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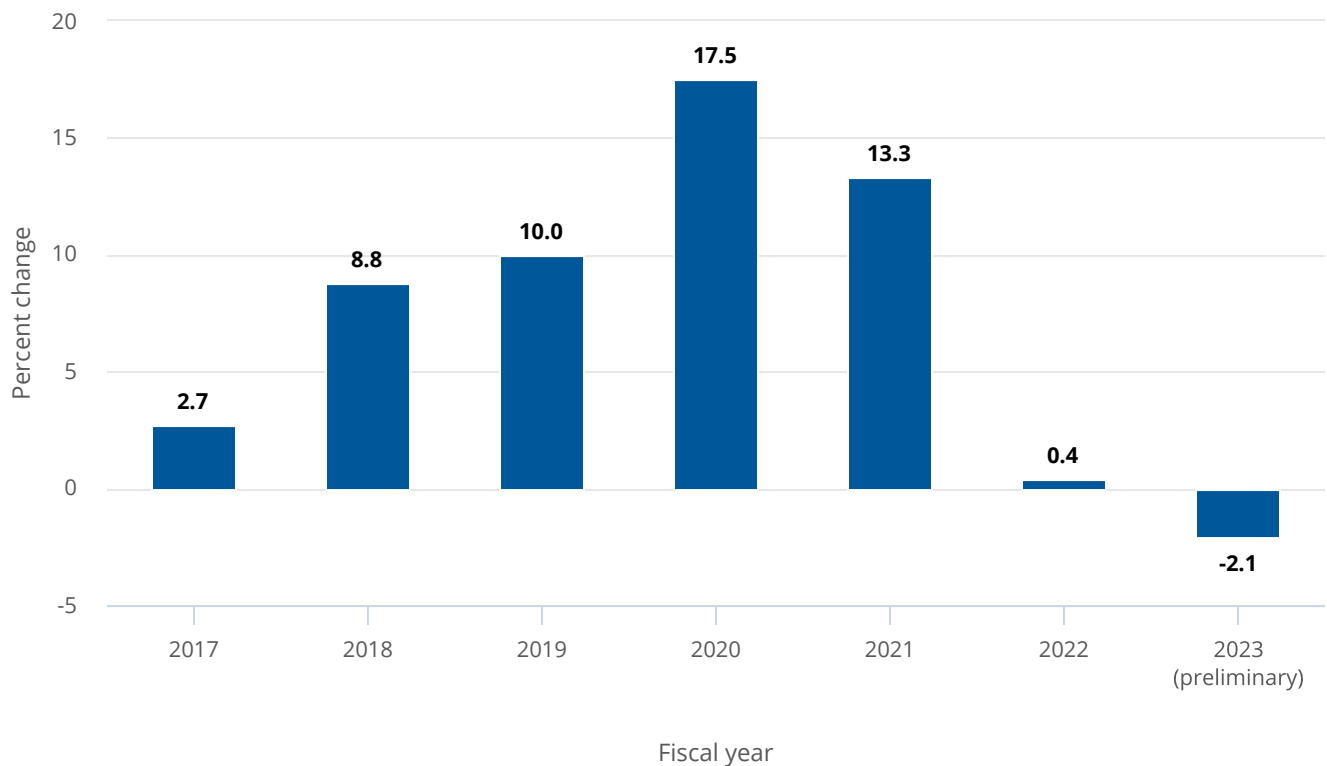
InfoBrief

Federal R&D Obligations Increased 0.4% in FY 2022; Estimated to Decline in FY 2023

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Federal agency obligations for research and experimental development (R&D) increased 0.4% between FY 2021 and FY 2022, from \$189.6 billion to \$190.4 billion ([figure 1](#)).¹ However, preliminary estimates for FY 2023 show obligations for R&D are expected to decline 2.1% to \$186.4 billion. This decline is driven by a reduction in COVID-19 pandemic-related funding that was obligated by the Biomedical Advanced Research and Development Authority (BARDA) (\$28.4 billion in FY 2022 to an expected \$818 million in FY 2023).²

Figure 1**Annual change in federal R&D obligations: FYs 2017–23****Note(s):**

Because of rounding, detail may not add to total. FYs 2020, 2021, and 2022 obligations include additional funding provided by supplemental COVID-19 pandemic-related appropriations (e.g., Coronavirus Aid, Relief, and Economic Security [CARES] Act).

Source(s):

National Center for Science and Engineering Statistics, Survey of Federal Funds for Research and Development.

