



September 2022

FEDERAL RESEARCH

Information on Funding for U.S.- China Research Collaboration and Other International Activities

Accessible Version

Why GAO Did This Study

Federally funded research and development (R&D) contributes to innovation, the economy, and national security. To achieve their missions, federal agencies sometimes provide research funds to foreign entities such as universities, laboratories, and public health organizations. Agencies may also collaborate with foreign entities to access resources such as one-of-a-kind scientific facilities. In fiscal year 2020, federal agencies obligated about \$1.4 billion for R&D collaboration with foreign entities. The federal government also appropriated about \$2 billion to multilateral institutions in fiscal year 2020 to promote U.S. and global security.

GAO was asked to review federal funds provided to China for collaborative research, and U.S. contributions to multilateral institutions. This report describes (1) the amount of funding departments and agencies provided to Chinese entities for collaborative research, (2) selected departments' and agencies' programs, activities, and results of collaborative research with Chinese entities, and (3) funding the U.S. government has provided to selected multilateral institutions that support activities in China.

GAO analyzed data from five agencies with the largest amount of funding for R&D. In consultation with the Departments of State and the Treasury, GAO analyzed publicly available data on eight selected multilateral institutions that provided funding and loans to China based on agency and multilateral institution's budget documents. GAO interviewed agency officials about the funding and activities.

View [GAO-22-105313](#). For more information, contact Candice N. Wright at (202) 512-6888 or WrightC@gao.gov or Kimberly Gianopoulos at (202) 512-8612 or GianopoulosK@gao.gov.

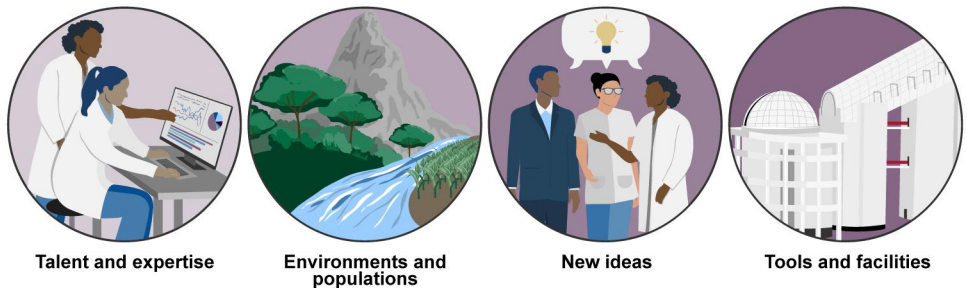
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What GAO Found

The U.S. government collaborates with and supports foreign entities such as those in China to, among other things, broaden U.S. access to scientific resources. Of the five agencies that GAO reviewed, the Centers for Disease Control and Prevention, the Department of Defense, and the National Institutes of Health obligated \$28.9 million directly to Chinese entities from fiscal years 2015 through 2021. Neither of the other two agencies—the National Science Foundation and the Department of Energy—provided awards directly to Chinese entities. Chinese entities also received federal research funds through subawards to do a portion of the work. The full extent of that funding is not known due to limitations in the data provided in accordance with federal subaward reporting requirements.

Examples of Resources Available Through International Research Collaborations



Source: GAO analysis of agency documents. | GAO-22-105313

The awards funded by the Centers for Disease Control and Prevention, the Department of Defense, and the National Institutes of Health focused on multiple scientific disciplines, including public health and biological sciences. For example, the Centers for Disease Control and National Institutes of Health funded Chinese entities to conduct a wide range of research, including disease surveillance, vaccination studies, and the development of new drugs. Additionally, the Department of Defense funded research in areas such as alternative technologies to propel vehicles such as drones. These awards provided directly to Chinese entities resulted in scientific articles, data collection systems, and international workshops.

The U.S. government, along with other donors, provides funding to some multilateral institutions—such as the United Nations. Multilateral institutions support activities worldwide, including in China, in areas such as agriculture, infrastructure, and economic development. According to State and Treasury officials, multilateral institutions specify how funding should be used, and which countries should receive funding.

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Abbreviations

ADB	Asian Development Bank
CDC	Centers for Disease Control and Prevention
Chinese CDC	Chinese Center for Disease Control and Prevention
CRS	Congressional Research Service
DOD	Department of Defense
DOE	Department of Energy
FAR	Federal Acquisition Regulation
FFATA	Federal Funding Accountability and Transparency Act of 2006
FSRS	FFATA Subaward Reporting System
GEF	Global Environment Facility
IBRD	International Bank for Reconstruction and Development
IFAD	International Fund for Agricultural Development
NIH	National Institutes of Health
NSF	National Science Foundation
OMB	Office of Management and Budget
R&D	research and development
State	Department of State
Treasury	Department of the Treasury
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
UNIDO	United Nations Industrial Development Organization
USAID	U.S. Agency for International Development
WHO	World Health Organization

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September 29, 2022

The Honorable Michael McCaul
Ranking Member
Committee on Foreign Affairs
House of Representatives

The Honorable Elise Stefanik
House of Representatives

Federally funded research and development (R&D) is a key contributor to innovation, the economy, and national security. Federal agencies fund R&D at universities, colleges, and other nonprofit and for-profit organizations to support their missions in areas including public health, energy security, and science advancement. To achieve these missions, federal agencies sometimes collaborate with foreign entities, such as those in China, to leverage talent or other resources around the world. In fiscal year 2020, the U.S. government obligated about \$1.4 billion for R&D with multiple foreign entities, including those in China according to the National Science Foundation (NSF).¹ Foreign entities can receive federal research funds in two ways:

- directly from an agency as a recipient of a federal award; or
- indirectly as a subrecipient of federal research funds through a subaward to perform part of the work for a federal award recipient.²

The U.S. government also contributes to multilateral institutions like the World Bank and the United Nations (UN). In fiscal year 2020, the federal

¹National Science Foundation, National Center for Science and Engineering Statistics, *Federal Funds for Research and Development* (Alexandria, VA.: Apr. 28, 2022). The U.S. obligated a total of about \$167 billion for R&D in fiscal year 2020.

²2 C.F.R. part 200, which provides guidance for grants and agreements, including cooperative agreements, defines a recipient as “an entity, usually but not limited to non-federal entities that receives a federal award directly from a federal awarding agency. The term recipient does not include subrecipients or individuals that are beneficiaries of the award.” A subrecipient is defined as “an entity, usually but not limited to non-federal entities that receives a subaward from a pass-through entity to carry out part of a Federal award; but does not include an individual that is a beneficiary of such award. A subrecipient may also be a recipient of other federal awards directly from a Federal awarding agency.” 2 C.F.R. § 200.1. Though subrecipients can include lower tier subrecipients that receive federal research funds through subawards from higher tier subrecipients, this report focuses on funding provided to direct recipients of federal awards and subrecipients who receive subawards from federal award recipients.

government appropriated about \$2 billion to multilateral institutions to promote U.S. and global security according to Congressional Budget Justifications. These institutions provide assistance to foreign entities to support health, education, infrastructure, environmental, and governance in the developing world.

