

2011 ACADEMIC R&D SPENDING TRENDS

NSF census, two years into a revamp, has more details about **CHEMISTRY DEPARTMENT FUNDING SOURCES**

CARMEN DRAHL, C&EN WASHINGTON

"FOLLOW THE MONEY" is a popular saying for a reason. For researchers and administrators, trends in academic research funding can tell many stories. They can be a harbinger of a department on the rise, or they may point out a rival university's investment priorities.

Every year, the National Science Foundation updates its comprehensive census of academic R&D spending. These data are an indicator of a university's research capacity and can be a factor in faculty and graduate student recruitment. This year, NSF made available data from fiscal 2011.

It is the second census to reflect a major revision of the survey by the agency.

The updated survey gives departments of chemistry and chemical engineering more ways than ever to see how they stack up in terms of research spending. For instance, the survey data now contain detailed breakdowns of funding sources at the level of individual departments. In years past, the survey only indicated the proportion of research dollars that a given chemistry department had received from the federal government. Now, the numbers show how much of a department's funds are kicked in by the university itself, as well as by industry, state, and local sources. (Except where indicated, all of the spending figures cited in this story are in current dollars and do not take into account the effect of inflation.)

U.S. academic science and engineering R&D spending:

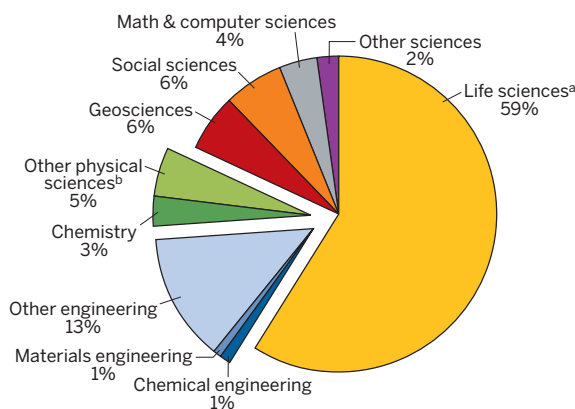
\$61.9 billion

Chemistry R&D spending:

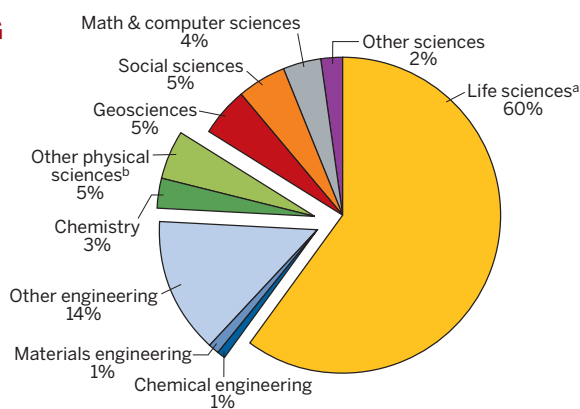
\$1.8 billion

INTERACTIVE ONLINE

For additional tables and an interactive graphic, which includes the top 100 chemistry spenders and where you can compare universities head-to-head, visit <http://cenm.ag/11rd>.



SPENDING BY FIELD
Different fields' pieces of the pie have barely changed over the past decade.

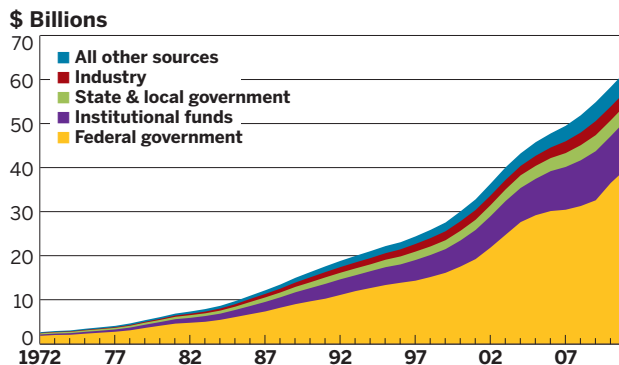


NOTE: Institutional fiscal years. Spending figures do not account for inflation. **a** Includes agricultural, biological, medical, and other life sciences. **b** Includes astronomy, physics, and other physical sciences. **SOURCE:** National Science Foundation, WebCASPAR Database System

WHO PAYS?

