InfoBrief
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Universities Report Increased Federal R&D Funding after 4-year Decline; R&D Fields Revised for FY 2016

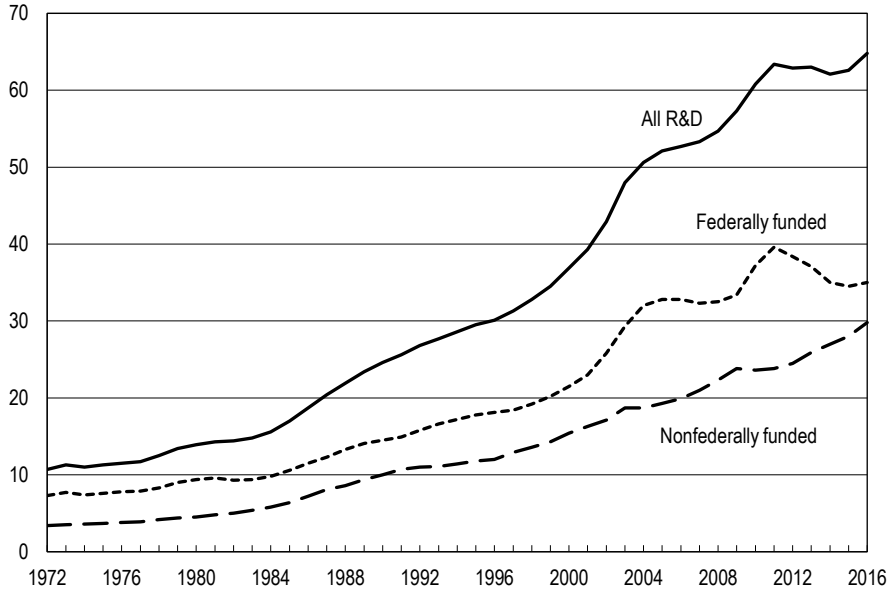
by Ronda Britt[1]

Federal funding of higher education research and development increased in both current and constant dollars for the first time in 5 years, according to data from the Higher Education Research and Development (HERD) Survey by the National Center for Science and Engineering Statistics (NCSES) within the National Science Foundation (NSF). When adjusted for inflation, federal funding for higher education R&D increased by 1.4% between FY 2015 and FY 2016 (figure 1).

Overall, universities reported current dollar R&D expenditures of $72.0 billion in FY 2016 (table 1), a 4.8% increase from the FY 2015 total of $68.6 billion. This total represents the reported totals of 902 degree-granting institutions that spent at least $150,000 in R&D in the previous fiscal year. The remainder of this InfoBrief will focus on the 640 institutions included in the full version of the HERD Survey (standard form) that reported at least $1 million in R&D during their previous fiscal year and that accounted for 99.8% of the total R&D expenditures reported for FY 2016. For more information, see "Data Sources, Limitations, and Availability."

FIGURE 1. Higher education R&D expenditures, by source of funds: FYs 1972–2016

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.

R&D Expenditures, by Source of Funding

In current dollars, federally funded R&D at universities increased 2.5% to $38.8 billion in FY 2016 (table 2). However, the share of higher education R&D supported by the federal government continued to decline. Since FY 2011, federally funded expenditures have dropped from 62.5% to 54.0% of total R&D expenditures.

TABLE 1. Higher education R&D expenditures, by source of funds, R&D field, and survey population: FY 2016
(Thousands of current dollars)

Source of funds and R&D field	All institutions	Survey population	
		Short form	Standard form
All R&D expenditures	71,971,736	138,428	71,833,308
By source of funds			
Federal government	38,860,649	67,107	38,793,542
State and local government	4,033,779	8,499	4,025,280
Institution funds	18,014,538	39,576	17,974,962
Institutionally financed research	11,505,260	34,173	11,471,087
Cost sharing	1,432,876	2,043	1,430,833
Unrecovered indirect costs	5,076,402	3,360	5,073,042
Business	4,215,883	5,320	4,210,563
Nonprofit organizations	4,628,526	13,726	4,614,800
All other sources	2,218,361	4,200	2,214,161
By R&D field			
Science	56,392,202	101,540	56,290,662
Computer and information sciences[a]	2,082,275	4,391	2,077,884
Geosciences, atmospheric, and ocean sciences[a]	3,095,606	7,832	3,087,774
Life sciences	40,933,821	45,971	40,887,850
Mathematics and statistics[a]	686,061	4,400	681,661
Physical sciences	4,913,289	19,724	4,893,565
Psychology	1,222,859	4,138	1,218,721
Social sciences	2,374,649	8,078	2,366,571
Sciences, nec	1,083,642	7,006	1,076,636
Engineering	11,394,686	12,959	11,381,727
Non-S&E	4,184,848	23,929	4,160,919

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

[a] As part of the reclassification of disciplines, some R&D field names have changed. See Technical Notes, Appendix A for details.