You asked us to review federal funds provided to Chinese entities for collaborative research and U.S. contributions to multilateral institutions. This report describes (1) the amount of funding departments and agencies provided to Chinese entities for collaborative research, (2) selected departments' and agencies' programs and activities, and results of their collaborative research with Chinese entities, and (3) funding the U.S. government has provided to selected multilateral institutions that support activities in China. For the purposes of this report, the term "Chinese entities" refers to government agencies, research institutions, universities, and laboratories located in mainland China and Hong Kong.³

For the first and second objectives, we selected five agencies with the largest amount of funding for R&D—the Centers for Disease Control and Prevention (CDC), the Department of Defense (DOD), the Department of Energy (DOE), the National Institutes of Health (NIH), and the National Science Foundation (NSF). According to the most recent data available, in fiscal year 2020, these agencies accounted for over 80 percent of all federal R&D obligations.⁴

For the first objective, we analyzed annual obligations data for research grants and cooperative agreements with Chinese entities from each of the

³We included federal research funds provided to entities in Hong Kong, a Special Administrative Region of China, due to the recent change in the treatment of the region by the U.S. government. In July 2020, Executive Order 13936 ended U.S. recognition of the Special Administrative Region of Hong Kong because the President determined it was no longer sufficiently autonomous to justify differential treatment in relation to China. The executive order directed agencies to take specified actions to suspend or eliminate preferential treatment for Hong Kong because of China's decision to impose new national security legislation in the region.

⁴To identify federal agencies with the largest amount of funding for federal research, we reviewed several public sources of information such as NSF reports on R&D obligations, federal spending data on the USAspending.gov website, and previous GAO reports on federal research funding.

five selected agencies for fiscal years 2015 through 2021.⁵ These funds were provided by federal agencies directly to Chinese entities in mainland China and Hong Kong. We corroborated the agency data by comparing it with data from USAspending.gov, the official source of spending data submitted by federal agencies, and determined the agency data to be sufficiently reliable for the purposes of our reporting objectives.⁶ For the second objective, we analyzed relevant agency documents, including award progress reports, and interviewed relevant agency officials on these activities.

For the third objective, we reviewed Department of the Treasury's (Treasury) and Department of State's (State) Congressional Budget Justifications for fiscal years 2015 through 2022, annual enacted appropriations acts, and State's annual report on U.S. Contributions to International Organizations for fiscal years 2015 through 2020 (the most current data available), to gather information on multilateral assistance.⁷

For each multilateral institution listed in State's budget justifications, we reviewed its website and annual reports to determine whether the institution made funding or loans available to China. Based on this analysis, we identified one trust fund—the Global Environment Facility—and two multilateral development banks—the World Bank International Bank for Reconstruction and Development, and the Asian Development Bank.

We also selected five UN agencies that the U.S. government funds—the Children's Fund, the World Health Organization, the Development Programme, the International Fund for Agricultural Development, and the

⁵Agencies we reviewed provided data on Federal Acquisition Regulation-based (FAR) contracts with Chinese entities but the purpose of these contracts was not for collaborative research. For this reason, we excluded FAR-based contracts from our analysis.

⁶The USAspending.gov website is the official source of spending data submitted by federal agencies pursuant to Federal Funding Accountability and Transparency Act of 2006 (FFATA), as amended by the Digital Accountability and Transparency Act. Pub L. No. 109-282, 120 Stat. 1186 as amended by The Digital Accountability and Transparency Act of 2014, Pub. L. No. 113-101, 128 Stat. 1146 (codified as amended at 31 U.S.C. § 6101 note).

⁷For information on U.S. contributions to UN agencies, see Department of State, *Congressional Budget Justification Department of State, Foreign Operations, and Related Programs*, for fiscal years 2017–2022; Department of the Treasury, *International Programs Congressional Justification for Appropriations*, for fiscal years 2017–2022; and Department of State, *Report to Congress on U.S. Contributions to International Organizations*, for fiscal years 2015–2020.

Industrial Development Organization—with the highest expenditures in China in 2019 and 2020. In addition, we discussed these data with Treasury and State officials and found them to be sufficiently reliable for the purposes of this report. The funding analyzed in our third objective covers a range of activities such as infrastructure, education, and economic development. For additional information on our scope and methodology, see appendix I.

We conducted this performance audit from June 2021 to September 2022 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

International Research Collaboration Supported by the U.S.

The U.S. government supports international research collaborations to acquire new knowledge and understanding in the areas of scientific development.⁸ For example, DOD’s International Science and Technology Engagement Strategy states “the U.S. must stay abreast of emerging science and technology around the world, leverage others’ investments, and actively seek leading-edge research collaborations.”⁹ Additionally, the Department of Health and Human Services’ Global Strategy states that building its collective capacity to respond to emerging health threats

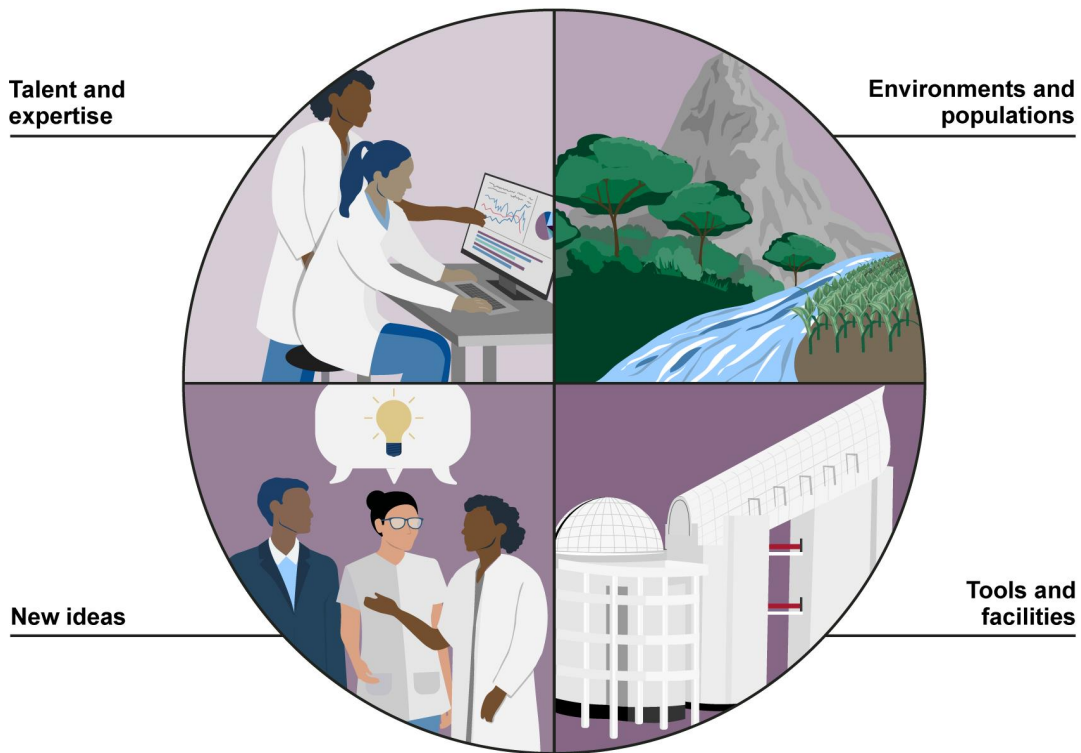
⁸The U.S. provides funding for different types of research including basic research, applied research, and development activities with foreign entities. Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge or understanding of the fundamental aspects of phenomena and of observable facts, which should exclude research directed toward a specific application or requirement. Applied research is original investigation undertaken in order to acquire new knowledge that is directed toward a specific practical aim or objective. Experimental development is creative and systemic work, drawing on knowledge gained from research and practical experience, which is directed at producing new processes or improving existing products or processing. Office of Management and Budget, *Circular No. A-11, Preparation, Submission, and Execution of the Budget* (Washington, D.C.: August 2021).