Funding for research (both basic and applied) increased 9.2% between FY 2021 and FY 2022, from \$85.9 billion to \$93.8 billion, and it is estimated to increase an additional 6.0% in FY 2023 to \$99.5 billion (table 1). At the same time, federal funding for experimental development decreased 6.8%, from \$103.7 billion in FY 2021 to \$96.6 billion in FY 2022, and it is estimated to decrease an additional 10.0% in FY 2023 to \$87.0 billion. Obligations for R&D plant totaled \$6.2 billion in FY 2022 and are estimated to increase further in FY 2023 to \$6.5 billion. At the same time, federal agency outlays for R&D totaled \$178.9 billion in FY 2022, an increase of 2.5% from \$174.5 billion in FY 2021.³ Outlays for R&D plant totaled \$4.2 billion in FY 2022.

Table 1**Federal obligations and outlays for research, experimental development, and R&D plant: FYs 2021–23**

(Dollars in billions)

Type of R&D	FY 2021	FY 2022	FY 2023 (preliminary)	Percent change FY 2021–22	Percent change FY 2022–23 (preliminary)
Outlays for R&D and R&D plant	178.3	183.1	177.6	2.7	-3.0
R&D	174.5	178.9	171.9	2.5	-3.9
R&D plant	3.8	4.2	5.7	10.0	36.3

Table 1**Federal obligations and outlays for research, experimental development, and R&D plant: FYs 2021–23**

(Dollars in billions)

Type of R&D	FY 2021	FY 2022	FY 2023 (preliminary)	Percent change FY 2021–22	Percent change FY 2022–23 (preliminary)
Obligations for R&D and R&D plant	193.9	196.6	193.0	1.4	-1.8
R&D	189.6	190.4	186.4	0.4	-2.1
Research	85.9	93.8	99.5	9.2	6.0
Basic research	42.3	45.4	48.5	7.4	6.8
Applied research	43.6	48.4	51.0	11.0	5.4
Experimental development	103.7	96.6	87.0	-6.8	-10.0
R&D plant	4.3	6.2	6.5	44.2	5.6

Note(s):

Because of rounding, detail may not add to total. Percentages are computed using actual dollars reported. FYs 2021 and 2022 data include obligations from supplemental COVID-19 pandemic-related appropriations (e.g., Coronavirus Aid, Relief, and Economic Security [CARES] Act).

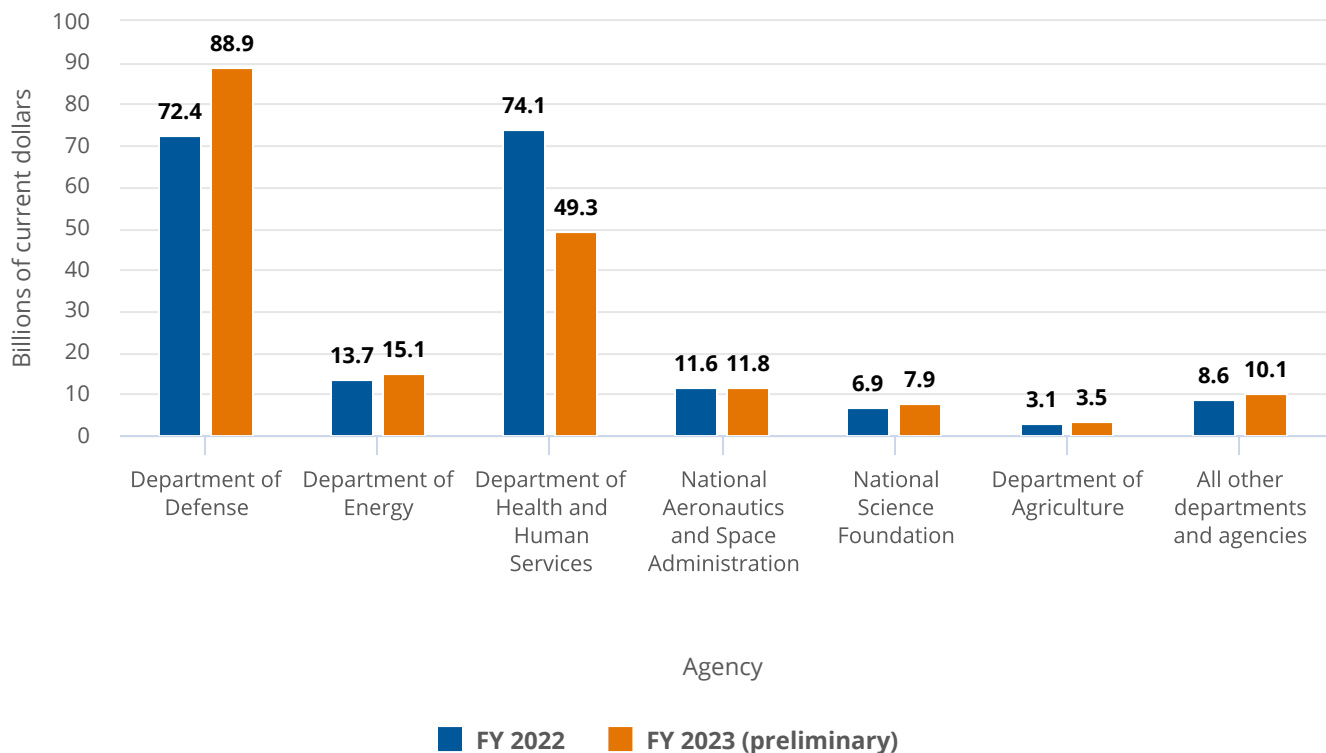
Source(s):

