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Higher Education R&D Spending: Spending and Funding Sources Differ by State

by Katherine Hale, Ronda Britt, and Michael Gibbons[1]

Universities and colleges play an important role in conducting research and development in the United States. Academic institutions spent $72 billion on R&D in 2016, an increase of 21% over the past decade, after adjusting for inflation. Data in this InfoBrief are from the Higher Education R&D Survey, from the National Center for Science and Engineering Statistics within the National Science Foundation.

Academic institutions focus on a variety of different fields as they conduct R&D and rely on various funding sources. This InfoBrief presents information on funding sources for academic R&D at the state level. It focuses on total academic R&D spending, by state in 2016, for the 640 institutions that spent at least $1 million on R&D in the previous reporting year (2015). Together, these institutions accounted for 99.8% of the total higher education R&D expenditures reported for 2016. Data are provided on the 50 U.S. states and the District of Columbia, with an emphasis on the 6 states with the largest academic R&D expenditures. Spending trends are analyzed by funding source from 2010 to 2016 and, where data are available more broadly, from 2007 to 2016.

Higher Education R&D Funding

State Overview

Six states accounted for just under 45% of the total academic R&D spending in 2016: California, Maryland, Massachusetts, New York, Pennsylvania, and Texas. Universities in each of these states spent 5% or more of the $72 billion total. An additional six states accounted for another 20%: North Carolina, Florida, Michigan, Illinois, Ohio, and Georgia. In each of these states, universities conducted between 3% and 4% of the 2016 total. By contrast, the remaining 38 states plus the District of Columbia accounted for only 35% of total academic R&D expenditures in 2016.

Academic R&D spending trends from 2007 to 2016 varied considerably across states. In 21 states and the District of Columbia, inflation-adjusted spending increased by more than the overall average increase of 21%. In ten states, spending decreased, although in each case the decrease was from a relatively small base. In general, states with high academic R&D expenditures did not experience declines over the past decade (table 1).

Universities rely to differing degrees on the various major sources of funding, including the federal government, state and local governments, businesses, nonprofit organizations, and higher education institutions (table 2). The federal government, for example, funded 54% of total academic R&D in 2016, but it contributed more than 70% in three states: Colorado, Maryland, and Vermont. Similarly, higher education institutions funded 25% of total academic R&D in 2016, ranging from less than 10% in Colorado to more than 45% in Rhode Island. Many differences by state also exist for the three other major funding sources. For example, among the six states with the highest levels of academic R&D spending, universities in Texas relied less on federal funding and more on state and local funds, compared with the national averages, whereas New York and Massachusetts schools relied more on funding from businesses.

R&D Fields

Life sciences was the science and engineering (S&E) field that accounted for the bulk of academic R&D spending: $41 billion in 2016, or 57% of the total. Other S&E fields, in declining order of

TABLE 1. Higher education R&D expenditures, by state: FYs 2007–16
(Millions of current dollars)