⁹DOD, *DOD International Science and Technology Engagement Strategy* (Dec. 11, 2020).

through collaboration with international partners is a key priority for the agency.¹⁰

Federal departments and agencies benefit from collaborating with foreign entities by broadening their access to scientific resources (see fig. 1).

Figure 1: Examples of Resources Available Through International Research Collaborations



Source: GAO analysis of agency documents. | GAO-22-105313

For example, collaboration with foreign entities can provide researchers in the U.S. with access to one-of-a-kind scientific tools like the Experimental Advanced Superconducting Tokamak in China. In this example, such access can advance U.S. research in fusion energy.

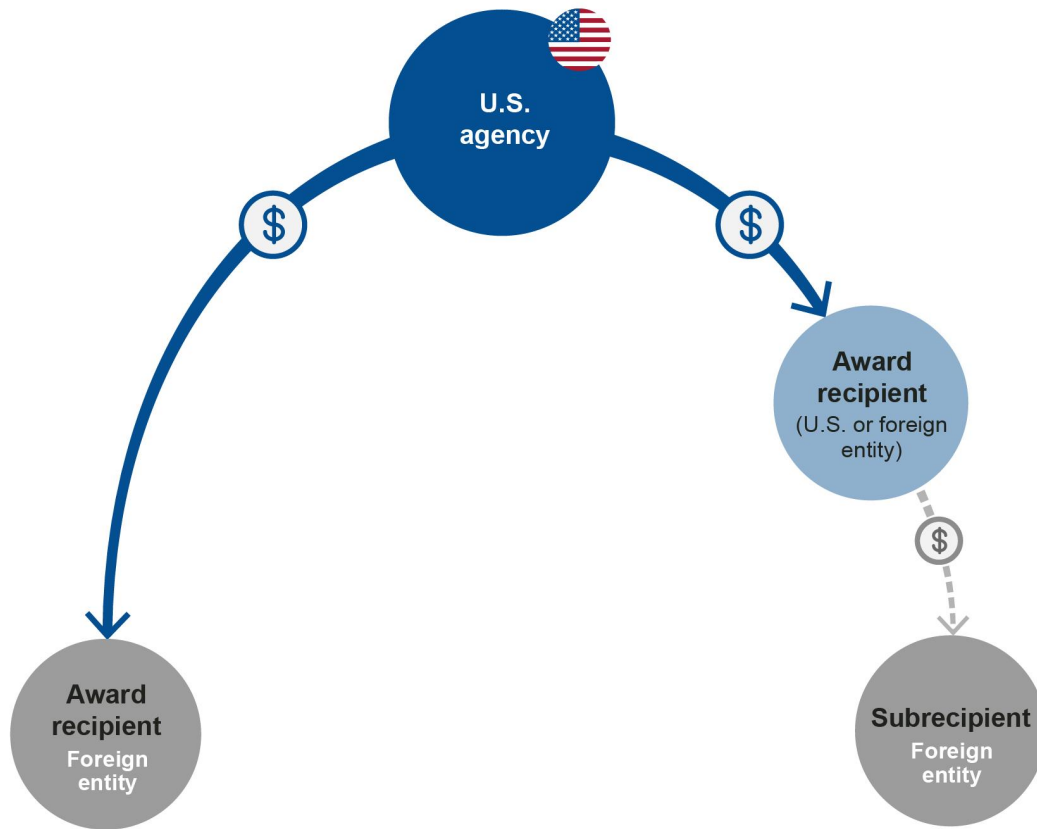
¹⁰U.S. Department of Health and Human Services, *The Global Strategy of the U.S. Department of Health and Human Services* (Washington, D.C.: May 20, 2016).

Process for Providing Research Funds

U.S. agencies provide federal research funds to foreign and domestic entities, primarily through grants and cooperative agreements.¹¹ Federal research funds are generally provided directly by a federal agency to an award recipient or indirectly through a U.S. or foreign award recipient to a subrecipient (see fig. 2).

¹¹A grant is a legal instrument of financial assistance between a federal awarding agency and an award recipient that is used to carry out a public purpose authorized by law. Grants are not used to acquire property or services for the federal awarding agency's direct benefit or use. Grants also do not provide for substantial involvement of the federal agency in carrying out the activity contemplated by the award. A cooperative agreement is similar to a grant, however a cooperative agreement provides for substantial agency involvement in carrying out the activity defined in the agreement. See 2 C.F.R. § 200.1.

Figure 2: Process for Providing Federal Research Funds to Foreign Entities



- U.S. agency has a direct relationship with the award recipient.
- -> U.S. agency has no direct relationship with the subrecipient.

Source: GAO analysis of federal regulations. | GAO-22-105313

Note: The funding process depicted above is the same for any domestic or foreign entity receiving federal research funds.

An award recipient is an entity, either foreign or domestic, that receives an award directly from a federal awarding agency.¹² A subrecipient is an entity that receives funds to carry out part of the work. An award recipient can pass on some portion of the funds to a subrecipient to conduct part of the work. The subrecipient receives the funds through a subaward from the award recipient.¹³ This entity is often referred to as a first-tier

¹²See 2 C.F.R. § 200.1.

¹³See 2 C.F.R. § 200.1.

subrecipient. These subrecipients, in turn, can pass on a portion of the funds they receive to other subrecipients (second-tier, third-tier, etc.).

A federal awarding agency has a direct relationship with an award recipient and no direct relationship with a subrecipient.¹⁴ Agencies report information on funds provided to award recipients and require these recipients to report on their first-tier subawards in government-wide systems.¹⁵

Agencies report information on funds provided to award recipients on USAspending.gov in accordance with the reporting requirements in the Federal Funding Accountability and Transparency Act of 2006 (FFATA) as amended. The website also includes subaward data reported by award recipients in the government-wide FFATA Subaward Reporting System (FSRS). Award recipients provide data on first-tier subawards in FSRS to meet the FFATA reporting requirements.¹⁶

¹⁴In August 2020, the Office of Management and Budget (OMB) issued final guidance revising sections of its Guidance for Grants and Agreements. The Supplemental Information portion of the Federal Register Notice issuing this guidance noted as part of its response to comments that federal agencies do not have a direct relationship with subaward recipients. Office of Management and Budget, Guidance for Grants and Agreements, 85 Fed. Reg. 49506, 49508 (Aug. 13, 2020) (codified at 2 C.F.R. pts. 25, 170, 183 and 200).

¹⁵In accordance with FFATA and implementing guidance, agencies are required to disclose certain information about federal awards that equal or exceed the micro-purchase threshold on a single public-facing, searchable website. In addition, award recipients are required to report specified information on first-tier subawards—with some exceptions—associated with these awards in the FFATA Subaward Reporting System (FSRS). The goal of the reporting is to increase transparency and publicly available information on federal spending. Since 2010, agencies have required award recipients to report subaward information in FSRS. USAspending.gov, the public facing searchable source of spending data includes data submitted by federal agencies and award recipients pursuant to FFATA as amended, including data from government-wide reporting systems, such as the Federal Procurement Data System, the System for Award Management, and FSRS. Pub L. No. 109-282, 120 Stat. 1186 as amended by The Digital Accountability and Transparency Act of 2014, Pub. L. No. 113-101, 128 Stat. 1146 (codified as amended at 31 U.S.C. § 6101 note); 2 C.F.R. pt. 170.