National Center for Science and Engineering Statistics, Survey of Federal Funds for Research and Development.

Data are from the latest cycle of the Survey of Federal Funds for Research and Development (Federal Funds for R&D), sponsored by the National Center for Science and Engineering Statistics within the National Science Foundation (NSF). Data for FY 2022 are actual amounts as of the fiscal year end; FY 2023 data are preliminary and subject to revision in future surveys. Data presented in this InfoBrief are in current dollars.

Federal Agencies' Share of R&D Obligations

In FY 2022, six federal agencies obligated \$181.8 billion for R&D, or 95% of the total federal share ([figure 2](#)). The Department of Health and Human Services (HHS) and the Department of Defense (DOD) accounted for \$74.1 billion (39%) and \$72.4 billion (38%), respectively. The Department of Energy (DOE) and the National Aeronautics and Space Administration (NASA) accounted for \$13.7 billion (7%) and \$11.6 billion (6%), respectively. These were followed by NSF (\$6.9 billion, or 4%) and the Department of Agriculture (USDA) (\$3.1 billion, or 2%).

Figure 2**Federal obligations for research and experimental development, by agency and type of R&D: FY 2022 and FY 2023****Note(s):**

Because of rounding, detail may not add to total. FY 2022 obligations include additional funding provided by supplemental COVID-19 pandemic-related appropriations (e.g., Coronavirus Aid, Relief, and Economic Security [CARES] Act).

Source(s):

National Center for Science and Engineering Statistics, Survey of Federal Funds for Research and Development, FYs 2022–23.

In FY 2023, although the total R&D obligations are expected to decrease, the total share of federal R&D is expected to remain virtually unchanged for these six federal agencies, totaling 95% of all federal obligations (\$176.3 billion out of \$186.4 billion). However, the relative shares of R&D between HHS and DOD have changed considerably between FY 2022 and FY 2023. Specifically, HHS's share of R&D is expected to decrease to 26% (\$49.3 billion), as BARDA's COVID-19 pandemic-related infusion of funding for R&D decreased from \$28.4 billion in FY 2022 to an expected \$818 million in FY 2023, a decrease of 97.1%.⁴ At the same time, DOD's R&D obligations increased from \$72.4 billion in FY 2022 to an estimated \$88.9 billion in FY 2023, increasing DOD's share of the federal R&D portfolio to 48%. This increase in DOD's R&D obligations between FY 2022 and FY 2023 is consistent with an increase in R&D budget authority for national defense functions.⁵

Federal Funding for Research

Federal agency obligations for basic research totaled \$45.4 billion in FY 2022 (table 2).⁶ HHS basic research obligations accounted for \$22.4 billion, or 49% of all federal government obligations for basic research. DOE and NSF accounted for approximately \$6.1 billion and \$5.9 billion, respectively (13% each). NASA accounted for \$5.1 billion (11%), followed by DOD with \$3.1 billion (7%) and USDA with \$1.4 billion (3%). Obligations for basic research are estimated to increase 6.8% to \$48.5 billion in FY 2023.

Table 2**Federal obligations for basic research and applied research, by agency: FYs 2022–23**

(Dollars in billions)

Agency	FY 2022		FY 2023 (preliminary)	
	Basic research	Applied research	Basic research	Applied research
All agencies	45.4	48.4	48.5	51.0
Department of Agriculture	1.4	1.4	1.6	1.6
Department of Defense	3.1	7.0	3.5	8.4
Department of Energy	6.1	5.0	6.5	5.8
Department of Health and Human Services	22.4	25.9	23.8	25.4
National Aeronautics and Space Administration	5.1	2.2	5.1	1.7
National Science Foundation	5.9	1.0	6.4	1.5
All other agencies	1.4	5.8	1.5	6.6

Note(s):

Because of rounding, detail may not add to total. FY 2022 obligations include additional funding provided by supplemental COVID-19 pandemic-related appropriations (e.g., Coronavirus Aid, Relief, and Economic Security [CARES] Act).