Institutions picked up most of the slack when federal financing of academic R&D slowed in the mid-2000s.

NOTE: Institutional fiscal years, beginning with 1972, the first year which data are available. **SOURCE:** Higher Education Research & Development Survey: Fiscal Year 2011, National Science Foundation, 2013



BIG MOVERS

University of Alabama jumped **55** places in chemical engineering spending rankings

Vanderbilt University moved up **21** places in chemistry spending rankings

SCHOOL SPENDING ON CHEMICAL R&D

This table ranks top chemistry spenders and breaks down funding sources

RANK		\$ THOUSANDS	SHARE OF TOTAL EXPENDITURES IN 2011, % ^a				ANNUAL CHANGE				
2011	2010		2001	2010	2011	FEDERAL GOVT	STATE/LOCAL GOVT	INDUSTRY	INSTITUTION	2010-11	2011-12
1	2	Rutgers U	\$13,190	\$34,150	\$38,813	85.6%	1.6%	2.5%	9.0%	13.7%	11.4%
2	1	California Inst. of Technology	15,357	35,612	35,393	77.1	1.1	6.6	2.0	-0.6	8.7
3	6	Northwestern U	13,733	28,303	32,213	73.2	0.0	0.0	17.4	13.8	8.9
4	7	Georgia Tech	9,027	27,354	31,424	62.4	0.8	11.7	22.5	14.9	13.3
5	3	U of Illinois, Urbana-Champaign	20,091	30,092	29,306	80.8	0.0	3.7	11.2	-2.6	3.8
6	5	Harvard U	17,446	28,723	29,007	83.9	0.2	3.4	0.0	1.0	5.2
7	8	U of California, San Diego	11,131	26,387	27,326	84.2	1.8	2.8	4.2	3.6	9.4
8	11	U of Texas, Austin	11,640	25,089	26,985	59.6	3.2	2.5	21.7	7.6	8.8
9	9	U of North Carolina, Chapel Hill	12,652	26,032	26,806	79.5	2.1	3.2	14.5	3.0	7.8
10	4	Massachusetts Inst. of Technology	18,063	29,110	26,376	87.9	0.1	7.1	2.2	-9.4	3.9
		Total, first 10 institutions	\$142,330	\$290,852	\$303,649	77.5%	1.1%	4.4%	10.4%	4.4%	7.9%
11	19	Texas A&M U	17,206	23,075	24,616	40.6	0.8	2.2	30.2	6.7	3.6
12	33	Vanderbilt U	3,171	15,577	24,577	86.1	0.0	0.7	9.8	57.8	22.7
13	20	U of Washington, Seattle	9,597	23,010	23,616	89.9	1.8	3.6	2.3	2.6	9.4
14	25	U of Utah	10,086	20,114	23,175	46.7	0.0	1.7	50.8	15.2	8.7
15	13	U of Colorado	14,229	24,147	23,115	81.3	0.0	0.7	10.2	-4.3	5.0
16	22	U of Massachusetts, Amherst	10,509	21,590	22,893	64.5	0.6	5.9	26.9	6.0	8.1
17	16	Stanford U	15,752	23,622	22,859	83.2	1.2	4.4	9.8	-3.2	3.8
18	18	Pennsylvania State U	18,042	23,220	22,809	56.1	0.0	2.2	31.4	-1.8	2.4
19	21	Purdue U	12,194	21,944	22,146	73.6	0.1	4.7	16.1	0.9	6.1
20	10	U of California, Berkeley	21,339	25,549	22,124	64.3	5.7	8.3	11.7	-13.4	0.4
		Total, first 20 institutions	\$274,455	\$512,700	\$535,579	73.6%	1.0%	3.9%	14.5%	4.5%	6.9%
21	12	U of Michigan	10,957	24,956	21,971	68.7	0.0	1.9	27.2	-12.0	7.2
22	15	U of Arizona	9,908	23,709	21,528	69.4	0.3	1.6	27.5	-9.2	8.1
23	17	U of Wisconsin, Madison	12,935	23,499	20,958	62.2	6.7	1.2	20.9	-10.8	4.9