State	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Inflation-adjusted percent change, 2007–16[a]
Total[b]	51,590	54,114	57,288	61,287	65,274	65,729	67,013	67,197	68,567	71,833	21.4
Alabama	664	724	775	847	898	831	838	813	898	950	24.7
Alaska	171	165	173	181	186	182	184	174	163	167	-14.9
Arizona	799	847	905	945	998	1,039	1,065	1,047	1,100	1,162	26.8
Arkansas	253	259	253	267	283	289	295	286	293	298	2.9
California	6,948	7,258	7,655	7,833	8,225	8,402	8,358	8,404	8,657	8,889	11.5
Colorado	899	955	1,098	1,181	1,292	1,339	1,253	1,232	1,274	1,379	33.6
Connecticut	713	755	778	889	946	946	1,059	1,063	1,091	1,176	43.8
Delaware	128	135	137	169	189	186	197	193	192	198	34.4
District of Columbia	376	411	354	470	493	502	524	543	559	556	28.9
Florida	1,768	1,821	1,900	1,995	2,126	2,179	2,172	2,273	2,355	2,527	24.6
Georgia	1,447	1,586	1,622	1,692	1,809	1,882	1,956	1,951	2,046	2,180	31.3
Hawaii	283	286	311	318	331	336	344	335	332	318	-2.1
Idaho	116	116	123	126	142	146	144	143	147	155	16.7
Illinois	1,971	2,078	2,229	2,224	2,352	2,362	2,501	2,327	2,383	2,401	6.2
Indiana	993	1,063	1,122	1,186	1,271	1,306	1,336	1,309	1,324	1,410	23.8
Iowa	605	540	573	707	725	718	714	774	759	814	17.3
Kansas	402	432	468	483	511	527	545	548	562	559	21.1
Kentucky	539	535	549	575	596	586	551	534	533	556	-10.1
Louisiana	632	696	711	714	728	699	672	666	663	683	-5.8
Maine	143	152	157	138	140	120	105	125	103	100	-38.8
Maryland	2,574	2,776	3,046	3,139	3,417	3,360	3,433	3,573	3,742	3,800	28.6
Massachusetts	2,287	2,396	2,605	2,750	2,949	3,215	3,533	3,501	3,674	3,797	44.7
Michigan	1,604	1,691	1,863	2,031	2,162	2,220	2,267	2,243	2,334	2,468	34.2
Minnesota	659	724	787	832	899	865	901	919	929	961	27.0
Mississippi	427	425	435	444	461	476	417	411	408	455	-7.2
Missouri	970	976	1,023	1,087	1,121	1,098	1,075	1,051	1,074	1,119	0.5
Montana	189	198	196	208	195	197	186	181	182	195	-10.1
Nebraska	379	392	411	401	413	438	445	455	465	481	10.6
Nevada	197	196	187	174	165	153	153	154	158	191	-15.6
New Hampshire	313	311	309	311	360	366	354	366	358	380	5.7
New Jersey	904	910	953	1,076	1,142	1,113	1,173	1,130	1,106	1,158	11.6
New Mexico	421	428	447	423	405	401	404	412	391	375	-22.2
New York	4,074	4,083	4,303	4,948	5,289	5,353	5,520	5,639	5,700	6,090	30.3
North Carolina	1,918	2,012	2,199	2,465	2,669	2,682	2,740	2,815	2,815	2,938	33.5
North Dakota	171	182	187	204	211	216	219	222	218	227	15.6
Ohio	1,815	1,881	1,948	2,052	2,222	2,129	2,168	2,159	2,153	2,193	5.3
Oklahoma	311	347	354	401	445	437	420	420	420	489	36.7
Oregon	636	663	707	696	740	722	705	706	720	759	4.0
Pennsylvania	2,502	2,686	2,798	3,128	3,315	3,239	3,361	3,329	3,357	3,951	37.6
Rhode Island	254	263	274	429	459	495	479	447	453	463	58.7
South Carolina	582	590	627	660	621	637	648	656	665	687	2.9
South Dakota	83	93	111	131	136	129	117	105	103	107	12.7
Tennessee	800	833	880	938	1,017	1,025	1,032	1,133	1,077	1,092	19.0
Texas	3,532	3,870	4,133	4,416	4,662	4,651	4,813	4,898	5,036	5,257	29.7
Utah	421	432	510	562	627	622	689	694	733	573	18.6
Vermont	118	118	126	133	137	120	121	115	120	121	-10.6
Virginia	1,036	1,123	1,152	1,199	1,390	1,379	1,420	1,381	1,411	1,463	23.0
Washington	1,024	1,105	1,134	1,358	1,502	1,475	1,562	1,537	1,549	1,646	40.1
West Virginia	173	184	186	195	211	202	196	196	199	199	0.3
Wisconsin	1,153	1,193	1,279	1,336	1,443	1,484	1,419	1,410	1,372	1,459	10.3
Wyoming	80	77	80	55	58	66	65	51	57	112	22.0

[a] Fiscal year gross domestic product deflators are derived from U.S. Bureau of Economic Analysis data by the Office of Management and Budget, Budget of the United States Government, Fiscal Year 2018, Historical Tables (Table 10.1), accessed 30 May 2018.

[b] Includes U.S. territories not listed separately.

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 state and share of funding source: ranked by FY 2016 R&D expenditures