¹⁶2 C.F.R. part 170, which includes guidance for FFATA required recipient subaward reporting for grants and cooperative agreements, defines recipient as “a non-Federal entity or Federal agency that received a Federal award.” 2 C.F.R. § 170.332.

U.S. Funding Provided to Multilateral Institutions

The U.S. also funds multilateral institutions such as the World Bank and the UN to advance a more secure, economically prosperous, and democratic world and address global issues such as poverty, inequality, and climate change, according to the Departments of State and Treasury. Multilateral development banks such as the World Bank receive contributions from member country governments. Each member country has voting shares determined mainly by the size of their contributions. According to a Congressional Research Service report, the U.S. is the largest stockholder in most of the multilateral development banks and has maintained this position to preserve veto power in some institutions over major policy decisions¹⁷

U.S. assistance to the UN consists of assessed and voluntary contributions. Assessed contributions are required dues shared among UN member states to pay for the expenses of the organization. The UN's regular budget, peacekeeping operations, and specialized agencies are funded mainly by assessed contributions. Voluntary contributions support UN funds, programs, and offices.

Extent of Federal Funds Provided for Collaborative Research with Chinese Entities Is Not Fully Known

Three of the five agencies we reviewed reported providing research funds directly to Chinese entities. Chinese entities also received additional federal research funds through subawards from award recipients. Information on the full extent of that funding is unknown due to limitations in the data provided in accordance with federal subaward requirements.

¹⁷See Congressional Research Service (CRS), *Multilateral Development Banks: U.S. Contributions FY2000–FY2020* (Jan. 23, 2020). According to CRS, the U.S. is a member of the following multilateral development banks: the World Bank and four regional development banks, including the African Development Bank, the Asian Development Bank, the European Bank for Reconstruction and Development, and the Inter-American Development Bank. For additional information, see Congressional Research Service, *Multilateral Development Banks: Overview and Issues for Congress* (Feb. 11, 2020).

Three Agencies Reported Providing Research Funds Directly to Chinese Entities

Three of the five agencies we reviewed provided funds to Chinese entities directly through grants and cooperative agreements from fiscal years 2015 through 2021 (see table 1). The CDC, NIH, and DOD provided 22 awards totaling \$28.9 million directly to Chinese entities including universities and other research institutions.

CDC awarded over half of the funding (\$15 million) through cooperative agreements to Chinese entities focused on applied research. The remaining funds were awarded by NIH (\$13.6 million) and DOD (\$0.4 million) through grants that focused on a mix of basic and applied research.¹⁸ The remaining two agencies we reviewed—NSF and DOE—did not provide awards directly to Chinese entities in fiscal years 2015 through 2021. For information on ways these agencies collaborated with Chinese entities on research without exchanging funds, see appendix II.

Table 1: Federal Funding Provided to Chinese Entities through Awards, Fiscal Years 2015–2021

Agency	Award Mechanism	Type of Research	Number of Awards	Total obligated funds (millions of dollars)
Centers for Disease Control and Prevention	Cooperative Agreements	Applied (3)	3	15.0
National Institutes of Health	Grants	Applied (7) Basic (8)	15	13.6
Department of Defense (DOD) ^a	Grants	Applied (3) Basic (1)	4	0.4
Total	--	--	22	28.9^b

Source: GAO analysis of agency data. | GAO-22-105313

Note: Funding data included in this table show Chinese entities that were award recipients of a grant or cooperative agreement. Funds passed on by award recipients to Chinese subrecipients are not included.

^aIn 2015, the DOD's Office of Naval Research awarded one grant to the City University of Hong Kong in the amount of \$198,050. DOD obligated \$99,025 for the award in the first year. The awardee disbursed \$10,439 and returned the remaining \$88,586 of the obligated funds to the agency.

^bTotal obligated funds may not sum precisely to total shown because of rounding.

Our review of agency funding data also showed that CDC, NIH, and DOD provided awards to 13 Chinese entities (see table 2). Three Chinese entities—the University of Hong Kong, Peking University, and the Chinese Center for Disease Control and Prevention (Chinese CDC)—

¹⁸Individual agency obligations do not sum precisely to \$28.9 million due to rounding.

received 84 percent of direct funding. Two of these three entities—the University of Hong Kong and the Chinese CDC—received awards from more than one agency.

Table 2: Chinese Entities that Received Federal Funding for Research Collaboration, Fiscal Years 2015–2021

Chinese Entity	Centers for Disease Control and Prevention	National Institutes of Health	Department of Defense	Total obligated funds (millions of dollars)
University of Hong Kong	1	1	1	10.7
Peking University	-	3	-	8.8
Chinese Center for Disease Control and Prevention	2	2	-	4.9
George Institute for Global Health China	-	1	-	1.0
Fudan University	-	1	-	0.7
Institut Pasteur of Shanghai	-	1	-	0.6
China Medical University	-	2	-	0.5
Southern Medical University	-	1	-	0.5
Wuhan University/Institut Pasteur of Shanghai ^a	-	1	-	0.5
Shanghai Institute of Materia Medica	-	1	-	0.3
Nanjing Medical University	-	1	-	0.2
City University of Hong Kong	-	-	2	0.1
Hong Kong Polytechnic University	-	-	1	0.05
Total	3	15	4	28.9

Source: GAO analysis of agency data. | GAO-22-105313

Note: (-) indicates no awards.

^aAccording to the National Institute of Health (NIH) officials, the Principal Investigator associated with the award changed entities from the Institut Pasteur of Shanghai to Wuhan University. Officials stated that in 2017 the Institut Pasteur of Shanghai submitted a relinquishing statement to the agency to certify that they did not wish to replace the Principal Investigator and supported transferring the grant to Wuhan University in 2018. NIH approved the request to change the recipient institution and retain the original Principal Investigator. According to agency data, the Institut Pasteur of Shanghai received \$310,230 of the award and Wuhan University received \$206,820.

Over one-third of the funding (\$10.8 million) to Chinese entities was provided to entities in Hong Kong, and the remaining \$18.1 million awarded to entities in mainland China. As noted earlier, the U.S. government treated Hong Kong separately from China until July 2020. All four of DOD’s awards were made to entities in Hong Kong. CDC and NIH made awards to entities in both Hong Kong and mainland China.

Of the 22 awards to Chinese entities, 17 were closed and five remained ongoing (NIH had three and CDC had two), as of July 2022.

Chinese Entities Received Additional Federal Research Funds through Subawards, but the Full Extent is Unknown

According to USAspending.gov data, U.S. award recipients from all five agencies we reviewed reported providing subawards to Chinese entities during fiscal years 2015 through 2021. Information on federal research funds provided through subawards to Chinese entities is not fully known because of limitations in the data provided in response to federal reporting requirements for subawards. Specifically:

- Award recipients are required to report information on first-tier subawards that are \$30,000 or more.¹⁹ Information on subawards that fall below \$30,000 and those below the first-tier (e.g., second-tier or third-tier) is not required to be reported in government-wide systems.
- According to Office of Management and Budget guidance, the quality of data that award recipients report in FSRS is the legal responsibility of the award recipient. The guidance further provides that agencies are not required to certify the quality of subaward data reported in FSRS and made available on USAspending.gov.²⁰ As previously

¹⁹2 C.F.R. part 170 which includes implementing guidance to federal awarding agencies on recipient reporting of subawards in accordance with FFATA for grants and cooperative agreements, includes an award term for inclusion in award that meet the funding threshold regarding recipient subaward reporting requirements. This award term also exempts recipients that, in the previous tax year, had a gross income, from all sources, under \$300,000 from reporting subawards. In addition, the requirements of 2 C.F.R. part 170 do not apply to individuals who receive a federal award and allow for OMB to exempt classes of federal awards or recipients when exceptions are not prohibited by statute. See 2 C.F.R. § 170.110 (b), (c).