24	24	Indiana U	14,316	20,882	20,716	43.1	0.0	13.0	30.6	-0.8	3.8
25	26	Cornell U	11,013	19,365	20,610	82.5	0.8	2.3	11.4	6.4	6.5
26	23	U of California, Los Angeles	15,071	20,935	20,225	76.4	2.1	2.8	9.0	-3.4	3.0
27	36	U of Chicago	9,403	15,007	19,583	79.2	0.0	1.5	12.1	30.5	7.6
28	32	U of Pittsburgh	7,943	16,002	18,082	62.7	0.0	1.4	34.0	13.0	8.6
29	34	U of Akron	8,108	15,310	17,793	17.6	0.5	5.9	54.4	16.2	8.2
30	47	Princeton U	11,314	12,319	17,608	44.6	0.0	4.4	48.8	42.9	4.5
		Total, first 30 institutions	\$385,423	\$704,684	\$734,653	70.3%	1.1%	3.8%	17.9%	4.3%	6.7%
31	31	U of California, Irvine	9,863	16,747	16,939	72.8	3.7	4.4	9.7	1.1	5.6
32	28	Johns Hopkins U ^b	12,124	18,632	16,776	97.2	0.0	0.3	1.8	-10.0	3.3
33	42	U of Texas M. D. Anderson Cancer Center	na	14,501	16,181	57.3	27.9	6.7	6.6	11.6	nm
34	14	U of South Carolina	9,228	23,799	15,759	45.9	0.0	0.1	53.4	-33.8	5.5
35	27	Stony Brook U, SUNY	6,730	18,983	15,333	61.8	0.6	1.3	34.2	-19.2	8.6
36	30	Virginia Tech	6,461	16,791	14,956	55.1	7.6	11.4	22.1	-10.9	8.8
37	41	U of Florida	11,359	14,739	14,550	61.4	3.8	6.3	25.3	-1.3	2.5
38	40	U of Minnesota	8,860	14,774	14,540	67.8	0.9	8.3	17.3	-1.6	5.1
39	50	U of Southern Mississippi	4,741	12,012	14,044	90.5	3.1	5.7	0.0	16.9	11.5
40	37	U of California, San Francisco	13,845	14,961	13,993	91.3	0.6	1.1	2.8	-6.5	0.1
		Total, first 40 institutions	\$468,634	\$870,623	\$887,724	70.3%	1.7%	3.9%	17.8%	2.0%	6.6%
41	29	U of Kansas	3,099	16,909	13,754	80.1	3.2	2.6	10.0	-18.7	16.1
42	56	Yale U	6,751	10,438	13,704	60.9	0.0	1.7	32.0	31.3	7.3
43	48	Columbia U	7,983	12,251	13,457	88.5	1.1	1.2	4.9	9.8	5.4
44	46	U of California, Davis	6,771	12,479	13,412	78.3	3.8	2.3	9.2	7.5	7.1
45	35	U of Pennsylvania	11,110	15,096	13,374	92.6	0.0	0.8	3.3	-11.4	1.9
46	38	Emory U	8,037	14,851	13,230	56.5	0.0	2.0	38.4	-10.9	5.1
47	51	U of Southern California	8,010	11,559	12,842	75.4	1.0	12.6	9.3	11.1	4.8
48	58	Florida State U	11,635	10,404	12,741	66.4	1.3	0.3	30.4	22.5	0.9
49	49	Arizona State U, Tempe	12,416	12,149	12,699	73.6	1.0	2.2	18.5	4.5	0.2
50	53	Rice U	7,390	11,238	12,249	60.4	7.1	7.0	12.3	9.0	5.2
		Total, first 50 institutions	\$551,836	\$997,997	\$1,019,186	70.7%	1.7%	3.9%	17.7%	2.1%	6.3%
		TOTAL, ALL INSTITUTIONS	\$1,007,814	\$1,747,771	\$1,785,614	69.7%	2.6%	3.6%	18.7%	2.2%	5.9%

NOTE: Institutional fiscal years. **a** Figures may not sum to 100% because other funding sources, such as nonprofit organizations, are not listed. **b** Includes funding for the Applied Physics Lab. **na** = not available. **nm** = not meaningful. **SOURCE:** National Science Foundation, WebCASPAR Database System