Rank	State	Total expenditures (millions of dollars)	Percent of total funded by source: Federal government	State and local governments	Businesses	Academic institutions	Nonprofit organizations	Other[a]
-	Total[b]	71,833	54.0	5.6	5.9	25.0	6.4	3.1
1	California	8,889	53.4	4.0	6.4	20.0	9.7	6.5
2	New York	6,090	51.0	4.5	7.5	24.8	8.2	3.9
3	Texas	5,257	39.1	16.5	6.5	25.3	8.1	4.6
4	Pennsylvania	3,951	57.8	2.2	5.5	26.4	5.4	2.7
5	Maryland	3,800	78.0	1.6	2.7	12.4	4.8	0.4
6	Massachusetts	3,797	57.0	1.4	7.4	21.2	9.0	4.0
7	North Carolina	2,938	56.6	5.0	12.1	19.2	5.8	1.3
8	Florida	2,527	44.4	8.3	4.4	35.5	4.9	2.4
9	Michigan	2,468	52.1	2.1	4.1	35.9	4.0	1.8
10	Illinois	2,401	58.6	1.9	5.9	25.7	6.6	1.3
11	Ohio	2,193	60.0	4.1	8.7	19.9	5.8	1.6
12	Georgia	2,180	57.9	2.6	5.4	28.5	4.8	0.8
13	Washington	1,646	66.8	4.1	3.5	14.3	8.0	3.3
14	Virginia	1,463	50.3	5.5	5.4	31.6	4.1	3.1
15	Wisconsin	1,459	49.1	6.1	3.0	30.5	8.1	3.2
16	Indiana	1,410	40.5	6.6	5.7	37.0	8.5	1.8
17	Colorado	1,379	72.7	3.7	5.5	9.0	7.3	1.8
18	Connecticut	1,176	56.1	1.2	6.2	28.4	7.1	0.9
19	Arizona	1,162	42.9	5.1	2.7	34.1	5.0	10.2
20	New Jersey	1,158	52.5	8.6	3.7	28.7	5.5	0.9
21	Missouri	1,119	55.8	0.7	8.7	26.5	7.1	1.3
22	Tennessee	1,092	58.7	2.7	4.8	28.3	3.9	1.6
23	Minnesota	961	50.5	7.5	3.6	32.2	1.7	4.4
24	Alabama	950	58.8	6.2	6.4	24.3	3.2	1.1
25	Iowa	814	45.3	6.4	5.9	38.4	3.6	0.4
26	Oregon	759	65.3	7.9	4.7	13.4	6.6	2.1
27	South Carolina	687	43.2	4.7	6.6	41.1	3.0	1.4
28	Louisiana	683	39.7	14.4	4.6	33.5	5.8	2.0
29	Utah	573	67.7	4.0	7.3	14.4	3.9	2.8
30	Kansas	559	39.7	14.2	9.6	31.7	4.4	0.5
31	Kentucky	556	43.2	10.6	3.7	31.9	4.4	6.2
32	District of Columbia	556	54.1	0.9	2.7	29.1	10.0	3.2
33	Oklahoma	489	40.2	14.2	7.6	34.0	2.1	1.9
34	Nebraska	481	39.5	13.4	6.2	33.6	3.7	3.5
35	Rhode Island	463	45.1	2.8	1.8	45.8	3.8	0.8
36	Mississippi	455	45.5	21.1	5.3	26.4	1.3	0.4
37	New Hampshire	380	61.5	1.4	3.9	27.4	4.1	1.8
38	New Mexico	375	64.0	6.6	1.9	22.1	3.2	2.2
39	Hawaii	318	63.4	4.8	1.8	25.3	3.8	0.8
40	Arkansas	298	35.1	21.1	3.9	30.2	0.9	8.8
41	North Dakota	227	34.4	27.4	4.8	30.1	1.0	2.2
42	West Virginia	199	43.3	7.0	6.0	33.4	2.8	7.5
43	Delaware	198	65.0	5.7	3.0	21.6	3.4	1.3
44	Montana	195	57.5	8.3	1.9	27.2	2.0	3.2
45	Nevada	191	51.2	12.3	1.7	30.3	1.2	3.4
46	Alaska	167	62.1	5.4	3.0	27.9	1.0	0.6
47	Idaho	155	51.7	21.8	2.9	19.9	1.5	2.2
48	Vermont	121	71.9	0.5	2.8	19.3	4.6	1.0
49	Wyoming	112	57.1	22.9	3.7	13.6	1.5	1.2
50	South Dakota	107	49.1	20.5	1.9	21.8	5.9	0.8
51	Maine	100	47.7	18.9	3.4	26.5	2.9	0.6

[a] Other sources not reported elsewhere, such as funds from foreign governments.

[b] Includes U.S. territories not listed separately.

NOTE: Details may not add to totals due to rounding.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, special tabulations (2018), Higher Education Research and Development Survey, FY 2016.

expenditures, were engineering (16%), physical sciences (7%), geosciences (4%), social sciences (3%), computer sciences (3%), psychology (2%), and mathematical sciences (1%). Non-S&E fields constituted 6% of total spending. In addition, just under 2% of academic R&D spending was allocated toward sciences that include multidisciplinary or interdisciplinary work that could not be classified within a broad field.[2]

Higher education R&D spending within states differs somewhat by field. Universities in California, New York, Pennsylvania, and Texas performed a higher proportion of R&D in life sciences (60%–65% in 2016) than the national average (57%), whereas those in Maryland and Massachusetts performed a lower proportion of their R&D in life sciences (44% and 41%, respectively). Schools in Maryland and Massachusetts performed a higher proportion of R&D in engineering (31% and 21%, respectively) than the national average (16%), whereas those in California, New York, and Pennsylvania performed a lower proportion of their R&D in engineering fields (12%–14%). The proportions spent on the other broad fields in the top six states were similar to the national average proportions for these fields.