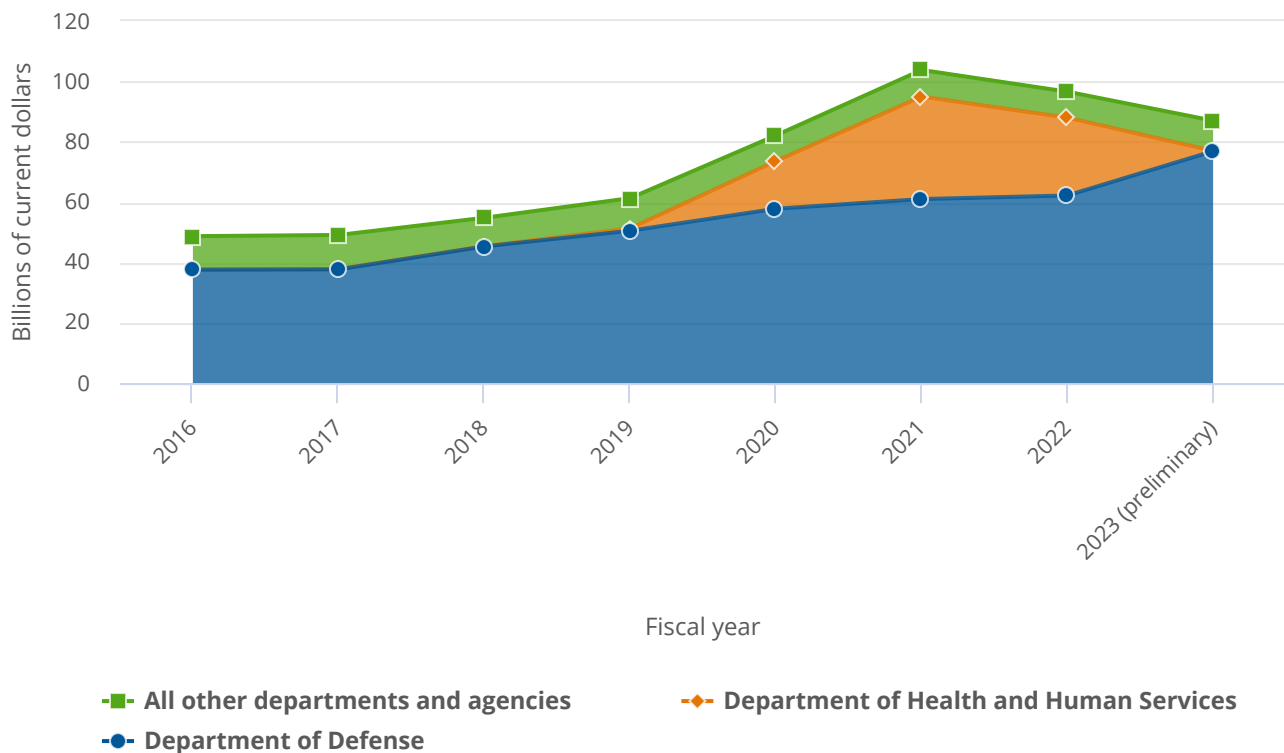
Source(s):

National Center for Science and Engineering Statistics, Survey of Federal Funds for Research and Development, FYs 2022–23.

Similar to basic research, HHS was the largest funder of applied research, with 53% of all applied research obligations in FY 2022 (\$25.9 billion).⁷ Although DOD accounted for \$3.1 billion of basic research, it was the second-largest funder of applied research with \$7.0 billion (14%) in FY 2022. DOE and NASA reported \$5.0 billion (10%) and \$2.2 billion (5%), respectively, for applied research obligations. All other federal departments and agencies combined totaled \$8.3 billion of applied research obligations in FY 2022. Obligations for applied research are estimated to increase 5.4% to \$51.0 billion in FY 2023.

Federal Funding for Experimental Development

Although federal obligations for research (both basic research and applied research) increased 9.2% between FY 2021 and FY 2022, obligations for experimental development decreased 6.8% during the same period ([figure 3](#) and [table 1](#)).⁸ Total FY 2022 obligations for experimental development totaled \$96.6 billion, decreasing from \$103.7 billion in FY 2021. DOD's obligations for experimental development increased \$1.2 billion between FY 2021 and FY 2022, from \$61.0 billion to \$62.2 billion. However, with decreased obligations from COVID-19 pandemic-related stimulus funds, HHS's obligations for experimental development declined by \$8.2 billion between FY 2021 and FY 2022, from \$34.0 billion to \$25.8 billion.