²⁰Office of Management and Budget, *Appendix A to OMB Circular No. A-123, Management of Reporting and Data Integrity Risk*. M-18-16, June 6, 2018. According to the same OMB guidance, agencies are responsible for resolving audit findings that may indicate if recipients are not complying with subaward reporting requirements. In addition, certain audits undertaken in accordance with the Single Audit Act include a compliance review of FFATA required subaward data. 2 C.F.R. pt. 200, Appendix XI, 3-L-1, July 2022. (This Compliance Supplement identifies compliance requirements expected to be considered as part of an audit required by the 1996 Amendments to the Single Audit Act.)

discussed, a federal awarding agency has a direct relationship with an award recipient, but has no direct relationship with subrecipients.²¹

Federal Awards Provided to Chinese Entities Focused on a Range of Scientific Disciplines, Including Public Health and Biological Sciences

Three of the five agencies (CDC, NIH, and DOD) funded Chinese entities through grants and cooperative agreements to conduct a range of research. CDC and NIH funded biomedical and public health research, while DOD funded research in other scientific disciplines. These awards provided directly to Chinese entities resulted in joint publications, information sharing, and workshops.

CDC and NIH Funded Chinese Entities to Conduct Public Health and Biomedical Research

CDC and NIH funded Chinese entities to conduct a wide range of research, including disease surveillance, vaccination studies, and the development of new drugs (see table 3). According to CDC and NIH, China provides a unique ecological environment where researchers can combat infectious diseases that could pose a threat to the U.S. and globally.

²¹Guidance for Grants and Agreements, 85 Fed. Reg. 49506, 49508 (Aug. 13, 2020) (codified at 2 C.F.R. pts. 25, 170, 183, and 200). Certain agencies have additional vetting requirements for subawards. For example, the U.S. Agency for International Development (USAID) has guidance referred to as *Mission Order 21*, which requires that certain individuals and non-U.S. organizations undergo vetting. The vetting requirements apply to certain contractors and subcontractors, recipients of grants and cooperative agreements, trainees and students, and recipients of cash or in-kind assistance, with some exceptions. The guidance states that USAID's West Bank and Gaza Mission is required to ensure that applicable vetting approval is obtained before a subaward is made, and mandatory provisions are included in subaward documents, as applicable. For additional information, see GAO, *West Bank and Gaza Aid: Should Funding Resume, Increased Oversight of Subawardee Compliance with USAID's Antiterrorism Policies and Procedures May Reduce Risks*, [GAO-21-332](#) (Washington, D.C.: Mar. 29, 2021).

Table 3: Examples of Federal Funding Provided Directly to Chinese Entities for Public Health and Biomedical Research, Fiscal Years 2015–2021

U.S. Agency	Research Purpose
Centers for Disease Control and Prevention (CDC)	<p>Disease surveillance and epidemiology</p> <ul style="list-style-type: none"> Assess incidences and identify causes of recurring and emerging infectious diseases Determine risk factors and severity of influenza infections in specific groups, such as older adults, children, and pregnant women <p>Vaccination coverage and effectiveness</p> <ul style="list-style-type: none"> Assess economic benefits of increased influenza vaccination coverage Promote seasonal influenza vaccination among specific populations such as people with chronic diseases and health care workers <p>Capacity building and program management activities</p> <ul style="list-style-type: none"> Strengthen ability to prepare for emerging and re-emerging infectious diseases Support epidemic and pandemic preparedness activities
National Institutes of Health (NIH)	<p>Disease surveillance and transmission studies</p> <ul style="list-style-type: none"> Determine resistance level to dengue among vector populations in urban and rural environments <p>Longitudinal studies on health and retirement among elderly Chinese</p> <ul style="list-style-type: none"> Evaluate dementia among elderly Chinese <p>Therapeutic and drug development studies</p> <ul style="list-style-type: none"> Explore new therapeutics to treat malignancies associated with Kaposi’s sarcoma Generate data to help design new HIV drugs <p>Vaccination studies</p> <ul style="list-style-type: none"> Identify and characterize new malaria vaccine candidates

Source: GAO analysis of CDC and NIH documents. | GAO-22-105313

CDC-funded research. Based on our review of agency documents, we determined that CDC award recipients focused on (1) surveillance, epidemiology, and pathogenicity of emerging, re-emerging, and novel viruses and (2) vaccination coverage and effectiveness.²² For example, one award to the University of Hong Kong monitored (1) cases of laboratory-confirmed influenza infections and illness among older adults, the severity of influenza on adult health and functionality, and (2) the potential impact of different vaccination strategies, including receiving

²²Pathogenicity refers to a bacterium, virus, or other microorganism’s ability to cause disease following infection. Centers for Disease Control and Prevention, “Glossary,” Atlanta, GA: July 2, 2024, accessed June 1, 2022, <https://www.cdc.gov/csels/dsepd/ss1978/glossary.html#:~:text=pathogenicity%20the%20ability%20of%20an,who%20then%20experience%20clinical%20disease>. In addition, epidemiology studies the distribution (frequency, pattern) and determinants (causes, risk factors) of health issues or events in specific populations. Centers for Disease Control and Prevention, “What is Epidemiology?” Atlanta, GA: June 17, 2016, accessed June 1, 2022, <https://www.cdc.gov/careerpaths/k12teacherroadmap/epidemiology.html#:~:text=By%20definition%2C%20epidemiology%20is%20the,state%2C%20country%2C%20global>.

once or twice-annual vaccinations among participants. Collectively, these efforts were part of two immunogenicity studies: examining twice-annual influenza vaccinations and alternate vaccination strategies in older adults.

In addition to studying influenza seasonal trends, the CDC works with entities like the Chinese CDC to monitor other emerging infectious diseases. For example, a 2017 CDC-funded project collected blood samples in China from local residents and citizens returning from travel during the Zika epidemic in 2016 to monitor mosquito-borne diseases such as Zika and dengue.²³

Other CDC-funded research activities focused on vaccination effects and benefits of increased vaccination within certain populations. In addition to monitoring influenza among at-risk populations, the CDC works with the Chinese CDC to promote influenza vaccination policy as part of a global health strategy to support public health systems. For example, Chinese CDC researchers sought to understand whether workplace requirements or on-site vaccination sites, common tools in the U.S. and Canada, could be similarly effective in China. As part of the project, the team developed an “Influenza Prevention and Control Strategy” for the 2018–2019 and 2019–2020 seasons, issued technical guidelines, and promoted materials online and in Chinese journals.

In interviews, CDC officials characterized collaborative research with the Chinese CDC as public health research and highlighted the 30 year partnership with China-based collaborators to support and enhance influenza research among animals and humans and inform seasonal trends.