Federal Funding

The federal government funded $39 billion (54%) of academic R&D in 2016, up from $31 billion in 2007.[3] In 2016, as in prior years, private universities relied more on federal funding than did their public counterparts (60% versus 51% of their total R&D in 2016). Over the past decade, federal funding increased by 8% after adjusting for inflation; since 2010, however, federal funding declined by 6%.[4]

The American Recovery and Reinvestment Act of 2009 (ARRA) funded over $9 billion of academic R&D during the recession and recovery from 2010 to 2012 and continued to contribute, although in smaller amounts, in 2013 and 2014. By 2015, all ARRA funds had been spent.[5]

Federal funding has played a larger role in overall support for some fields than for others. In 2016, the federal government provided the majority of funding in life and physical sciences, engineering, computer sciences, geosciences, mathematics, and psychology.[6] By contrast, the federal government played a smaller role in social sciences and non-S&E fields, funding only one-third or less of the academic R&D performed.[7] Among the six states with the highest levels of academic R&D spending, universities in California and Massachusetts spent a relatively large share of federal funds on the physical sciences, compared with the national average; in Maryland, a relatively large share of federal funds was spent on engineering; in New York, life sciences; and in Pennsylvania, computer and information sciences. In Texas, the field distribution of federal funding of higher education R&D largely mirrored the overall national pattern.

Federal funding of states' higher education R&D ranged from about 35% in North Dakota and Arkansas to more than 70% in Colorado, Maryland, and Vermont (figure 1). In 31 states, federal funding contributed over 50% to their total academic R&D spending. Texas, which ranked third among all states in total spending, ranked third from the bottom in the percent to which the federal government contributed to this spending (39%), above only Arkansas and North Dakota. As a group, however, 45% of total federal spending in 2016 was concentrated in the top six states, identical to the concentration of overall spending.

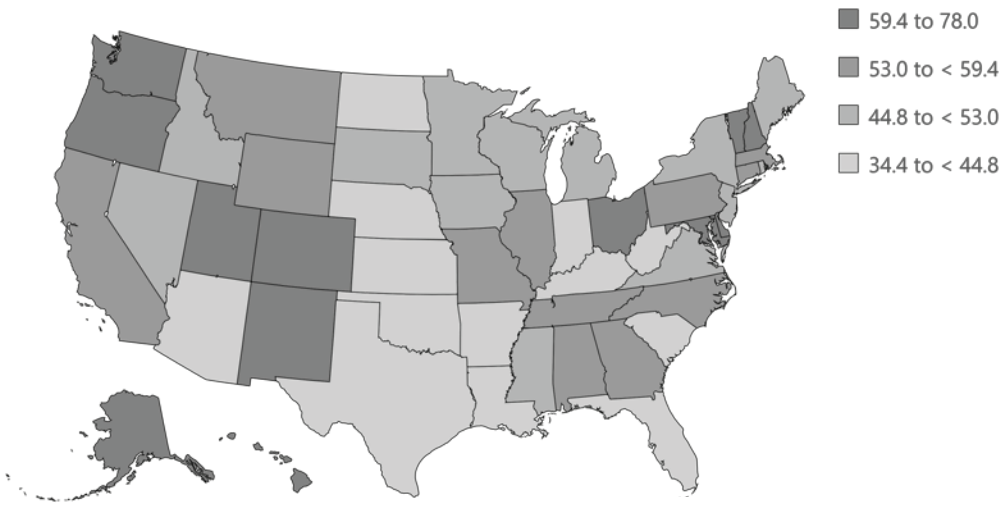
Institutions' Own Funding

Institutional funds play a prominent role in academic R&D spending.[8] At $18 billion and 25% of total expenditures in 2016, funds provided by institutions themselves provide the second largest source of R&D spending for universities and colleges. Such funding is especially important at public universities, where it accounted for 27% of total spending in 2016 compared to 21% at private universities. Among the major funding sources for academic R&D, institutional funding saw the largest increase (37%) from 2010 to 2016, after adjusting for inflation.