TOP 25 UNIVERSITIES IN 2011 R&D SPENDING

Few of chemistry's top spenders place in the overall top 25

RANK			SCIENCE & ENGINEERING							OVERALL
OVERALL	CHEMISTRY	\$ MILLIONS	CHEMISTRY	LIFE SCIENCES ^a	ENGINEERING (INCL. CHEM)	PHYSICAL SCIENCES ^b	GEOSCIENCES	MATH & COMPUTER SCIENCES	OTHER SCIENCES	OVERALL
1	32	Johns Hopkins U ^c	\$17	\$862	\$855	\$176	\$45	\$128	\$69	\$2,136
2	21	U of Michigan	22	759	211	48	16	21	164	1,220
3	13	U of Washington, Seattle	24	717	108	53	180	35	21	1,113
4	23	U of Wisconsin, Madison	21	686	116	88	49	28	56	1,023
5	68	Duke U	9	861	56	21	21	15	44	1,018
6	7	U of California, San Diego	27	607	109	62	139	41	46	1,004
7	40	U of California, San Francisco	14	981	0	14	0	0	0	995
8	26	U of California, Los Angeles	20	689	68	75	17	24	69	942
9	28	U of Pittsburgh	18	770	33	29	11	11	26	880
10	17	Stanford U	23	556	122	97	26	31	37	868
11	45	U of Pennsylvania	13	726	41	30	2	19	35	852
12	38	U of Minnesota	15	600	100	40	29	26	54	848
13	43	Columbia U	13	603	55	49	81	23	30	841
14	56	Ohio State U	11	488	166	32	11	41	56	794
15	15	U of Colorado	23	440	102	98	95	14	38	786
16	18	Pennsylvania State U	23	272	279	61	58	54	60	784
17	25	Cornell U	21	513	93	94	18	23	39	780
18	9	U of North Carolina, Chapel Hill	27	609	0	36	28	20	70	763
19	11	Texas A&M U	25	261	264	46	131	21	33	758
20	85	Washington U in St. Louis	7	644	20	16	11	6	10	707
21	44	U of California, Davis	13	507	87	29	28	13	34	698
22	10	Massachusetts Inst. of Technology	26	119	305	115	40	58	56	694
23	37	U of Florida	15	507	93	36	8	9	33	686
24	20	U of California, Berkeley	22	213	164	90	13	6	183	671
25	33	U of Texas M. D. Anderson Cancer Center	16	592	0	16	0	20	35	663
Total, listed institutions			\$465	\$14,582	\$3,447	\$1,452	\$1,056	\$689	\$1,298	\$22,525
TOTAL, ALL INSTITUTIONS			\$1,786	\$37,232	\$10,045	\$4,779	\$3,167	\$2,371	\$4,295	\$61,891

NOTE: Institutional fiscal years. Totals may not sum because of rounding. **a** Includes agricultural, biological, medical, and other life sciences. **b** Includes astronomy, chemistry, physics, and other physical sciences. **c** Includes Applied Physics Lab expenditures. **SOURCE:** National Science Foundation, WebCASPAR Database System

The data make clear just how much sources of funding vary at universities that have invested the most in chemistry R&D. The data also illustrate that despite vast changes in the scientific landscape over the past decade, the various scientific disciplines still receive essentially identical pieces of the overall academic spending pie.

The lion's share of academic R&D funds goes to the life sciences, and so it follows that the top-spending universities in academic R&D overall are big life sciences spenders. None of the top five chemistry spenders made the top 25 universities in research spending overall.

In chemistry, there are overall top-dog schools. In fiscal 2011, Rutgers University spent the most money for chemistry R&D from all sources combined. The top chemical engineering research spender

in 2011 was the University of Texas, Austin. Universities fund science and engineering R&D through a variety of sources, such

as the federal government; industry, state and local government; and institutional funds. A given department's percentage of institutional R&D funds, however, can vary from the single digits to more than 50%. The top 10 spenders on chemistry R&D had, on average, a lower percentage of institutional funds, 10.4%, than the overall average of 18.7%.