NIH-funded research. Based on our review of agency documents, we determined that NIH award recipients focused on biomedical research with Chinese entities. Specifically, NIH awards to Chinese entities focused on (1) monitoring disease transmission and (2) supporting a longitudinal study examining elderly health and retirement. For example, based on our review of progress reports, we determined that an NIH-funded award to Southern Medical University in Guangzhou conducted

²³A pregnant woman may transmit Zika, which has the potential to cause severe brain defects and other challenges during birth, to her fetus. Centers for Disease Control and Prevention, “Zika Virus,” Atlanta, GA: May 20, 2019, accessed June 14, 2022, <https://www.cdc.gov/zika/about/overview.html>, and “About Dengue: What You Need to Know,” Atlanta, GA: Sept. 23, 2021, accessed June 14, 2022, <https://www.cdc.gov/dengue/about/index.html>. Approximately half of the world lives in areas at-risk areas for dengue.

field sampling and molecular studies in China to determine resistance levels of dengue-carrying mosquitoes.

Another NIH-funded grant with a Chinese entity focused on developing therapeutics and antiviral drugs to target specific diseases. For example, one award to the Shanghai Institute of Materia Medica studied the coreceptor, proteins that serve as the binding sites for molecules and viruses similar to the human immunodeficiency virus.

NIH officials told us that the agency only funds biomedical programs and activities with Chinese entities. According to the 2019 U.S.-China Program for Biomedical Research Cooperation agreement, cooperative medical research benefits both countries.²⁴ Officials noted that biomedical activities between both countries have recently increased because of the agreement. Projects in the agreement cover allergy, immunology, infectious diseases, cancer, mental health, Parkinson’s disease, and stroke research.

DOD Funded Chinese Entities to Conduct Research in Other Scientific Disciplines

Based on our review of agency documents, we determined that DOD award recipients addressed a range of scientific topics, including alternative technologies to propel vehicles such as drones (see table 4).

Table 4: Department of Defense (DOD) Research Funding Provided Directly to Chinese Entities, Fiscal Years 2015–2021

Research Purpose

- Apply probabilistic and statistical methods to improve battery life
- Compare impacts of applying a fully electronic technology to study air flow of vehicles such as drones
- Develop feedback method for video-based tracking control and test new methods using robotic platforms
- Hold international conference on molecular electronic materials and other topics

Source: GAO analysis of DOD documents. | GAO-22-105313

Note. All four of the awards funded by DOD were made to entities in Hong Kong.

For example, one award to the City University of Hong Kong conducted research on applying probabilistic and statistical methods to improve the

²⁴U.S. Department of Health and Human Services, *U.S.-China Program for Biomedical Collaborative Research (R01 Clinical Trial Optional)* (Washington, D.C.): accessed Sept. 23, 2022, <https://grants.nih.gov/grants/guide/rfa-files/rfa-ca-19-009.html>.

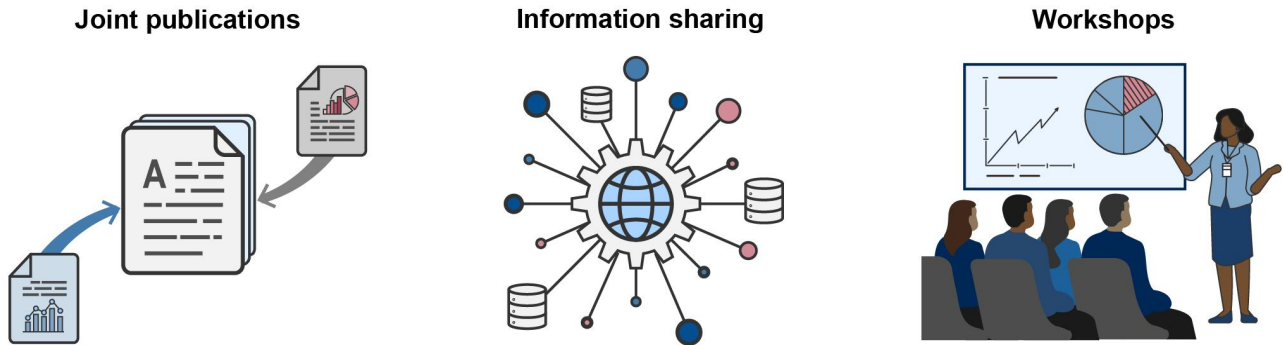
optimization of run time of portable electronics and distributed grid systems. In interviews, officials stated this award was funded by the Navy International Cooperative Opportunities in Science and Technology to address naval science and technology challenges.

Another award to the Hong Kong Polytechnic University examined air flow control and the role of plasma actuators to advance aerodynamic performance and capabilities of unmanned aerial vehicles and micro aerial vehicles.²⁵ According to DOD, because of the emerging role of aerial vehicles in intelligence, surveillance and reconnaissance applications, such research can advance the agency's understanding in these areas.

Federal Awards Provided to Chinese Entities Resulted in Joint Publications, Information Sharing, and Workshops

We found three main kinds of results of awards provided by federal agencies to Chinese entities (see fig. 3).

Figure 3: Results of Collaborative Research between the U.S. and Chinese Entities



Source: GAO analysis of agency documents; Irina Strelnikova/adobe.stock.com (image, far right). | GAO-22-105313

Joint publications. Based on our review of award documents, we determined that federal research funds provided to Chinese entities resulted in scientific and academic articles. For example, researchers on one CDC award published articles on influenza illness and

²⁵A plasma actuator is a device that could be used for active flow control. It can delay or eliminate flow separation, and thus improve aerodynamic performance of airfoils, straight wings, delta wings, aircraft, and bluff bodies. See Jinjun Wang and Lihao Feng, *Flow Control Techniques and Applications* (Cambridge, UK: Cambridge University Press, 2018).

hospitalizations among young children.²⁶ Other examples include an NIH-funded award at Wuhan University that resulted in publications on the replication and persistence of Kaposi's sarcoma-associated herpesvirus. Similarly, a DOD award to the Hong Kong Polytechnic University led to four academic articles and two conference papers.

Information sharing. Based on our review of award documents, we determined that federal research funds provided to Chinese entities also resulted in data collection systems, improved frameworks, and policy and technical guidance updates. These efforts facilitate sharing of information and enhance global access to public health data, according to award documents. For example, one NIH award to the National School of Development of Peking University resulted in a website that provides project data, documentation, and updates of recent progress on the China Health and Retirement Longitudinal Study. Another collaborative CDC project established an epidemiological information collection system, similar to platforms in Europe and the U.S.²⁷

Workshops. Based on our review of award documents, we determined that federal research funds provided to Chinese entities resulted in workshops, conferences, or poster presentations. For example, one CDC award to the Chinese CDC resulted in presentations at national and provincial conferences in 2020 on influenza illnesses and hospitalizations among children in Suzhou. The award also resulted in a series of workshops to test and update a risk assessment tool for an avian strain of influenza, making it more applicable to conditions in China. During one of the workshops, researchers conducted a tabletop exercise, creating different scenarios for influenza pandemic preparedness and response. Similarly, a DOD-funded award, in 2015, to the City University of Hong Kong resulted in an international conference on molecular electronic materials and devices.

²⁶W. Zhang, J. Gao, L. Chen, J. Tian, M. Biggerstaff, S. Zhou, S. Situ, Y. Wang, J. Zhang, A.J. Millman, C.M. Greene, T. Zhang, and G. Zhao. "Estimated influenza illnesses and hospitalizations averted by influenza vaccination among children aged 6-59 months in Suzhou, China, 2011/12 to 2015/16 influenza seasons," *Vaccine*, vol. 38, no. 51 (2020): 8200–8205.