Universities differ by state in the extent to which they rely on their own institutions' funds for academic R&D, ranging from 9% in Colorado to 46% in Rhode Island (figure 2). In three of the top six states—California, New York, and Texas—inflation-adjusted increases in institutional funding of roughly 40% from 2010 to 2016 broadly matched the overall increase in the United States. From 2010 to 2016, institutional funding doubled in Pennsylvania and tripled in Massachusetts, after adjusting for inflation, but it increased by only 13% in Maryland. In Pennsylvania, Texas, and New York, institutional spending constituted about 25% of these states' total academic R&D; in Massachusetts and California, on the other hand, institutional funding was a somewhat smaller share of total academic R&D (around 20%), and in Maryland, institutional funding constituted only 12% of the state's total spending on higher education R&D.

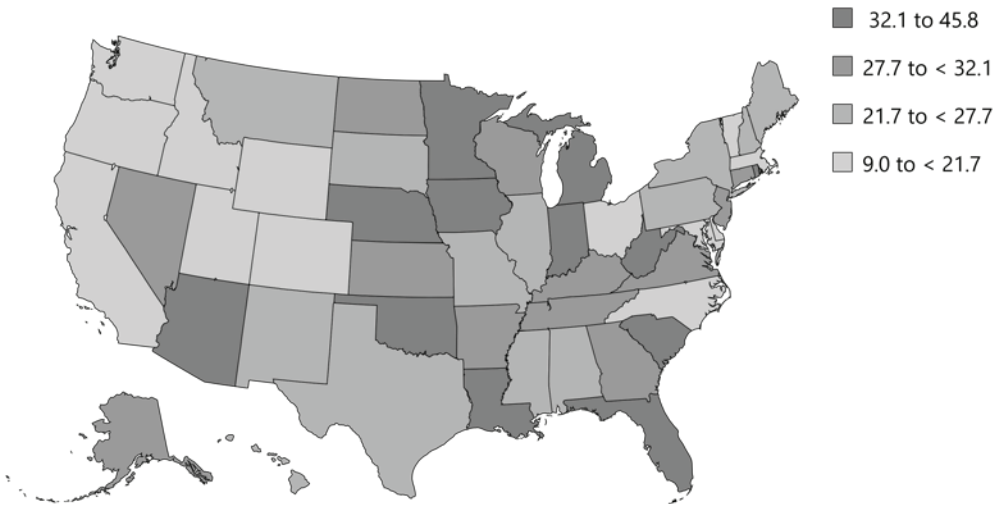
As with total academic R&D spending, institutional funding largely supports the broad fields of life sciences (54%) and engineering (13%). However, the non-S&E fields also feature prominently in universities' own funding of R&D (12%). These fields include education, business management, and law, among others. Among the top six states, however, institutional funding patterns vary from the national trend: universities in California and New

FIGURE 1. Federal funding share of higher education R&D, by state: FY 2016



SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, special tabulations (2018), Higher Education Research and Development Survey, FY 2016. Map powered by Bing. © DSAT for MSFT, GeoNames, Navteq.

FIGURE 2. Institutions' own funding share of higher education R&D, by state: FY 2016



SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, special tabulations (2018), Higher Education Research and Development Survey, FY 2016. Map powered by Bing. © DSAT for MSFT, GeoNames, Navteq.

York spent relatively large shares of institutional funds on life sciences; in Maryland, geosciences; and in Massachusetts and Pennsylvania, non-S&E fields. Institutional funds in Texas schools followed a similar pattern as the United States, with 56% spent on life sciences and 16% on engineering.

Nonprofit Funding

Nonprofit organizations provided $4.6 billion (6.4%) of academic R&D funding in 2016. The proportion of funding provided by nonprofit organizations was slightly higher at private institutions (8%) than at public institutions (6%).[9] After adjusting for inflation, overall funding by nonprofit organizations increased from 2010 to 2016 within 31 states and nationally by 12%. Among the top six states, nonprofit funding increases varied widely, from 5% in California to 35% in Massachusetts. As a share of a state's total higher education R&D spending, nonprofit funding ranged from 1% in Arkansas to 10% in the District of Columbia (figure 3).

For the top six states, nonprofit funds as a percentage of total higher education R&D expenditures ranged from 5% in Maryland to just under 10% in California.