Figure 3**Federal obligations for experimental development, by agency: FYs 2016–23****Note(s):**

Because of rounding, detail may not add to total. Beginning with FY 2016, the totals reported for development obligations represent a refinement to this category by more narrowly defining it to be "experimental development." Most notably, totals for development do not include the Department of Defense (DOD) Budget Activity 7 (Operational System Development) obligations. Those funds, previously included in DOD's development obligation totals, support the development efforts to upgrade systems that have been fielded or have received approval for full-rate production and anticipate production funding in the current or subsequent fiscal year. Therefore, the data are not directly comparable with totals reported in previous years. FYs 2020, 2021, and 2022 obligations include additional funding provided by supplemental COVID-19 pandemic-related appropriations (e.g., Coronavirus Aid, Relief, and Economic Security [CARES] Act).

Source(s):

National Center for Science and Engineering Statistics, Survey of Federal Funds for Research and Development.

In FY 2023, obligations for experimental development are estimated to decline further to a total of \$87.0 billion. HHS obligations for experimental development are expected to decline even further in FY 2023 to a total of \$56 million, which would be similar to pre-pandemic funding levels. However, DOD's obligations are estimated to increase \$14.7 billion to a total of \$76.9 billion, accounting for 88% of total experimental development and about double the amount obligated in FY 2016 (\$37.6 billion in current dollars).

FY 2022 Legislation Affecting Future Federal Funding for R&D

Although the end of COVID-19 pandemic-related stimulus funds in FY 2023 contributes to the overall decline in federal obligations for experimental development between FY 2022 and the expected obligations in FY 2023, FY 2022 saw the passage of three bills that are estimated to contribute to additional R&D obligations in FY 2023 and succeeding years. Specifically, the Infrastructure Investment and Jobs Act (IIJA) (P.L. 117-58) was signed into law 15 November 2021; Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act, (P.L. 117-167) was signed on 9 August 2022; and the Inflation Reduction Act (IRA) (P.L. 117-169), was signed on 16 August 2022. Although the legislation for IIJA, CHIPS, and IRA contains science, technology, and innovation provisions that extend well beyond appropriations and

obligations for R&D, supplemental data collected from specific agencies subject to R&D provisions in the legislation, namely, NSF, DOE, the National Oceanic and Atmospheric Administration, and the National Institutes of Standards and Technology, show preliminary obligations for R&D from IIJA, CHIPS, and IRA are \$180 million, \$410 million, and \$56 million, respectively (table 3).⁹

Table 3

Federal obligations for research and experimental development from CHIPS and Science Act, the Inflation Reduction Act, and the Infrastructure Investment and Jobs Act: FYs 2022–23

(Dollars in thousands)

Type of work	Infrastructure Investment and Jobs Act (P.L. 117-58)		CHIPS and Science Act (P.L. 117-167)		Inflation Reduction Act (P.L. 117-169)	
	FY 2022	FY 2023 (preliminary)	FY 2022	FY 2023 (preliminary)	FY 2022	FY 2023 (preliminary)
Basic research	0	0	0	12,000	204	43
Applied research	44,945	165,407	0	6,000	0	51,900
Experimental development	4,140	14,741	0	392,041	0	3,785
Total R&D	49,085	180,148	0	410,041	204	55,728
Total R&D plant	4,048	48	0	0	1,102	510,406
Total R&D and R&D plant	53,133	180,196	0	410,041	1,306	566,134

Note(s):

