased from \$38.8 billion in FY 2016 to \$40.3 billion in FY 2017.

R&D expenditures funded from universities’ own sources reached \$18.9 billion in FY 2017. This total accounted for 25.1% of total higher education R&D and 54.0% of total nonfederal funding. Both shares are virtually unchanged since FY 2016 and remain the largest since the advent of the survey. Almost two-thirds of institutional spending

TABLE 1. Higher education R&D expenditures, by source of funds: FYs 2012–2017
(Millions of current dollars)

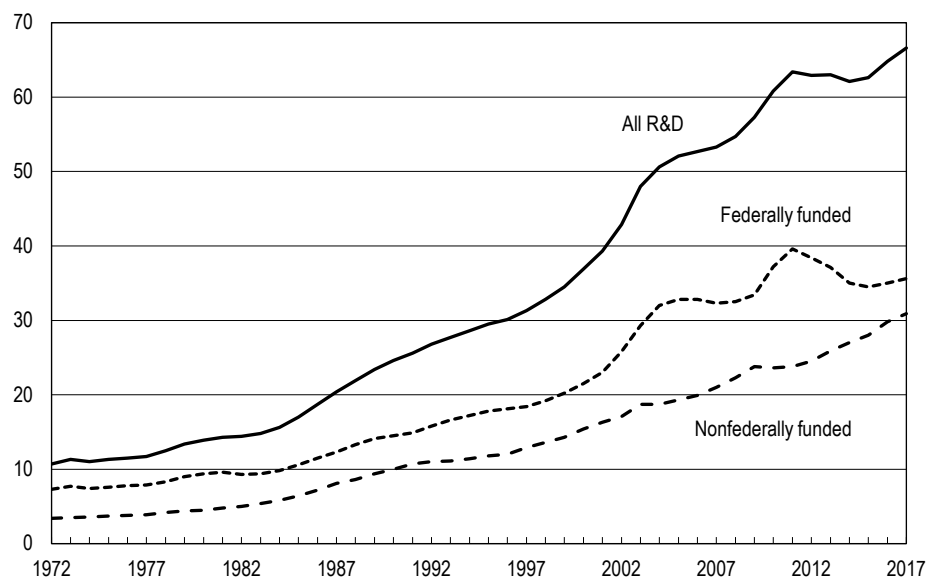
Fiscal year	All R&D expenditures	Source of funds					
		Federal government	State and local government	Institution funds	Business	Nonprofit organizations	All other sources
2012	65,873	40,217	3,744	13,625	3,279	4,037	970
2013	67,145	39,510	3,706	14,974	3,515	3,903	1,537
2014	67,349	38,031	3,915	15,781	3,733	3,977	1,911
2015	68,692	37,911	3,864	16,638	4,008	4,235	2,037
2016	71,935	38,845	4,034	18,004	4,216	4,629	2,207
2017	75,315	40,305	4,247	18,922	4,430	5,133	2,278

NOTES: Because of rounding, detail may not add to total. Includes all institutions surveyed in the fiscal years shown. Institutions reporting less than \$1 million in total R&D expenditures in the previous year completed a shorter version of the survey questionnaire. Respondents to the short form questionnaire accounted for \$140 million (0.2%) of total R&D expenditures in FY 2017.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Higher Education Research and Development Survey.

FIGURE 1. Higher education R&D expenditures, by source of funds: FYs 1972–2017

Billions of constant 2009 dollars



NOTES: Because of rounding, detail may not add to total. Includes all institutions surveyed in the fiscal years shown. Prior to FY 2003, totals did not include R&D expenditures in non-science and engineering fields.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Higher Education Research and Development Survey.

(\$12.1 billion) came from direct funding of R&D activities through the universities' own research accounts (figure 2). Unrecovered indirect costs (the amount of indirect costs that are not reimbursed to the institution for externally funded R&D) totaled \$5.2 billion in FY 2017, and cost sharing commitments accounted for \$1.6 billion. All of these totals increased from FY 2016, equaling an overall growth of 5.1%.