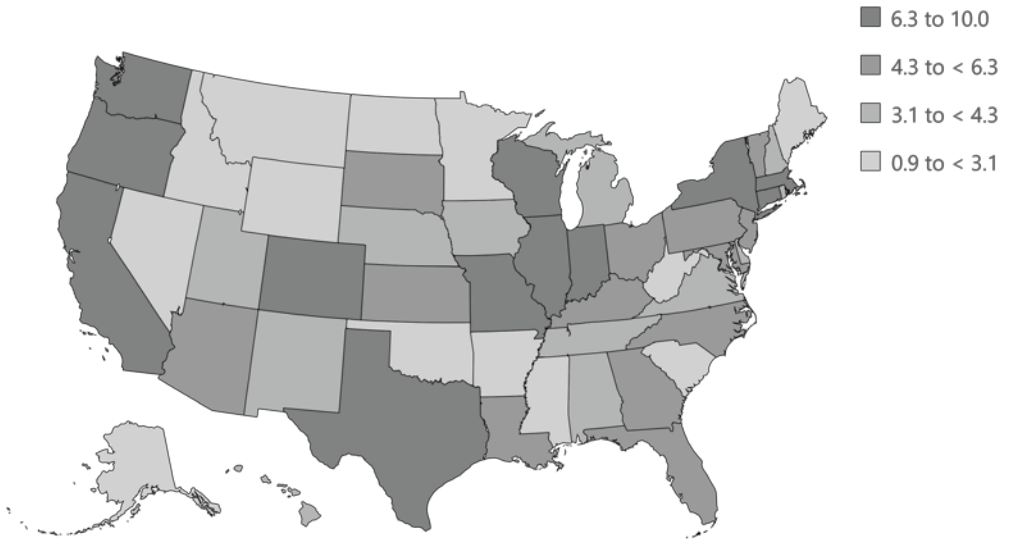
Nonprofit funds are used largely for life sciences (66%). Among the top six states, universities in California, Maryland, New York, Pennsylvania, and Texas all spent large shares (65% to 89%) of the funds provided by nonprofit organizations on R&D in life sciences. The situation was different in Massachusetts, which used nonprofit funding more evenly across the various S&E and non-S&E fields. Although the largest share went to the life sciences (38%), relatively large shares went to non-S&E fields (16%) and the social sciences (14%).

Business Funding

Businesses provided $4.2 billion for higher education R&D in 2016 (6% of total spending). As a percentage of total funding, business sources ranged from 1.7% in Nevada to 12.1% in North Carolina (figure 4). Private universities relied somewhat more on R&D funding from businesses than their public counterparts did (7% versus 5%).[9] After adjusting for inflation, R&D funds from business sources increased by 19% from 2010 to 2016, with 34 states experiencing an increase. Business funds increased at universities in five of the top six states but declined by 3% in Maryland. Among the other top six states, increases ranged from 5% in California to 58% in New York.

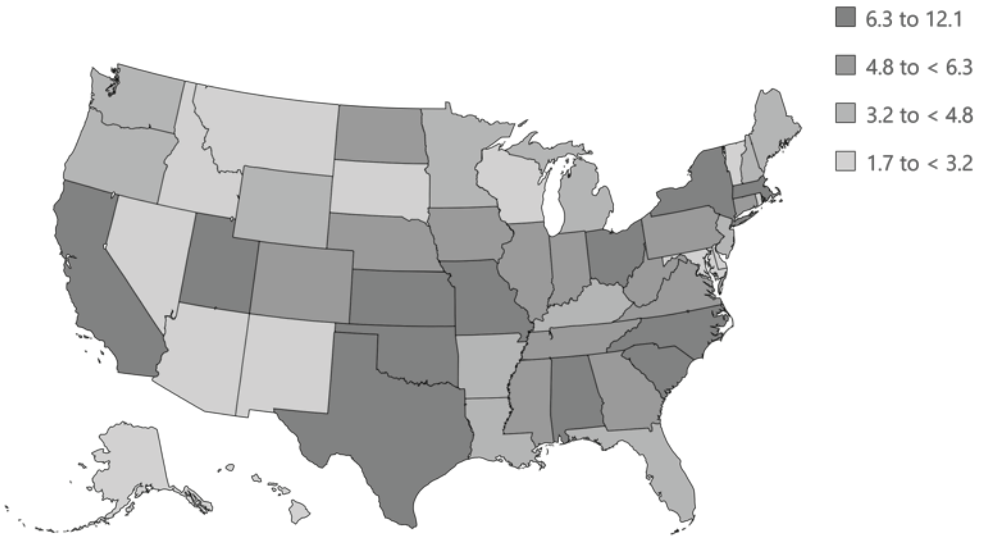
In 2016, the percentage of total business funding devoted to life sciences was slightly larger (61%) than the percentage across all sources of funding (57%). Businesses also placed a greater emphasis on engineering, with engineering receiving 25% of total business funds in 2016 (but only 16% of total academic R&D expenditures). R&D funds from businesses increased most from 2010 to 2016 in non-S&E fields.