NOTE: Institutions are included in the short form population if they reported less than $1 million in total R&D expenditures during the previous fiscal year.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Higher Education Research and Development Survey, FY 2016.

Universities reported increases in expenditures funded by all the major R&D funding agencies except NSF. Expenditures funded by the National Aeronautics and Space Administration and the Departments of Agriculture, Defense, Energy, and Health and Human Services increased between about 2% and 8% over FY 2015, while NSF-funded expenditures remained flat. Expenditures funded by other federal agencies declined almost 5% in FY 2016.

All of the nonfederal funding sources showed increases from FY 2015 to FY 2016, in total rising 7.6% to $33.0 billion in FY 2016. Expenditures funded by nonprofit organizations had the largest increase, up 9.4% to $4.6 billion. Nonfederal funding reported as all other sources—such as foreign governments, other universities, or gifts designated by the donors for research—also rose nearly 9% to $2.2 billion in FY 2016.

The universities' own funding of R&D continued to rise in FY 2016, increasing 8.2% from the FY 2015 total to reach nearly $18 billion. Continuing the trend of recent years, the bulk of this growth has been in the institutions' direct funding of R&D activities, which has risen 49.1% since FY 2012 to $11.5 billion in FY 2016 (figure 2). Cost sharing on sponsored projects has stayed roughly stable at $1.4 billion since FY 2013. Unrecovered indirect costs, or the amount of indirect costs that are not reimbursed to the institution for externally funded R&D, has risen more slowly over the past 4 years, with a 4.7% increase between FY 2015 and FY 2016. Unrecovered indirect costs now total over $5 billion, or 7% of all R&D expenditures within the higher education sector.

R&D Expenditures, by Field

Higher education R&D has long been heavily concentrated in three fields, which together accounted for 65.2% of the total spent in FY 2016: health sciences ($22.4 billion), biological and biomedical sciences ($13.0 billion), and engineering ($11.4 billion) (table 3). Among the broad fields, R&D expenditures within non-science and engineering fields saw the largest growth in FY 2016, increasing 14.9% to $4.1 billion.

Substantive changes were made to the field list and classification structure for the FY 2016 survey to modernize the list and harmonize 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. This is reflected in the 36.4% decline in life sciences, nec, for FY 2016. 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.

TABLE 2. Higher education R&D expenditures, by source of funds: FYs 2011–16
(Millions of current dollars)

Source of funds	2011	2012	2013	2014	2015	2016	% change 2015–16
All R&D expenditures	65,274	65,729	67,013	67,197	68,567	71,833	4.8
All federal R&D expenditures	40,768	40,142	39,446	37,960	37,849	38,794	2.5
DOD	4,814	4,908	5,023	4,926	5,089	5,313	4.4
DOE	1,866	1,955	1,876	1,806	1,710	1,771	3.6
HHS	22,995	21,916	21,211	20,299	19,999	20,659	3.3
NASA	1,423	1,331	1,332	1,329	1,418	1,492	5.2
NSF	5,140	5,276	5,393	5,125	5,118	5,114	-0.1
USDA	1,006	1,094	1,092	1,062	1,119	1,209	8.0
Other	3,524	3,663	3,519	3,413	3,396	3,236	-4.7
All nonfederal R&D expenditures	24,506	25,587	27,567	29,236	30,718	33,040	7.6
State and local government	3,851	3,734	3,696	3,903	3,855	4,025	4.4
Institution funds	12,580	13,587	14,936	15,735	16,608	17,975	8.2
Business	3,183	3,274	3,511	3,727	4,002	4,211	5.2
Nonprofit organizations	3,854	4,022	3,889	3,964	4,220	4,615	9.4
All other sources	1,038	969	1,535	1,908	2,033	2,214	8.9