Portion of chemistry spending funded by industry at Indiana University:
13%
(highest in the top 50)

Most chemistry departments received small percentages of their funds from industry sources. Among all institutions, the average was 3.6%. Standouts included Georgia Tech, Indiana University, Virginia Tech, and the University of Southern California,

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Only school in the top five in spending for both chemistry and chemical engineering:
Georgia Tech

SCHOOL SPENDING ON CHEMICAL RESEARCH EQUIPMENT

Roughly three-quarters of spending came from federal funds in 2011

RANK 2011	\$ THOUSANDS							% FEDERAL FUNDS, ANNUAL AVERAGE,	
		2001	2007	2008	2009	2010	2011	2011 ^a	2007-11
1	U of Illinois, Urbana-Champaign	\$2,213	\$2,201	\$1,565	\$3,006	\$2,284	\$4,188	91.3%	\$2,649
2	U of Southern Mississippi	863	988	1,450	2,087	1,958	3,611	97.3	2,019
3	Northwestern U	1,063	1,969	1,038	1,878	1,993	3,343	68.1	2,044
4	Florida State U	1,763	301	194	239	302	2,947	98.0	797
5	U of Delaware	1,145	880	765	717	1,456	2,720	89.8	1,308
6	Massachusetts Inst. of Technology	1,805	1,384	2,166	2,176	4,404	2,521	68.6	2,530
7	U of Akron	745	2,846	743	3,337	2,588	2,491	25.7	2,401
8	U of California, Berkeley	1,254	1,489	1,661	1,769	2,240	2,488	71.3	1,929
9	Georgia Tech	984	981	483	1,008	1,476	2,484	49.9	1,286
10	Pennsylvania State U	1,601	901	2,868	3,331	2,051	2,453	61.3	2,321
11	Harvard U	1,312	1,923	1,476	1,321	1,844	2,344	90.1	1,782
12	U of Chicago	2,885	1,382	1,171	1,405	1,259	2,312	70.5	1,506
13	Wayne State U	510	1,039	1,493	725	2,733	2,264	41.5	1,651
14	U of North Carolina, Chapel Hill	483	2,269	1,941	956	2,532	2,131	96.4	1,966
15	Cornell U	534	268	728	3,484	3,147	2,085	97.4	1,942
16	U of California, San Diego	337	2,646	1,150	2,356	1,976	2,042	86.9	2,034
17	Stanford U	1,685	964	1,187	747	1,369	2,033	89.4	1,260
18	California Inst. of Technology	1,503	679	1,072	1,467	1,920	2,003	96.7	1,428
19	U of Wisconsin, Madison	850	864	1,661	2,253	3,371	2,002	82.8	2,030
20	U of Washington, Seattle	1,037	585	1,181	2,113	2,010	1,970	96.7	1,572
21	U of Oregon	619	857	1,703	1,330	1,396	1,927	33.5	1,443
22	U of Michigan	524	970	1,051	1,994	4,060	1,915	44.4	1,998
23	U of Colorado	1,056	952	708	1,164	1,124	1,910	91.5	1,172
24	Rutgers U	1,360	2,541	651	1,487	1,223	1,867	59.1	1,554
25	U at Buffalo, SUNY	186	580	687	96	220	1,852	99.2	687
	Total, listed institutions	\$28,317	\$32,459	\$30,793	\$42,446	\$50,936	\$59,903	76.6%	\$43,307
	TOTAL, ALL INSTITUTIONS	\$101,370	\$112,980	\$114,324	\$135,957	\$162,079	\$155,361	72.8%	\$136,140

NOTE: Institutional fiscal years. **a** Share of total expenditures funded by the federal government. **SOURCE:** National Science Foundation, WebCASPAR Database System

SPENDING IN CURRENT AND CONSTANT DOLLARS

When inflation is considered, increases are more modest

ACADEMIC R&D SPENDING (\$ MILLIONS)	2001	2010	2011	CHANGE	
				2010-11	2001-11
TOTAL					
Current dollars	\$32,801	\$58,311	\$61,891	6.1%	88.7%
Constant dollars	32,801	47,643	49,528	4.0	51.0
CHEMISTRY					
Current dollars	\$1,008	\$1,748	\$1,786	2.2%	77.2%
Constant dollars	1,008	1,428	1,429	0.1	41.8

NOTE: Calculated using 2001 = 1.00; deflator data obtained from whitehouse.gov/omb/budget/historicals.
SOURCE: National Science Foundation, WebCASPAR Database System

