

## ACADEMIC R&D DOUBLED DURING PAST DECADE, REACHING \$40 BILLION IN FY 2003

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Universities and colleges reported research and development (R&D)<sup>1</sup> expenditures of \$40.1 billion in FY 2003, 10.2 percent more than the previous year (\$36.4 billion) and double the \$20.0 billion expended in FY 1993. This increase represents the second consecutive year of double-digit growth (academic R&D was up 10.9 in FY 2002), according to data from the National Science Foundation's (NSF's) Survey of Research and Development Expenditures at Universities and Colleges. When adjusted for inflation, academic R&D rose 8.8 percent in FY 2002 and 8.3 percent in FY 2003, the fastest growth rate reported for any 2-year period since FY 1985-86.

### Sources of R&D funding

Federal funding has fueled most of the recent growth in total academic R&D (table 1). Universities and colleges reported that federally financed R&D grew by 13.7 percent and 13.1 percent, in FY 2002 and FY 2003, respectively, reaching \$24.7 billion. As a result, the federal share of the academic R&D support total (61.7 percent) is at its highest level since FY 1985. In contrast, R&D expenditures funded by nonfederal sources (\$15.3 billion) increased by 5.7 percent (or \$0.8 billion) in FY 2003.

The largest source of nonfederal funding, universities and colleges (reported as institutional funds), increased

<sup>1</sup> Universities and colleges report their separately budgeted R&D expenditures. This category includes all funds expended for activities specifically organized to produce research outcomes and commissioned by an agency either external to the institution or separately budgeted by an organizational unit within the institution. Unless noted differently, expenditures analyzed in this report refer to science and engineering R&D activities only.

by 7.8 percent to \$7.7 billion. Academic R&D supported directly by state and local governments (\$2.7 billion in FY 2003) increased by 5.9 percent.<sup>2</sup> R&D support from the industrial sector declined slightly for the second consecutive year and has leveled at approximately \$2.2 billion per year since FY 2000. As a consequence, industry's share of FY 2003 academic R&D support slipped to 5.4 percent, its lowest relative level since FY 1983 when industry accounted for 4.9 percent.

### Funding by Field and Federal Agency

The medical sciences (\$12.8 billion) and biological sciences (\$7.4 billion) accounted for the largest field shares of academia's FY 2003 R&D performance total, combining for one-half of R&D (table 2). These two fields also accounted for 54 percent of all federally financed academic R&D. Adding engineering, these three fields accounted for 65 percent and 68 percent, respectively, of total and federally financed academic R&D.

For the first time, the survey provides the agency sources of federal support. Universities have identified specific agency sources for 83 percent (\$20.5 billion) of the \$24.7 billion federal FY 2003 total. By far, the largest amount of funding (\$10.9 billion) was provided by the Department of Health and Human Services (primarily by its National Institutes of

<sup>2</sup> Figures reported for state and local government support of academic R&D exclude general purpose funds that schools receive from these sources and devote to R&D activities. These funds are included in figures reported as institutional funds.



TABLE 1. R&D expenditures at universities and colleges: FY 1998–2003  
(Millions of current dollars)

Source and character of work	1998	1999	2000	2001	2002	2003
All expenditures	25,855	27,530	30,067	32,797	36,370	40,077
Source of funds						
Federal government	15,150	16,101	17,535	19,223	21,860	24,734
State and local governments	1,944	2,021	2,200	2,321	2,506	2,653
Industry	1,888	2,033	2,156	2,220	2,187	2,162
Institutional funds	5,002	5,380	5,923	6,607	7,128	7,683
All other sources	1,870	1,994	2,254	2,426	2,689	2,845
Character of work						
Basic research	19,040	20,366	22,442	24,385	27,280	29,981
Applied research and development	6,815	7,163	7,625	8,412	9,090	10,097

NOTE: Because of rounding, detail may not add to total.

SOURCE: National Science Foundation, Division of Science Resources Statistics, Survey of Research and Development Expenditures at Universities and Colleges, FY 2003.

TABLE 2. R&D expenditures at universities and colleges, by source of funds and science and engineering field: FY 2003  
(Millions of current dollars)

Source and field	All R&D expenditures	Federal R&D expenditures	DoD	DOE	HHS	NASA	NSF	USDA	Other agencies	Unspecified agencies
All R&D expenditures	40,077	24,734	2,008	822	10,930	938	2,404	634	2,723	4,275
Agricultural sciences	2,555	762	10	15	30	15	54	369	146	123
Biological sciences	7,392	5,017	97	64	3,428	41	295	135	339	618
Computer sciences	1,304	936	297	29	21	28	291	2	101	167
Environmental sciences	2,188	1,440	91	72	22	182	344	25	392	312
Mathematical sciences	429	295	31	6	34	5	124	2	25	68
Medical sciences	12,787	8,249	156	37	5,846	42	26	21	592	1,530
Physical sciences	3,273	2,353	245	303	304	280	559	6	189	467
Psychology	769	553	22	2	364	9	37	0	45	72
Social sciences	1,661	667	18	10	229	12	82	31	194	89
Engineering	5,999	3,608	989	266	158	308	526	27	551	782

NOTE: Because of rounding, detail by agency may not add to total. Not all fields are reported in this table.