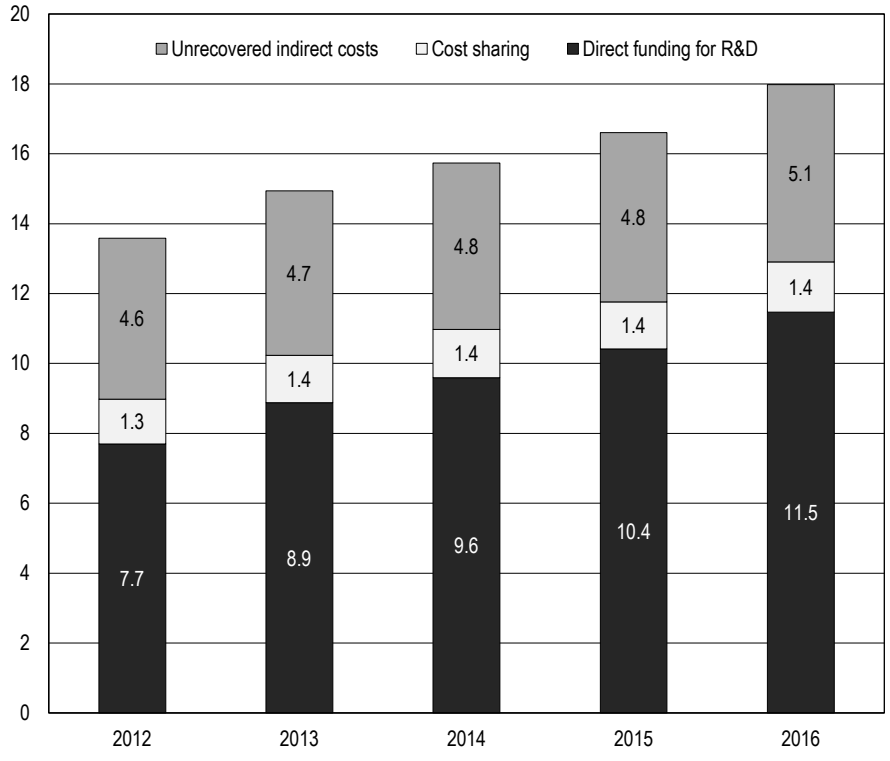
DOD = Department of Defense; DOE = Department of Energy; HHS = Department of Health and Human Services; NASA = National Aeronautics and Space Administration; NSF = National Science Foundation; USDA = Department of Agriculture.

NOTES: Because of rounding, detail may not add to total. Beginning with FY 2012, institutions reporting less than $1 million in total R&D expenditures completed a shorter version of the survey questionnaire. Those totals are not reflected here.

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

FIGURE 2. Institutionally funded R&D expenditures, by purpose: FYs 2012–16

Billions of current dollars



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

For complete details on the changes, see Technical Notes, Appendix A in the full set of data tables (https://ncsesdata.nsf.gov/herd/2016/).

Top University Research Performers

There remains remarkable stability in the year-to-year composition of the largest university R&D performers. Relative to FY 2015, there was only one institution change within the top 30 institutions in R&D spending in FY 2016 (table 4). New York University rose 12 spots from number 35 in FY 2015 to number 23 in FY 2016, with a 34% increase to $810 million. This increase was driven by a newfound ability to capture and report all institution funding of R&D within their medical school, as well as increased R&D expenditures at their Abu Dhabi campus. The University of Texas, Austin, which had ranked at number 30 in FY 2015, fell to number 34 in FY 2016 with $622 million in R&D expenditures. The University of Pennsylvania

TABLE 3. Higher education R&D expenditures, by R&D field: FYs 2015–16
(Thousands of current dollars)

Field	2015	2016	% change 2015–16
All R&D fields	68,566,890	71,833,308	4.8
Science	53,873,278	56,290,662	4.5
Computer and information sciences	1,962,827	2,077,884	5.9
Geosciences, atmospheric, and ocean sciences	3,247,416	3,087,774	-4.9
Atmospheric science and meteorology	573,932	626,518	9.2
Geological and earth sciences	1,113,619	999,351	-10.3
Ocean sciences and marine sciences	1,050,173	1,097,864	4.5
Geosciences, atmospheric and ocean sciences, nec	509,692	364,041	-28.6
Life sciences	38,787,071	40,887,850	5.4
Agricultural sciences	3,480,029	3,293,092	-5.4
Biological and biomedical sciences	11,702,462	13,048,981	11.5
Health sciences	21,304,898	22,393,716	5.1
Natural resources and conservation	na	689,725	na
Life sciences, nec	2,299,682	1,462,336	-36.4
Mathematics and statistics	641,083	681,661	6.3
Physical sciences	4,659,279	4,893,565	5.0
Astronomy and astrophysics	626,652	622,008	-0.7
Chemistry	1,757,423	1,775,071	1.0
Materials science	na	172,086	na
Physics	2,047,761	2,124,098	3.7
Physical sciences, nec	227,443	200,302	-11.9
Psychology	1,181,909	1,218,721	3.1
Social sciences	2,317,108	2,366,571	2.1
Anthropology	na	96,505	na
Economics	456,561	396,393	-13.2
Political science and government	459,416	385,245	-16.1
Sociology, demography, and population studies	524,763	504,594	-3.8
Social sciences, nec	876,368	983,834	12.3
Sciences, nec	1,076,585	1,076,636	0.0
Engineering	11,072,232	11,381,727	2.8
Aerospace, aeronautical, and astronautical engineering	734,104	883,260	20.3
Bioengineering and biomedical engineering	1,003,766	1,084,355	8.0
Chemical engineering	915,204	885,273	-3.3
Civil engineering	1,287,446	1,331,155	3.4
Electrical, electronic, and communications engineering	2,492,317	2,517,147	1.0
Industrial and manufacturing engineering	na	239,078	na
Mechanical engineering	1,514,753	1,435,828	-5.2
Metallurgical and materials engineering	1,102,027	771,683	-30.0
Engineering, nec	2,022,615	2,233,948	10.4
Non-S&E	3,621,380	4,160,919	14.9
Business management and business administration	569,811	649,856	14.0
Communication and communications technologies	168,525	168,861	0.2
Education	1,291,062	1,352,650	4.8
Humanities	430,210	435,079	1.1
Law	174,734	190,443	9.0
Social work	214,381	208,969	-2.5
Visual and performing arts	100,656	142,445	41.5
Non-S&E, nec	672,001	1,012,616	50.7