FIGURE 3. Nonprofit funding share of higher education R&D, by state: FY 2016



SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, special tabulations (2018), Higher Education Research and Development Survey, FY 2016. Map powered by Bing. © DSAT for MSFT, GeoNames, Navteq.

FIGURE 4. Business funding share of higher education R&D, by state: FY 2016



SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, special tabulations (2018), Higher Education Research and Development Survey, FY 2016. Map powered by Bing. © DSAT for MSFT, GeoNames, Navteq.

Among the top six states, Massachusetts and New York spent relatively large shares of R&D funds provided by businesses on engineering (33% and 44%, respectively); schools in Massachusetts also spent a relatively large share of business funds on non-S&E fields (16%).[10] Schools in California, Pennsylvania, and Maryland spent the majority of funds provided by businesses on life sciences R&D (62%, 76%, and 85%, respectively).

State and Local Government Funding

Funds from state and local governments totaled just over $4 billion in 2016 and constituted 6% of total higher education R&D spending that year.[11] As a percentage of total funding, state and local government funding ranged from 1% in Vermont to 27% in North Dakota (figure 5). Public institutions derived more of their R&D funds from state and local governments than did private institutions (8% versus 1% of their total R&D in 2016).

State and local government funds for higher education R&D declined 6% from 2010 to 2016, after adjusting for inflation. There were wide variations among the states. Such funding declined by varying amounts in 31 states, for example, falling by 2% in Florida and by 75% in Missouri.

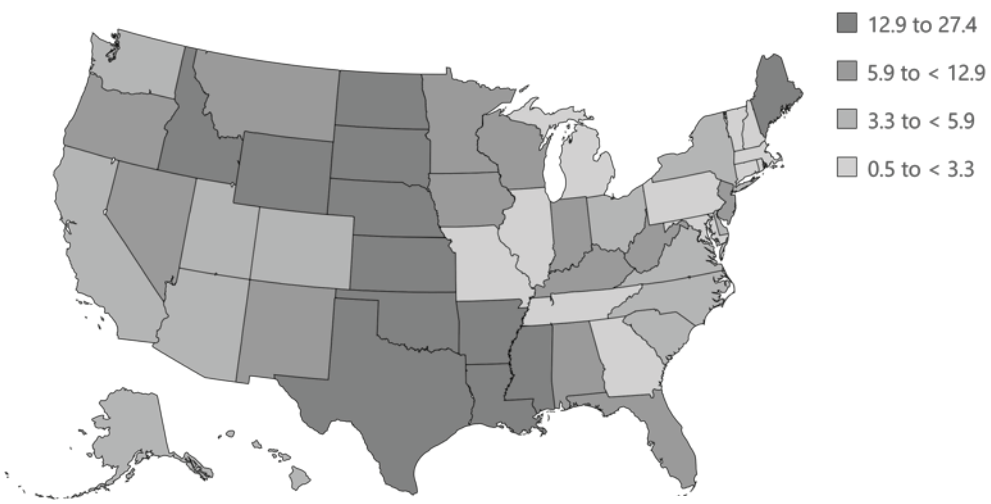
Among the top six states, state and local government funding declined in California, Maryland, New York, and Pennsylvania (9% to 45%), whereas it doubled in Massachusetts, largely as the result of an increase in state grants to equip several laboratories focused on R&D in life sciences. State and local government funding for academic R&D increased by 27% in Texas.

State and local funds have largely been used to support life sciences (61%) and engineering (17%) R&D. Among the top six states, Maryland and New York spent relatively large shares of R&D funds provided by state and local governments on engineering R&D (25% and 41%, respectively) and Pennsylvania spent a large share of such funds on life sciences R&D (76%).

Data Sources and Limitations

Data are from the 2016 Higher Education R&D Survey. The year referred to throughout this report is the academic fiscal year. For most institutions, FY 2016 represents 1 July 2015 through 30 June 2016. Expenditures are in current year dollars, but the report adjusts for inflation when comparing across more than one year.[12] 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.

FIGURE 5. State and local government funding share of higher education R&D, by state: FY 2016



SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, special tabulations (2018), Higher Education Research and Development Survey, FY 2016. Map powered by Bing. © DSAT for MSFT, GeoNames, Navteq.

The national total includes approximately $3 billion in pass-through funds that are double-counted because such funds are counted by the universities initially receiving the money and by the universities to which the funds are passed. R&D expenditures at university-administered federally funded research and development centers are not included in this report.