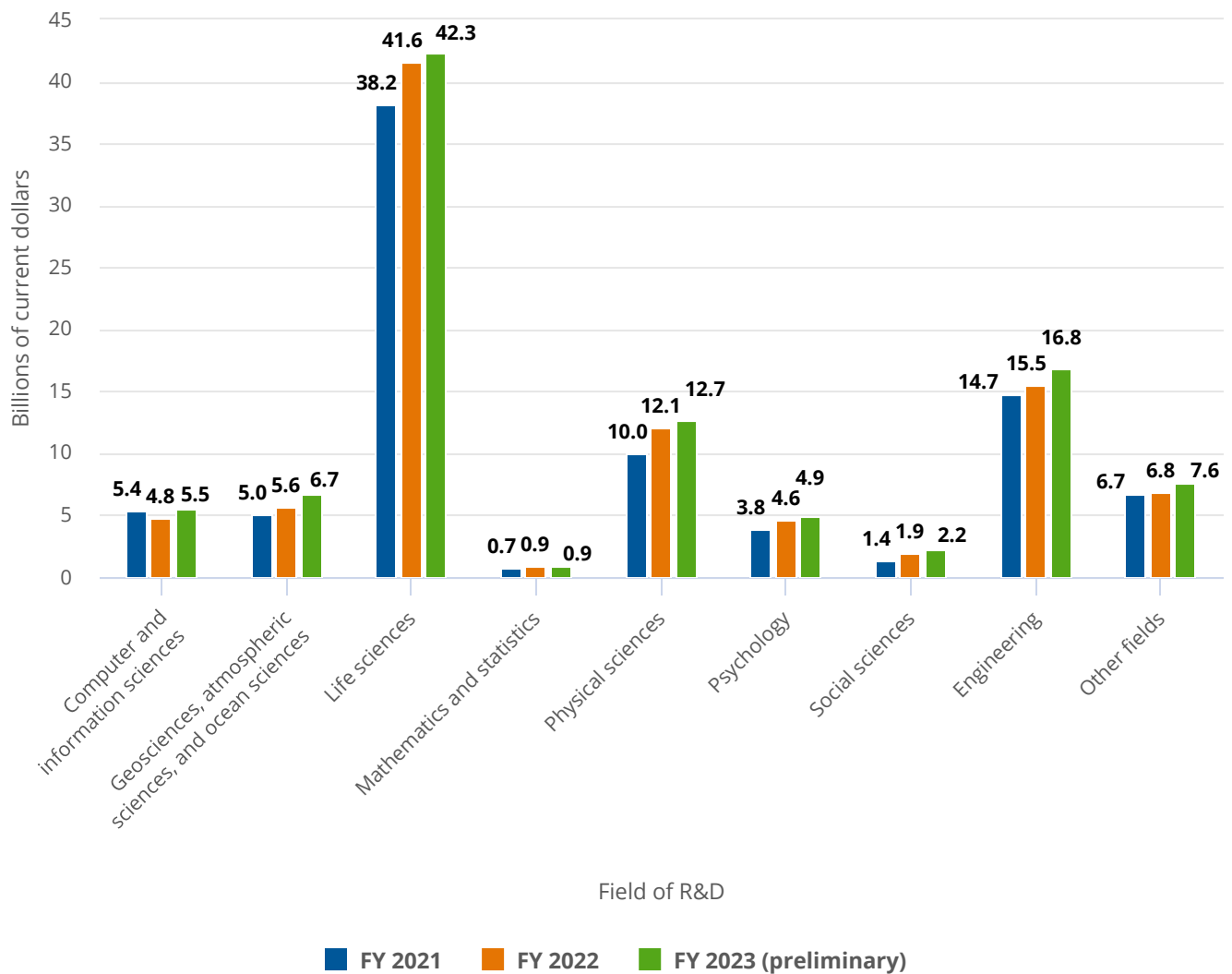
Because of rounding, detail may not add to total. Reporting agencies include the Department of Energy, the National Oceanographic and Atmospheric Administration, the National Institutes of Standards and Technology, and the National Science Foundation.

Source(s):

National Center for Science and Engineering Statistics, Survey of Federal Funds for Research and Development, FYs 2022–23.

Federal Funding by Field of R&D

Federal R&D funds are obligated to a variety of different fields of R&D. In FY 2022, life sciences was the largest field of R&D supported by federal funds with \$41.6 billion, increasing from \$38.2 billion in FY 2021 and estimated to increase to \$42.3 billion in FY 2023 (figure 4). Obligations for engineering research increased from \$14.7 billion in FY 2021 to \$15.5 billion in FY 2022 and are estimated to reach \$16.8 billion in FY 2023. Similarly, physical sciences obligations increased from \$10.0 billion in FY 2021 to \$12.1 billion in FY 2022 and are estimated to total \$12.7 billion in FY 2023. Most of the nine broad fields of R&D show some degree of increased obligations in FY 2022 and FY 2023.