Other sources of nonfederal funding rose similarly over the past year, including \$4.4 billion funded by businesses (5.1% increase), \$4.2 billion funded by state and local government (5.3% increase), and \$2.3 billion funded by undifferentiated other sources—such as foreign governments, other universities, or gifts designated by donors for research (3.2% increase). The growth in funding from nonprofit organizations (10.9%) exceeded all

other nonfederal sources, reaching \$5.1 billion in FY 2017.

Expenditures, by Type of R&D

The share of dollars spent by universities on basic research has gradually declined since FY 2010, when the HERD Survey first asked institutions to categorize their expenditures by basic research, applied research, or experimental development.² Of the \$75.2 billion spent on R&D in FY 2017, 61.8% was categorized as basic research, 28.5% as applied research, and 9.6% as experimental development (table 2). By contrast, the shares in FY 2010 were 65.9% for basic research, 25.3% for applied research, and 8.8% for experimental development. While both federal and nonfederal sources funded similar shares of applied research (about 28%) in FY 2017, a higher proportion of federal funding (63.7%) is devoted to basic research

compared with funding by nonfederal sources (59.6%).

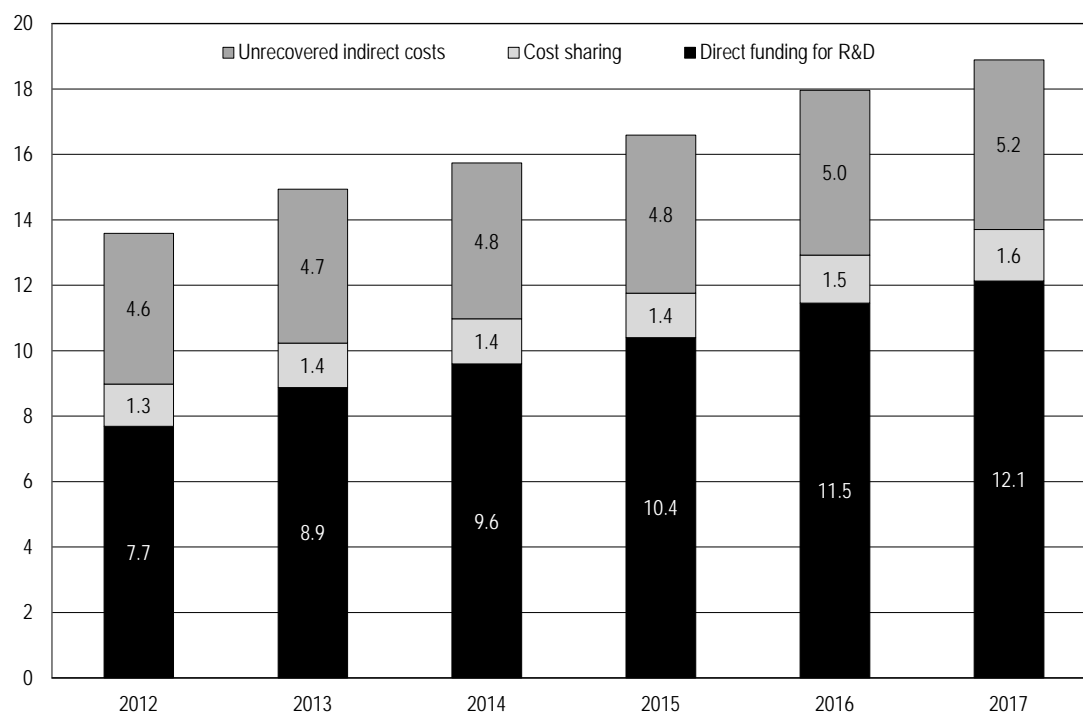
R&D Expenditures, by Field

R&D expenditures in science (\$58.9 billion), engineering (\$11.9 billion), and non-science and engineering (non-S&E) (\$4.3 billion) had similar increases of between 4.5% and 4.8% from FY 2016 to FY 2017 (table 3). Two thirds of the \$3.4 billion growth in R&D expenditures for FY 2017 stemmed from increases in the life sciences subfields of biological and biomedical sciences (up \$664 million) and health sciences (up \$1,609 million).