na = not applicable; separate data for natural resources and conservation, materials science, anthropology, and industrial and manufacturing engineering were not collected prior to FY 2016.

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

NOTES: R&D expenditure amounts in various fields may show increases or decreases from amounts reported in FY 2015 because of the reclassification of disciplines. See Technical Notes, Appendix A in the full set of data tables for specific details about discipline changes.

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

TABLE 4. Thirty institutions reporting the largest FY 2016 R&D expenditures in all fields: FYs 2014–16
(Millions of current dollars)

Rank	Institution	2014	2015	2016	% change 2015–16
	All institutions	67,197	68,567	71,833	4.8
	Leading 30 institutions	27,589	28,343	30,157	6.4
1	Johns Hopkins U.[a]	2,242	2,306	2,431	5.4
2	U. Michigan, Ann Arbor	1,349	1,369	1,436	4.9
3	U. Pennsylvania	828	864	1,296	50.0
4	U. California, San Francisco	1,084	1,127	1,294	14.8
5	U. Washington, Seattle	1,176	1,181	1,278	8.2
6	U. Wisconsin-Madison	1,109	1,069	1,158	8.3
7	U. California, San Diego	1,067	1,101	1,087	-1.3
8	Harvard U.	934	1,014	1,077	6.2
9	Stanford U.	959	1,023	1,066	4.2
10	Duke U.	1,037	1,037	1,056	1.8
11	U. North Carolina, Chapel Hill	990	967	1,045	8.1
12	U. California, Los Angeles	948	1,021	1,038	1.7
13	Cornell U.	883	954	974	2.1
14	Massachusetts Institute of Technology	908	931	946	1.6
15	U. Minnesota, Twin Cities	877	881	910	3.3
16	Texas A&M U., College Station and Health Science Center	854	867	893	3.0
17	U. Pittsburgh, Pittsburgh	857	861	890	3.4
18	Yale U.	773	803	882	9.8
19	U. Texas M. D. Anderson Cancer Center	795	833	852	2.3
20	Columbia U. in the City of New York	891	868	837	-3.6
21	Pennsylvania State U., University Park and Hershey Medical Center	801	791	826	4.4
22	Ohio State U.	815	818	818	0.0
23	New York U.	524	602	810	34.6
24	U. Florida	709	740	791	6.9
25	Georgia Institute of Technology	726	765	791	3.4
26	U. California, Berkeley	744	789	774	-1.9
27	U. California, Davis	712	721	742	2.9
28	Washington U., Saint Louis	665	694	741	6.8
29	Northwestern U.	645	656	713	8.7
30	U. Southern California	687	691	703	1.7

[a] Johns Hopkins University includes Applied Physics Laboratory, with $1,403 million in total R&D expenditures in FY 2016.

NOTES: Because of rounding, detail may not add to total. Institutions ranked are geographically separate campuses headed by a campus-level president or chancellor.

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

also rose substantially in the ranks, from number 17 in FY 2015 to number 3 in FY 2016. Their 50% increase in one year was also due to new reporting of institution funding of R&D within their medical school.

The number of universities reporting over $1 billion in R&D spending has increased from 1 institution in FY 2007 to 12 institutions in FY 2016. Combined, the top 30 institutions accounted for 42.0% of the total spent on R&D within the higher education sector in FY 2016.

Data Sources, Limitations, and Availability

The fiscal year referred to throughout this report is the academic fiscal year. For most institutions, FY 2016 represents 1 July 2015 through 30 June 2016. The higher education R&D expenditures data were collected from a census of 902 universities and colleges that grant a bachelor's degree or higher and expended at least $150,000 in R&D in FY 2016. To reduce respondent burden, the HERD Survey was revised beginning 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 reported by 262 institutions that completed a short-form version of the survey in FY 2016. These institutions accounted for $138 million (0.2%) of total higher education R&D expenditures in FY 2016.

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 R&D Survey, and these data are available at https://www.nsf.gov/statistics/ffrdc/.

The full set of data tables from this survey is available at https://ncsesdata.nsf.gov/herd/2016/.

Note

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