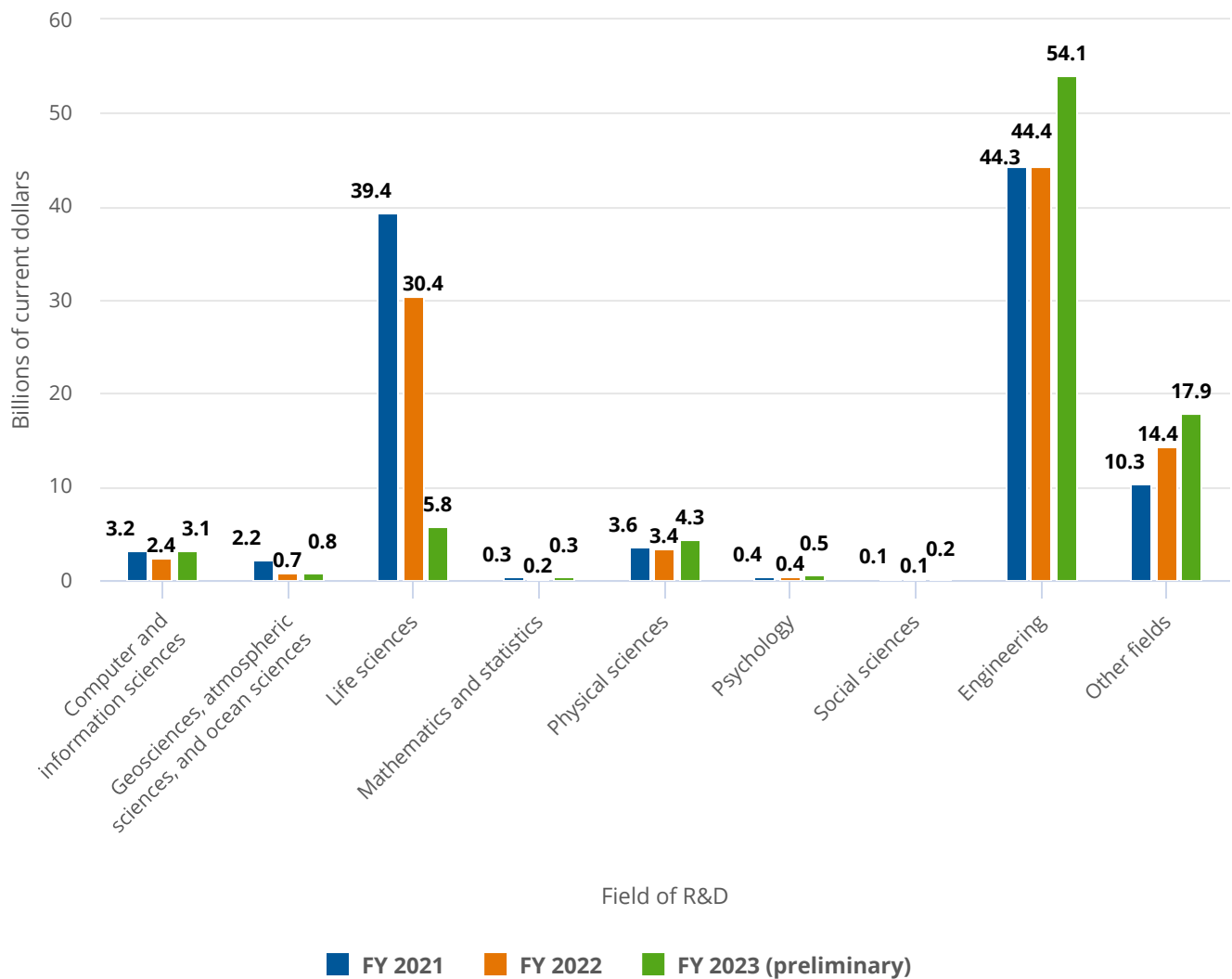
Figure 4**Federal obligations for research by field of R&D: FYs 2021–23****Note(s):**

Because of rounding, detail may not add to total. FYs 2021 and 2022 data include obligations from supplemental COVID-19 pandemic-related appropriations (e.g., Coronavirus Aid, Relief, and Economic Security [CARES] Act).

Source(s):

National Center for Science and Engineering Statistics, Survey of Federal Funds for Research and Development.

Federal obligations for experimental development by field of R&D are much more concentrated than they are for research obligations. For example, in FY 2022, engineering accounted for 46% of all experimental development across all fields compared with 17% of research obligations. Engineering obligations for experimental development increased from \$44.3 billion in FY 2021 to \$44.4 billion in FY 2022 and are estimated to increase further in FY 2023 to \$54.1 billion ([figure 5](#)). Life sciences also received considerable funds for experimental development in FY 2021 and FY 2022, with \$39.4 billion and \$30.4 billion, respectively. However, with the end of pandemic-related stimulus funds, FY 2023 obligations to life sciences are expected to decrease to \$5.8 billion.

Figure 5**Federal obligations for experimental development, by field of R&D: FYs 2021–23****Note(s):**

Because of rounding, detail may not add to total. FYs 2021 and 2022 data include obligations from supplemental COVID-19 pandemic-related appropriations (e.g., Coronavirus Aid, Relief, and Economic Security [CARES] Act).

Source(s):

National Center for Science and Engineering Statistics, Survey of Federal Funds for Research and Development.

Data Sources, Limitations, and Availability

Federal Funds R&D is a census of all federal agencies that fund R&D programs, as identified from information in the president's budget submission to Congress, excluding the Central Intelligence Agency. Federal agencies that fund R&D are identified in *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2023*.¹⁰ Data were obtained from 32 federal agencies (14 federal departments and 18 independent agencies) that had obligations for R&D during FY 2022 or FY 2023. Because multiple subdivisions of some federal departments completed the survey, there were agency-level responses from 6 federal departments, 48 agencies (within another 8 federal departments), and 18 independent agencies.