Several of the subfields added to the survey in FY 2016 showed large percentage increases in FY 2017, such as industrial and manufacturing engineering (44.2%), materials science (31.4%), and anthropology (15.1%).³ The subfields of sciences, not elsewhere classified (nec); engineering, nec; and

FIGURE 2. Source of institutionally funded R&D expenditures: FYs 2012–17

Billions of current dollars



SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Higher Education Research and Development Survey.

TABLE 2. Higher education R&D expenditures, by source of funds and type of R&D: FYs 2010–17

(Millions of current dollars)

Source and funds and type of R&D	2010	2011	2012	2013	2014	2015	2016	2017
Total								
All R&D expenditures	61,287	65,274	65,729	67,013	67,197	68,551	71,795	75,175
Basic research	40,416	42,809	42,402	43,305	42,989	43,851	45,103	46,465
Applied research	15,478	16,734	17,296	17,391	17,746	18,025	19,973	21,461
Experimental development	5,392	5,732	6,032	6,317	6,461	6,675	6,719	7,249
Federal								
All R&D expenditures	37,478	40,768	40,142	39,446	37,960	37,849	38,778	40,238
Basic research	25,400	27,331	26,469	26,072	24,905	24,942	24,949	25,630
Applied research	9,362	10,499	10,578	10,327	10,016	9,974	10,887	11,561
Experimental development	2,716	2,938	3,095	3,047	3,039	2,932	2,942	3,047
Nonfederal								
All R&D expenditures	23,809	24,506	25,587	27,567	29,236	30,702	33,017	34,937
Basic research	15,017	15,478	15,932	17,234	18,084	18,909	20,155	20,835
Applied research	6,116	6,235	6,718	7,064	7,730	8,051	9,086	9,900
Experimental development	2,676	2,793	2,937	3,270	3,422	3,742	3,777	4,203

NOTES: This table includes only institutions reporting \$1 million or more in total R&D expenditures in the previous fiscal year. Institutions reporting less than \$1 million in total R&D expenditures in the previous fiscal year completed a shorter version of the survey form that did not collect R&D expenditures by type of R&D.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Higher Education Research and Development Survey.

TABLE 3. Higher education R&D expenditures, by R&D field: FYs 2016–17
(Thousands of current dollars)