²⁷CaliciNet is the U.S. national norovirus outbreak surveillance network of federal, state, and local public health laboratories in the U.S.

The U.S. Contributed Funding to Some Multilateral Institutions that Support Activities in China

The U.S. government, along with other donors, provided funding from fiscal years 2015 through 2020 to some multilateral institutions that, in turn, supported a range of activities worldwide including in China. Multilateral institutions fund projects such as education, infrastructure, and economic development.²⁸ According to State and Treasury officials, multilateral institutions specify how funding should be used and which country should receive funding.²⁹

From fiscal years 2015 through 2020, the U.S. government provided approximately \$9.6 billion to the eight selected multilateral institutions that funded activities in China, among other locations.³⁰ For example, one multilateral institution that received U.S. funding—the International Bank for Reconstruction and Development—reported loan agreements with 78 countries in 2021, of which China was one.

Of the \$9.6 billion, the U.S. provided about \$1.6 billion in appropriated funds to a trust fund and multilateral development banks and obligated about \$8 billion for selected UN agencies. The U.S. was one of many donor countries to provide funding to multilateral institutions that fund activities in China. According to State and Treasury officials, U.S. funding to multilateral institutions was pooled with funding from other donors, and

²⁸This section of the report analyzes funding data from fiscal years 2015 through 2020 because it was the most recent data available across the selected multilateral institutions. The funding information includes all sectors, and is not limited to research.

²⁹While the U.S. government does not control how multilateral institutions use U.S. funding, it may retain some influence, according to U.S. officials. The U.S. is often the largest or among the largest shareholders or donors to many multilateral institutions. As a large shareholder or donor, the U.S. at a high level may advocate for policies in its interests, have voting power, or exercise veto rights depending on the multilateral institution.

³⁰The selected multilateral institutions are: Global Environment Facility (GEF), World Bank's International Bank for Reconstruction and Development (IBRD), Asian Development Bank (ADB), the UN Children's Fund (UNICEF), the UN World Health Organization (WHO), the UN Development Programme (UNDP), the UN International Fund for Agricultural Development (IFAD), and the UN Industrial Development Organization (UNIDO).

thus cannot be directly attributed to activities multilateral institutions funded in China or in other countries.

The U.S. government provided about \$1.6 billion in appropriated funds for one trust fund and two multilateral development banks that reported funding programs or loans in China (see table 5). Trust funds address specific issues by providing support for global public goods, fragile and conflict-affected states, disaster prevention and relief, global and regional partnerships, and knowledge and innovation. Multilateral development banks provide countries with financial assistance, such as loans, to promote economic and social growth.

Table 5: U.S. Appropriations Provided to Selected Multilateral Institutions that Subsequently Provided Funds to Member Countries, Including China, Fiscal Years 2015–2020

		Appropriations (millions of dollars)
Trust fund	Global Environment Facility (GEF)	870
	Multilateral development banks	586
	World Bank International Bank for Reconstruction and Development (IBRD)	586
	Asian Development Bank (ADB) ^a	112
Total		1,568

Source: GAO analysis of annual enacted appropriations acts. | GAO-22-105313

Note: Funds shown in the table were provided to multilateral institutions that fund multiple countries, including China. Congress appropriates funds for international financial institutions to the Department of the Treasury, which then pays those funds to multilateral institutions. Congress appropriates GEF funds for payment to IBRD, which is the trustee for GEF.

^aBeginning in fiscal year 2017, appropriations for the ADB have only been provided for the Asian Development Fund, which does not provide funding to China. Funds shown in the table were appropriated for the ADB in fiscal years 2015 and 2016, and do not include appropriations for the Asian Development Fund.

State and Treasury Congressional Budget Justifications describe the U.S. government’s rationale for funding multilateral institutions.

Global Environment Facility. GEF funds activities in countries with developing economies to address international environmental issues. GEF programs around the world address health and safety issues that may affect Americans, such as preventing toxins from entering U.S. food, water, and air, and supporting U.S. companies by conserving fish stocks and curbing illegal international logging.

International Bank for Reconstruction and Development. IBRD is a World Bank agency that provides loans at market-based interest rates to middle-income countries for economic and social development

activities. Contributing to the World Bank enables the U.S. to maintain shareholding and voting power and promotes U.S. foreign policy objectives.

Asian Development Bank. ADB provides funding to the private sector and long-term loans at market-based interest rates to middle-income Asian countries to support infrastructure and economic development. ADB supports markets and economies in countries that are important to U.S. strategic interests and assists countries in addressing environmental issues.

The U.S. government also obligated about \$8 billion for five UN agencies that funded activities in China, among other locations (see table 6).³¹

Table 6: U.S. Obligations for Selected United Nations (UN) Agencies that Funded Activities in Multiple Countries, Including China, Fiscal Years 2015–2020

Agency	Obligations (millions of dollars)
UN Children’s Fund	4,159
UN World Health Organization	2,252
UN Development Programme	1,401
UN International Fund for Agricultural Development	184
UN Industrial Development Organization	12
Total	8,008

Source: GAO analysis of the Department of State annual report, U.S. Contributions to International Organizations. | GAO-22-105313

Note: Funds shown in the table were provided to multilateral institutions that fund multiple countries, including China. Congress appropriates contributions to U.S. agencies to meet annual obligations of membership in international multilateral organizations, including the United Nations. The Departments of State and Treasury manage the obligation and disbursement of those funds to UN agencies.

State and Treasury Congressional Budget Justifications describe how U.S. funding for the UN promotes U.S. security interests by supporting stability in global economy and politics, among other outcomes. For example, UNDP’s mission is to promote sustainable development, democratic governance and peace building, and climate and disaster resilience. Additionally, IFAD is an UN multilateral fund that addresses poverty and malnutrition and works to improve farmers’ productivity and incomes. IFAD promotes U.S. interests by reducing poverty and increasing economic growth in rural areas.

³¹We are reporting obligations data for the five UN agencies because U.S. appropriations data are not available for UNICEF, WHO, UNDP, and UNIDO. Rather than appropriating funding directly to UN agencies, Congress appropriates funding to accounts managed by federal agencies that obligate and disburse the funding to the selected UN agencies.

The selected multilateral institutions support countries globally, including China, to achieve outcomes such as improving infrastructure, addressing climate and environmental issues, improving childhood education, addressing health disparities, and promoting economic development (see table 7).³²

Table 7: Examples of Selected Multilateral Institutions’ Goals and Activities in China

Multilateral Institution	Goals and Objectives	Activities
Asian Development Bank (ADB)	Support China through knowledge transfer, such as policy-oriented technical assistance. Mitigate and adapt to climate change, strengthen regional cooperation in China and with other countries, and reduce poverty and inequality.	ADB provided technical assistance, such as policy research on ecological protection and rural vitalization. ADB provided loans, equity investments, and other funding for projects in areas such as microfinance, farmers’ access to financing, and economic and social infrastructure.
Global Environment Facility (GEF)	Support work to address environmental issues, including biodiversity loss, control of chemicals and waste, climate change, management of international waters, and land degradation.	GEF provided funding for projects in areas such as wetland protection and migratory bird conservation in China.
United Nations Children’s Fund (UNICEF)	Improve the health and nutrition of children and decrease their mortality and poverty rates. Improve the quality and inclusivity of education with a focus on girls. Protect children from violence, abuse, and bullying, including online exploitation.	China participated in UNICEF projects in areas such as early childhood development, poverty reduction, and social protection programs, which included information, policy dialogues, and network and partnership building.
United Nations Development Programme (UNDP)	Work in partnership with China to ensure inclusive and environmentally sustainable development and strengthen resilience to natural disasters and public health emergencies.	UNDP provided funding for projects in areas such as alleviating poverty, reducing pollutants, and empowering women from ethnic minorities to participate in industry.
United Nations Industrial Development Organization (UNIDO)	Promote inclusive and sustainable industrial development by achieving low-carbon economic growth, addressing food insecurity, and strengthening international cooperation.	UNIDO provided funding for projects in areas such as advancing economic competition, reducing poverty, improving food safety, and establishing eco-effective urban development.