SOURCE: National Science Foundation/Division of Science Resources Statistics, Survey of Research and Development Expenditures at Universities and Colleges, FY 2003.

Health).<sup>3</sup> Not surprisingly, most (85 percent) of the reported R&D was to support the medical and biological sciences. From among the individual agencies, support for engineering was largest from the Department of Defense (\$1.0 billion of the \$3.6 billion engineering total) and the National Science Foundation (NSF) (\$0.5 billion). NSF also provided considerable support

<sup>3</sup> The agency data reported here represent a lower bound estimate of agencies' actual R&D support totals. The question on specific agency sources is relatively new to the survey, and 97 of the 630 institutions surveyed did not respond to this question. Of the \$24.7 billion federally financed total, respondents did not report agency sources for \$4.3 billion. NSF did not attempt to allocate the undistributed amounts to individual agencies.

(on the order of \$0.3 billion to \$0.6 billion) for each of physical, environmental, biological and computer sciences. In contrast to those of most other agencies, these funding patterns reflect NSF's legislative mandate to provide support for a broad mix of scientific disciplines.

### Top Academic Research Performers

Although more and more institutions are increasing their R&D expenditures,<sup>4</sup> academic R&D remains highly concentrated in the largest research institutions.

<sup>4</sup> See NSF InfoBrief, *U.S. Academic R&D Continues to Grow as More Universities and Colleges Expand Their R&D Activities*. (NSF 04-319, May 2004).

- Of the 630 institutions surveyed, the top 100 in terms of federally financed R&D expenditures accounted for 81 percent of federally financed R&D spending. The top 100 institutions in terms of total R&D expenditures accounted for 80 percent of all R&D dollars in FY 2003.
- The 20 research performers with the highest federally financed R&D expenditures represented 32 percent of federally sponsored expenditures. The 20 leading research performers in terms of total R&D expenditures accounted for 31 percent of total academic R&D spending (table 3).

TABLE 3. Twenty institutions reporting the largest FY 2003 academic R&D expenditures in the sciences and engineering: FY 2002-03 (Millions of current dollars)

Institution and 2003 rank	Total		Federal	
	2002	2003	2002	2003
All R&D expenditures <sup>a</sup>	36,370	40,077	21,860	24,734
Leading 20 institutions	11,125	12,284	6,968	7,828
1 Johns Hopkins U., The <sup>b</sup>	1,140	1,244	1,023	1,107
2 U. CA, Los Angeles	788	849	367	421
3 U. MI all campuses	674	780	444	517
4 U. WI Madison	662	721	345	396
5 U. WA	627	685	487	566
6 U. CA, San Francisco	597	671	327	372
7 U. CA, San Diego	585	647	359	400
8 Stanford U.	538	603	427	484
9 U. PA	522	565	398	416
10 Cornell U. all campuses	496	555	271	321
11 PA State U. all campuses	493	533	285	301
12 Duke U.	442	520	261	307
13 U. MN all campuses	494	509	295	293
14 U. CA, Berkeley	475	507	217	238
15 OH State U. all campuses	432	496	178	198
16 U. IL Urbana-Champaign	427	494	214	266
17 MA Institute of Technology	447	486	330	356
18 U. CA, Davis	457	482	177	208
19 Washington U. St. Louis	417	474	303	357
20 Baylor C. of Medicine	412	462	259	303
All other institutions	25,245	27,794	14,892	16,906

<sup>a</sup> Data do not include R&D performed by university-administered federally funded research and development centers.

<sup>b</sup> Includes R&D expenditures for Applied Physics Laboratory (APL). For FY 2003, APL reported \$607 million in total and \$582 million in federally financed R&D expenditures.

NOTE: Because of rounding, detail may not add to total.

SOURCE: National Science Foundation/Division of Science Resources Statistics, Survey of Research and Development Expenditures at Universities and Colleges, FY 2003.

These concentrations have changed little over the past five years, indicating that the recent growth in R&D expenditures reflects increased R&D activities across a broad spectrum of academic institutions rather than among a select few.

Most of the universities that ranked in the top 20 in FY 2003 also ranked among the leading 20 academic performers in FY 2002. Several changed rank positions in FY 2003: Baylor College of Medicine, which ranked 21 in FY 2002, reentered the list, and Texas A&M, which ranked 17 in FY 2002, dropped out (table 3). Duke University has climbed the most among the top 20 institutions in these national rankings during the past several years: It was ranked 21<sup>st</sup> in FY 2001, 16<sup>th</sup> in FY 2002, and 12<sup>th</sup> in FY 2003.