Figures 1 to 5 present data by quartile. The quartiles were determined by dividing the 50 states plus the District of Columbia into quartiles, with the top quartile showing the 25% of states that reported the highest shares for the funding source presented, the second quartile presenting data for the 25% of states that reported the second-highest shares, and so forth.

For more data on the relationship of higher education R&D state economies, see the National Science Board's *Science and Engineering Indicators 2018 State Indicators*. This site includes data on the ratio of R&D expenditures at a state's colleges and universities to the size of the state's economy (https://www.nsf.gov/statistics/state-indicators/indicator/academic-rd-per-1000-state-gdp).

Notes

1. Katherine Hale is with the Science and Engineering Indicators Program and Ronda Britt and Michael Gibbons are with the Research and Development Statistics Program, all at the National Center for Science and Engineering Statistics, National Science Foundation, 2415 Eisenhower Avenue, Suite W14200, Alexandria, VA 22314. For more about this report, please contact Ronda Britt (rbritt@nsf.gov; 703-292-7765) and Michael Gibbons (mgibbons@nsf.gov; 703-292-4590).

2. Trend data by field are available in table 9 of the FY 2016 Higher Education R&D data tables: https://ncsesdata.nsf.gov/herd/2016/html/HERD2016_DST_09.html.

3. Six agencies contributed more than 90% of federal funding for academic R&D in 2016: the Department of Health and Human Services, particularly the National Institutes of Health; the Department of Defense; the National Science Foundation; the Department of Energy; the National Aeronautics and Space Administration; and the U.S. Department of Agriculture.

4. Trend data by funding source are available in table 2 of the FY 2016 Higher Education R&D data tables: https://ncsesdata.nsf.gov/herd/2016/html/HERD2016_DST_02.html.

5. For more information on federally funded higher education R&D expenditures funded by ARRA, see table 5-3 in National Science Board (NSB). 2016. *Science and Engineering Indicators 2016,* NSB-2016-1. Arlington, VA: National Science Foundation. Available at https://www.nsf.gov/statistics/2016/nsb20161/#/table/tt05-03.

6. See appendix table 5-4 in National Science Board (NSB). 2018. Academic Research and Development. In *Science*

and Engineering Indicators 2018, NSB-2018-1. Alexandria, VA: National Science Foundation. Available at https://www.nsf.gov/statistics/2018/nsb20181/.

7. See table 5-1 in National Science Board (NSB). 2018. Academic Research and Development. In *Science and Engineering Indicators 2018*, NSB-2018-1. Alexandria, VA: National Science Foundation. Available at https://www.nsf.gov/statistics/2018/nsb20181/.

8. Institutionally financed research includes organized research projects fully supported with internal funding and all other institutional funds for research that are separately accounted for. The ability to identify and report all such internal funding for research varies by institution, resulting in an undercount of this source of funding for some institutions. Institutional spending does not include funds spent on research that are not separately accounted for, such as estimates of faculty time budgeted for instruction that is spent on research. For further detail on institutional spending for academic R&D, see table 5-7 and table 5-8 in National Science Board (NSB). 2018. Academic research and development. In *Science and Engineering Indicators 2018*, NSB-2018-1. Alexandria, VA: National Science Foundation. Available at https://www.nsf.gov/statistics/2018/nsb20181/.

9. See figure 5-4 in National Science Board (NSB). 2018. Academic Research and Development. In *Science and Engineering Indicators 2018*, NSB-2018-1. Alexandria, VA: National Science Foundation. Available at https://www.nsf.gov/statistics/2018/nsb20181/.

10. National Science Foundation, National Center for Science and Engineering Statistics, special tabulations (2018) from WebCASPAR with FY 2016 data from the Higher Education R&D Survey: https://ncsesdata.nsf.gov/webcaspar/.

11. The share of state and local government funding has declined from a peak of 10% in the early 1970s to below 6% in recent years. However, actual amounts may be understated, particularly for public institutions, because they reflect only funds specifically targeted for R&D, whereas general purpose funds may be designated by the recipient institutions for R&D or indirect cost recovery and may thus show up as institutional research support. See table 5-4 in National Science Board (NSB). 2018. Academic research and development. In *Science and Engineering Indicators 2018,* NSB-2018-1. Alexandria, VA: National Science Foundation. Available at https://www.nsf.gov/statistics/2018/nsb20181/.

12. Fiscal year gross domestic product deflators are derived from U.S. Bureau of Economic Analysis data by the Office of Management and Budget, Budget of the United States Government, Fiscal Year 2018, Historical Tables (table 10.1), accessed 30 May 2018.