However, lower offices could also be authorized to enter data. In Federal Funds for R&D nomenclature, agency-level offices could authorize program offices, program offices could authorize field offices, and field offices could authorize branch offices. When these suboffices are included, there were 725 total respondents: 72 agencies, 95 program offices, 178 field offices, and 380 branch offices.

Volume 72 of Federal Funds for R&D collected final FY 2022 data and preliminary FY 2023 totals. FY 2023 data are subject to revision when collected under next year's survey, volume 73 (FY 2023 data and preliminary FY 2024 totals).

Beginning with volume 66 of the survey (FYs 2016 and 2017), the totals reported for development obligations and outlays represent a refinement to this category by more narrowly defining it to be "experimental development" to align with federal R&D budget formulation as per the Office of Management and Budget's Circular A-11, Section 84. As a result, totals for experimental development from FY 2016 and on do not include DOD Budget Activity 7 (Operational System Development) obligations and outlays. Those funds, previously included in DOD's development totals, support the development efforts to upgrade systems that have been fielded or have received approval for full-rate production and anticipate production funding in the current or subsequent fiscal year. Therefore, the development data and total R&D data are not directly comparable with totals reported prior to FY 2016.¹¹ Although this survey is a census of federal agencies that fund R&D and there is no sampling error, survey data are still subject to some degree of unmeasurable nonsampling error which may include errors in classification or measurement of certain aspects of an agencies R&D. For additional information see the section "Survey Quality Measures" within the Technical Notes of the survey.¹²

The full set of data tables for FYs 2022 and 2023 are available at <https://ncses.nsf.gov/surveys/federal-funds-research-development/>. For more information, please contact the author.

Notes

- 1 Obligations represent the amount for orders placed, contracts awarded, services received, and similar transactions during a given period, regardless of when the funds were appropriated or when future payment of money is required.
- 2 Although COVID-19 pandemic-related stimulus funds were not collected as a separate source of funds on volume 72 of the Survey of Federal Funds for Research and Development, data from volumes 70 and 71 survey cycles show that in FY 2020, FY 2021, and FY 2022, 74%, 93%, and 94%, respectively, of all pandemic funds for R&D were obligated by the Biomedical Advanced Research Development Authority, within the Department of Health and Human Services. See Pece CV; National Center for Science and Engineering Statistics (NCSES). 2023. *Federal Obligations for R&D Increased Nearly 14% in FY 2021, Supported by COVID-19 Pandemic-Related Funding*. NSF 23-352. Alexandria, VA: National Science Foundation. Available at <https://ncses.nsf.gov/pubs/nsf23352>.
- 3 Outlays represent the amounts for checks issued and cash payments made during a given period, regardless of when funds were appropriated.
- 4 For specific obligations by the Biomedical Advanced Research Development Authority in FY 2022 and FY 2023, see tables 5 and 6, respectively, in the full set of data tables at <https://ncses.nsf.gov/surveys/federal-funds-research-development/2022-2023#data>.
- 5 Budget authority is the primary source of legal authorization to enter into obligations that will result in outlays. See <https://ncses.nsf.gov/pubs/ncses24204> for more details.
- 6 Basic research is defined as experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts. Basic research may include activities with broad or general applications in mind, such as the study of how plant genomes change, but should exclude research directed toward a specific application or requirement, such as the optimization of the genome of a specific crop species.
- 7 Applied research is defined as original investigation undertaken in order to acquire new knowledge. Applied research is, however, directed primarily toward a specific practical aim or objective.
- 8 Experimental development is creative and systematic work, drawing on knowledge gained from research and practical experience, which is directed at producing new products or processes or improving existing products or processes. Like research, experimental development will result in gaining additional knowledge.

9 Based on provisions in the respective legislation and in consultation with staff at the Office of Management and Budget and the Office of Science and Technology Policy, the supplemental request was sent to those agencies where R&D spending was authorized. No agencies reported obligations for R&D from these laws in FY 2022 as they were passed within that same fiscal year. However, they did report estimated obligations to be made in FY 2023. This request will be formalized in future survey cycles across all agencies to ensure complete coverage in the FY 2023 actuals collected under volume 73.

10 See chapter 18, Research and Development, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2024*. Available at https://www.whitehouse.gov/wp-content/uploads/2023/03/ap_6_research_fy2024.pdf.

11 For additional information see Pece C, Jankowski J; National Center for Science and Engineering Statistics (NCSES). 2021. *Statistical Definition of Development Clarified: Effect on R&D Totals*. NSF 21-326. Alexandria, VA: National Science Foundation. Available at <https://ncses.nsf.gov/pubs/nsf21326/>.

12 Survey technical notes are available at <https://ncses.nsf.gov/surveys/federal-funds-research-development/2022-2023#technical-notes>.

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