### Pass-Through Funds

In an attempt to capture all academic R&D expenditures, the NSF Academic R&D Survey instructs respondents to “include research funds for which an outside organization, educational or other, is a subrecipient.” Perhaps reflecting growth in collaborative research relationships, the data show that an increasing amount of the university and college R&D totals have passed through one institution to others.<sup>5</sup> In FY 2003, universities reported that \$1.1 billion (of the reported \$40 billion) in R&D expenditures were passed through to other educational subrecipients; not coincidentally, universities also reported \$1.1 billion was received as a subrecipient from other higher education pass-through entities.<sup>6</sup> Of the \$1.1 billion total, most (\$1.0 billion) of the funds originated from federal sources.

Universities also reported that substantial R&D amounts were received from and passed through to non-higher education sectors. In FY 2003, at least \$0.8 billion was passed through to subrecipients outside of higher

<sup>5</sup> Some research collaborations are funded through single grants; whereas others are funded through multiple awards. Either mechanism could necessitate a physical flow of funds among institutions in order to accomplish the funded research.

<sup>6</sup> Data from the Academic R&D Survey and other surveys are used to analyze patterns of R&D activity in the United States. For this analysis, the most recent data update of the report *National Patterns of R&D Resources* adjusts university and college R&D performance to net out R&D expenditures reported as passed through to educational subrecipients beginning with FY 1998. *National Patterns* reports and data updates are on the NSF Web site at <http://www.nsf.gov/statistics/nsf05308/>.

education and \$1.1 billion in pass-through funding was received from sectors outside of higher education.<sup>7</sup> In FY 2003, 8.5 percent (\$2.1 billion) of all federally financed academic R&D was passed through to all types of subrecipients, compared with 2.1 percent (\$0.3 billion) of all nonfederal sources of funds.

### Non-S&E R&D Expenditures

For the first time, in addition to expenditures on science and engineering (S&E) R&D, the survey also includes information at the institution level on non-S&E R&D expenditures. In FY 2003, respondents to the Survey of Academic R&D reported \$1.4 billion in non-S&E R&D expenditures (table 4). This amount is in addition to the \$40.1 billion expended on S&E R&D. The largest amount (\$0.6 billion) of non-S&E expenditures supported education research, but more than \$100 million was also expended each in support of business and management and the humanities.

The data reported here are lower-bound estimates for the national totals because (1) not all universities responding to the Academic R&D Survey reported their non-S&E R&D expenditures<sup>8</sup> and (2) only institutions included in this S&E R&D performing sample were surveyed. The activities of institutions that do not perform S&E R&D (but may conduct substantial amounts of non-S&E R&D) are not reflected here.

### Data Notes

The academic R&D expenditures data presented in this InfoBrief were obtained from 630 universities and colleges that grant degrees in the sciences or engineering and expend at least \$150 thousand in science and engineering R&D in the surveyed fiscal year. The FY 2003 Survey of Research and Development Expenditures at Universities and Colleges detailed statistical tables will be available on the NSF Web site at <http://www.nsf.gov/statistics/>.

<sup>7</sup> The data reported here are lower bound estimates since some institutions are unable to identify their pass through funding. Additionally, a number of institutions are able to report pass-through totals (both received as a subrecipient and passed through to other subrecipients), but are unable to differentiate between educational subrecipients/pass-through entities and those located in other sectors.

<sup>8</sup> Responding to this question were 516 of the 630 surveyed institutions; 114 did not respond. NSF did not attempt to estimate for item nonresponse.

TABLE 4. R&D expenditures in non-science and engineering fields at universities and colleges: FY 2003

(Millions of current dollars)	
All non-S&E R&D expenditures	1,371
Business and management	165
Communications, journalism, and library science	55
Education	597
Humanities	135
Law	41
Social work	56
Visual and performing arts	39
Other non-S&E fields	241

NOTE: Because of rounding, detail may not add to total.

SOURCE: National Science Foundation/Division of Science Resources Statistics, Survey of Research and Development Expenditures at Universities and Colleges, FY 2003.

NSF makes available computer-generated institutional profiles for individual doctorate-granting institutions and institutions of higher education with S&E departments that grant at least master's degrees. The profiles contain data from this survey as well as from two other NSF academic S&E surveys: the Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions and the Survey of Graduate Students and Postdoctorates in Science and Engineering. Data from the three surveys are available on the Web (<http://www.nsf.gov/statistics/>) and on NSF's WebCASPAR database system, a web tool for retrieval and analysis of statistical data on academic S&E resources (<http://webcaspar.nsf.gov>).

For more information related to the Survey of Research and Development Expenditures at Universities and Colleges, contact

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