Field	2016	2017	% change 2016–17
All R&D fields	71,795,275	75,174,941	4.7
Science	56,266,661	58,932,076	4.7
Computer and information sciences	2,078,154	2,191,762	5.5
Geosciences, atmospheric sciences, and ocean sciences	3,085,624	3,154,446	2.2
Atmospheric science and meteorology	626,457	623,871	-0.4
Geological and earth sciences	1,000,064	1,086,382	8.6
Ocean sciences and marine sciences	1,097,963	1,101,625	0.3
Geosciences, atmospheric sciences, and ocean sciences, nec	361,140	342,568	-5.1
Life sciences	40,868,307	43,095,195	5.4
Agricultural sciences	3,294,989	3,282,797	-0.4
Biological and biomedical sciences	13,044,385	13,708,543	5.1
Health sciences	22,374,973	23,983,549	7.2
Natural resources and conservation	690,376	686,729	-0.5
Life sciences, nec	1,463,584	1,433,577	-2.1
Mathematics and statistics	681,562	701,085	2.9
Physical sciences	4,888,752	5,049,175	3.3
Astronomy and astrophysics	622,101	648,744	4.3
Chemistry	1,774,776	1,792,738	1.0
Materials science	173,314	227,682	31.4
Physics	2,118,434	2,154,152	1.7
Physical sciences, nec	200,127	225,859	12.9
Psychology	1,219,432	1,242,853	1.9
Social sciences	2,368,285	2,550,173	7.7
Anthropology	96,638	111,199	15.1
Economics	399,250	434,743	8.9
Political science and government	385,305	404,512	5.0
Sociology, demography, and population studies	503,931	551,645	9.5
Social sciences, nec	983,161	1,048,074	6.6
Sciences, nec	1,076,545	947,387	-12.0
Engineering	11,381,183	11,897,397	4.5
Aerospace, aeronautical, and astronautical engineering	883,194	994,422	12.6
Bioengineering and biomedical engineering	1,084,749	1,220,451	12.5
Chemical engineering	885,107	933,776	5.5
Civil engineering	1,330,778	1,302,098	-2.2
Electrical, electronic, and communications engineering	2,517,183	2,727,498	8.4
Industrial and manufacturing engineering	238,780	344,224	44.2
Mechanical engineering	1,435,690	1,531,092	6.6
Metallurgical and materials engineering	744,333	736,717	-1.0
Engineering, nec	2,261,369	2,107,119	-6.8
Non-S&E	4,147,431	4,345,468	4.8
Business management and business administration	647,858	731,868	13
Communication and communications technologies	167,872	205,561	22.5
Education	1,337,779	1,380,221	3.2
Humanities	445,995	498,700	11.8
Law	184,588	223,829	21.3
Social work	211,920	236,069	11.4
Visual and performing arts	138,608	130,807	-5.6
Non-S&E, nec	1,012,811	938,413	-7.3

nec = not elsewhere classified; S&E = science and engineering.

NOTES: This table includes only institutions reporting \$1 million or more in total R&D expenditures in the previous fiscal year. Institutions reporting less than \$1 million in total R&D expenditures in the previous fiscal year completed a shorter version of the survey form that did not collect federally financed R&D expenditures by detailed field.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Higher Education Research and Development Survey.

non-S&E, nec all declined as universities tried to more accurately report their expenditures by R&D field and removed some funds that were not pertinent to the survey.

Top University Research Performers

The top 30 institutions accounted for 42.0% of the total spent on R&D

within the higher education sector in FY 2017, the same share as in FY 2016 (table 4). Only two of the top 30 institutions reported declines in their R&D spending from the prior year, with each declining less than 1%. The same 30 institutions were the largest university R&D performers in FY 2016 and FY 2017. Within the top 30, only New York University saw its rank change by more

than three places in FY 2017, rising five places to 18th. This continued a trend by the university, which saw its reported expenditures triple since 2006 and double since 2012, due to more detailed accounting of institution funding, increased foreign funding of R&D within its medical school, and increased R&D expenditures at its Abu Dhabi campus.

TABLE 4. Thirty institutions reporting the largest FY 2017 R&D expenditures in all fields: FYs 2015–17 (Millions of current dollars)