SCHOOL SPENDING ON CHEMICAL ENGINEERING R&D

This table ranks top chemical engineering spenders and breaks down funding sources

RANK		\$ THOUSANDS	SHARE OF TOTAL EXPENDITURES IN 2011, % ^a			ANNUAL CHANGE					
2011	2010		2001	2010	2011	FEDERAL GOVT	STATE/LOCAL GOVT	INDUSTRY	INSTITUTION	2010-11	2001-11
1	6	U of Texas, Austin	\$7,888	\$21,947	\$36,931	28.6%	17.5%	30.2%	15.4%	68.3%	16.7%
2	3	Massachusetts Inst. of Technology	16,843	25,497	32,138	48.3	0.0	42.0	3.1	26.0	6.7
3	12	Oklahoma State U ^b	1,428	14,327	31,108	92.8	2.2	2.8	2.2	117.1	36.1
4	1	Georgia Tech	7,735	28,202	28,053	55.7	2.3	19.7	18.3	-0.5	13.8
5	8	Texas A&M U	9,135	17,688	27,683	18.5	2.9	25.2	29.2	56.5	11.7
6	4	College of Nanoscale Science & Engineering, SUNY	na	23,540	26,401	2.7	44.0	32.9	15.8	12.2	nm
7	2	Ohio State U	6,441	27,771	25,225	23.6	17.9	15.2	11.3	-9.2	14.6
8	7	North Carolina State U, Raleigh	19,677	20,589	22,043	44.1	29.7	7.4	18.6	7.1	1.1
9	9	Johns Hopkins U	7,045	17,351	18,955	93.3	0.4	0.8	1.5	9.2	10.4
10	17	U of Colorado	3,773	13,299	18,843	46.4	0.1	16.6	29.4	41.7	17.4
11	18	Pennsylvania State U	13,167	13,082	17,052	41.7	0.2	14.8	27.8	30.3	2.6
12	5	U of South Carolina	6,280	22,990	16,450	32.3	0.0	19.2	34.7	-28.4	10.1
13	10	U of Massachusetts, Amherst	3,748	15,383	15,724	62.1	0.4	7.8	28.2	2.2	15.4
14	16	U of Delaware	6,324	13,531	15,557	79.7	0.2	8.4	11.1	15.0	9.4
15	14	Purdue U	6,875	13,958	14,322	59.8	1.1	9.8	26.2	2.6	7.6
16	21	Michigan State U	4,874	12,409	13,994	59.9	4.2	2.2	30.6	12.8	11.1
17	11	U of Akron	3,939	14,354	13,398	16.8	9.6	3.8	60.9	-6.7	13.0
18	13	U of California, Davis	4,793	14,295	13,191	55.0	7.9	4.8	19.1	-7.7	10.7
19	22	U of Wisconsin, Madison	6,920	11,656	12,990	66.5	9.2	0.7	15.3	11.4	6.5
20	15	Stanford U	8,001	13,826	12,823	58.3	0.5	22.8	7.7	-7.3	4.8
21	23	U of Minnesota	6,547	11,024	12,653	44.8	1.4	14.5	15.8	14.8	6.8
22	20	U of Tulsa	7,353	12,722	12,500	13.3	0.8	57.8	28.1	-1.7	5.4
23	78	U of Alabama	2,321	3,255	12,357	46.7	1.7	1.1	50.5	279.6	18.2
24	48	Northwestern U	3,793	5,879	12,298	76.0	0.0	0.0	14.4	109.2	12.5
25	33	Princeton U	3,649	8,029	11,002	62.7	0.3	3.9	26.6	37.0	11.7
		Total, listed institutions	\$168,549	\$396,604	\$473,691	47.5%	7.7%	16.7%	19.5%	19.4%	10.9%
		TOTAL, ALL INSTITUTIONS	\$414,349	\$820,941	\$926,658	53.5%	6.7%	13.6%	19.3%	12.9%	8.4%

NOTE: Institutional fiscal years. School ranks in 2010 revised to reflect revision of U at Albany, SUNY, data. **a** Figures may not sum to 100% because other funding sources, such as nonprofit organizations, are not listed. **b** Includes funding for University Multispectral Lab. **na** = not available. **nm** = not meaningful.

SOURCE: National Science Foundation, WebCASPAR Database System