Rank	Institution	2015	2016	2017	% change 2016–17
	All institutions	68,551	71,795	75,175	4.7
	Leading 30 institutions	28,343	30,157	31,548	4.6
1	Johns Hopkins U. ^a	2,306	2,431	2,562	5.4
2	U. Michigan, Ann Arbor	1,369	1,436	1,530	6.5
3	U. California, San Francisco	1,127	1,294	1,409	8.9
4	U. Pennsylvania	864	1,296	1,374	6.0
5	U. Washington, Seattle	1,181	1,278	1,348	5.5
6	U. Wisconsin-Madison	1,069	1,158	1,193	3.1
7	U. California, San Diego	1,101	1,087	1,133	4.3
8	Duke U.	1,037	1,056	1,127	6.7
9	Harvard U.	1,014	1,077	1,123	4.3
10	Stanford U.	1,023	1,066	1,110	4.1
11	U. North Carolina, Chapel Hill	967	1,045	1,102	5.4
12	U. California, Los Angeles	1,021	1,038	1,077	3.8
13	Cornell U.	954	974	984	1.1
14	Massachusetts Institute of Technology	931	946	952	0.6
15	Yale U.	803	882	951	7.9
16	U. Pittsburgh, Pittsburgh	861	890	940	5.6
17	U. Minnesota, Twin Cities	881	910	922	1.3
18	New York U.	602	810	918	13.3
19	Texas A&M U., College Station and Health Science Center	867	893	905	1.4
20	Columbia U. in the City of New York	868	837	893	6.7
21	U. Texas M. D. Anderson Cancer Center	833	852	888	4.2
22	Ohio State U.	818	818	864	5.6
23	Pennsylvania State U., University Park and Hershey Medical Center	791	826	855	3.5
24	Georgia Institute of Technology	765	791	804	1.7
25	U. Florida	740	791	801	1.3
26	U. California, Berkeley	789	774	771	-0.4
27	U. Southern California	691	703	764	8.7
28	Washington U., Saint Louis	694	741	754	1.8
29	Northwestern U.	656	713	752	5.4
30	U. California, Davis	721	742	738	-0.5

^a Johns Hopkins University includes Applied Physics Laboratory, with \$1,472 million in total R&D expenditures in FY 2017.

NOTES: Because of rounding, detail may not add to total. Total for all institutions excludes \$140 million reported on the short form questionnaire by institutions with less than \$1 million in R&D during the previous fiscal year. Institutions ranked are geographically separate campuses headed by a campus-level president or chancellor. The University of Texas, Austin was ranked number 30 in FY 2015, but was not in the top 30 in subsequent years.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Higher Education Research and Development Survey.

Data Sources, Limitations, and Availability

The fiscal year referred to throughout this report is the academic fiscal year. For most institutions, FY 2017 represents 1 July 2016 through 30 June 2017. The higher education R&D expenditures data were collected from a census of 903 universities and colleges that grant a bachelor's degree or higher and expended at least \$150,000 in R&D in FY 2017. To reduce respondent burden, the HERD Survey was revised in FY 2012 to request abbreviated data from institutions reporting less than \$1 million in R&D expenditures during the previous fiscal year. Except for figure 1 and table 1, the totals shown in this InfoBrief do not include expenditures of 259 institutions that completed a short-form version of the survey in FY 2017. These institutions accounted for \$140 million (0.2%) of total higher education R&D expenditures in FY 2017.

The amounts reported include all funds expended for activities specifically organized to produce research outcomes and sponsored by an outside

organization or separately accounted for using institution funds. R&D expenditures at university-administered federally funded research and development centers (FFRDCs) are collected in a separate survey, the FFRDC Research and Development Survey, and these data are available at <https://www.nsf.gov/statistics/ffrdc/>.

The full set of data tables and technical information from this survey is available at <https://ncesdata.nsf.gov/herd/2017/>.

Notes

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2. Prior to 2010, the survey requested the percentage of the total devoted to basic research instead of specific dollar amounts for basic research, applied research, and experimental development.

3. Substantive changes were made to the field list and classification structure for the FY 2016 survey to coordinate the categories with other NCSES surveys. Several fields were renamed, such as medical sciences to health sciences, and some disciplines were moved to different subfields to achieve comparability across surveys. In particular, many of the disciplines listed under life sciences, not elsewhere classified (nec) were moved to health sciences. In addition, four new subfields were added: natural resources and conservation under life sciences, materials science under physical sciences, anthropology under social sciences, and industrial and manufacturing engineering under engineering. These changes primarily affect trends in the revised subfields and do not significantly affect the broad field trends. For complete details on the changes, see Technical Notes, Appendix A in the full set of 2016 data tables (<https://ncesdata.nsf.gov/herd/2016/>).