³²In 2015, the UN adopted 17 sustainable development goals that address poverty, health, education, equality, economic growth, sustainability and infrastructure, the environment and climate, peaceful and just societies, and global partnership. These goals apply across all UN agencies, including UNICEF, WHO, UNDP, IFAD, and UNIDO. Additionally, the GEF, the World Bank, and the ADB have acknowledged dedication to achieving the UN sustainable development goals. The sustainable development goals are not reproduced in table 7.

Multilateral Institution	Goals and Objectives	Activities
United Nations International Fund for Agricultural Development (IFAD)	Reduce rural poverty and support inclusive access to markets, such as for owners of small farms. Strengthen environmental sustainability and climate resilience.	IFAD provided funding for projects in areas such as poverty reduction and rural revitalization. IFAD established the China-IFAD South-South and Triangular Cooperation Facility to increase global exchanges, innovation, and investment in rural areas.
United Nations World Health Organization (WHO)	Reduce health inequity in China, such as inequity resulting from discrimination or disadvantage of employment, gender, ethnicity, sexual orientation, physical or mental impairment, or socioeconomic status. Strengthen health systems to achieve universal health coverage, and reduce morbidity and mortality rates.	China participated in a WHO malaria elimination program, E-2020, which included WHO-provided guidance, forums, and advisory bodies.
World Bank International Bank for Reconstruction and Development (IBRD)	Support environmentally sustainable, socially inclusive, and competitive development of the private sector. Gradually decrease IBRD funding of activities in China.	IBRD provided loans in areas such as rural development, energy, transport, education, health, urban development, and the environment. IBRD provided technical assistance on economic and financial topics.

Source: GAO analysis of documents published by the selected multilateral institutions. | GAO-22-105313

Agency Comments and Our Evaluation

We provided a draft of our report to CDC, DOD, DOE, NIH, NSF, State, and Treasury. DOD, DOE, NIH, NSF, and State did not have comments on the draft of our report. CDC and Treasury provided technical comments, which we incorporated as appropriate.

We are sending copies of this report to the appropriate congressional committees, the Secretaries of Defense, Energy, Health and Human Services, State, and Treasury, the Director of the National Science Foundation, and other interested parties. In addition, the report is available at no charge on the GAO website at <https://www.gao.gov>.

If you or your staff have any questions about this report, please contact Candice N. Wright at (202) 512-6888 or WrightC@gao.gov or Kimberly Gianopoulos at (202) 512-8612 or GianopoulosK@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may

be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix III.



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Appendix I: Objectives, Scope, and Methodology

Our objectives for this report were to describe (1) the amount of funding departments and agencies provided to Chinese entities for collaborative research, (2) selected departments' and agencies' programs and activities, and results of their collaborative research with Chinese entities, and (3) funding the U.S. has provided to selected multilateral institutions that support activities in China.¹

For the first and second objectives, we selected for review the National Institutes of Health (NIH), the Centers for Disease Control and Prevention (CDC), the Department of Defense (DOD), the Department of Energy (DOE), and the National Science Foundation (NSF). We selected these federal agencies based on NSF's report on federal obligations for research and development, prior GAO work, and publicly available data in USAspending.gov.² The USAspending.gov website is the official source of spending data submitted by federal agencies and includes subaward data reported by award recipients.

Our analysis of grants and cooperative agreements award data published in a government-wide public database of federal spending—USAspending.gov—showed that from fiscal years 2015 through 2021, NIH and CDC accounted for over 95 percent of U.S. federal awards made directly to Chinese entities. DOD, DOE, and NSF each had at least five award recipients that reported subawards to Chinese entities. In addition, based on the most recent data available, NSF's Federal Funds for Research and Development: Fiscal Years 2020–21, these five agencies

¹In July 2020, Executive Order 13936 ended the U.S. recognition of the Special Administrative Region of Hong Kong because the President determined it was no longer sufficiently autonomous to justify differential treatment in relation to China. The executive order directed agencies to take specified actions to suspend or eliminate preferential treatment for Hong Kong because of China's decision to impose new national security legislation in the region. For the purposes of this report, we have treated Hong Kong as a part of China.

²GAO, *Federal Research: Agency Actions Needed to Address Foreign Influence*, [GAO-22-105434](#) (Washington, D.C.: Oct. 5, 2021) and *Federal Research: Agencies Need to Enhance Policies to Address Foreign Influence*, [GAO-21-130](#) (Washington, D.C.: Dec. 17, 2020).

accounted for over 80 percent of all federal research and development obligations in fiscal year 2020.

To examine how the selected agencies fund collaborative research with Chinese entities, we collected and analyzed annual obligations data from the five selected agencies for research grants and cooperative agreements with Chinese entities for fiscal years 2015 through 2021.³ These funds were provided directly from a federal award agency to a Chinese entity in mainland China and Hong Kong. We analyzed award information, such as entity name, location, amount funded, performance period and status (open or closed) from fiscal years 2015 through 2021. We also interviewed agency officials about the collection, management and reliability of their internal databases and processes. Award data provided by agencies were corroborated by the publicly available data on the USAspending.gov for three agencies with federal awards (CDC, DOD, and NIH). For NIH, we also compared their award data with information available on the Research Portfolio Online Reporting Tool, which provides information on NIH awards. We reviewed and discussed the methodology with agency officials and found these data to be sufficiently reliable for the purposes of our reporting objectives. For subaward data, we reviewed one public source—USAspending.gov—but did not find these data sufficiently reliable to report on for the purposes of our reporting objectives.⁴

To examine the selected agencies' programs, activities, and results of collaborative research with Chinese entities from fiscal years 2015 through 2021, we reviewed relevant agency documents, including interim and final progress reports. For NIH, we focused our review on awards valued at or above \$100,000, and for NSF, we reviewed awards valued at or above \$1 million. For the remaining agencies CDC, DOD, and DOE we reviewed documents for all award recipients. We also interviewed agency officials from CDC, DOD, DOE, NIH, and NSF about the programs, activities, and results of collaborative research with Chinese entities that these agencies funded.

³Agencies we reviewed provided data on Federal Acquisition Regulation-based (FAR) contracts with Chinese entities but the purpose of the contracts was not for collaborative research. For this reason, we excluded FAR-based contracts from our analysis.

⁴See the first section of this report for additional information on subawards.

To examine U.S. funding to multilateral institutions that support activities in China, we reviewed Department of Treasury's (Treasury) and Department of State's (State) Congressional Budget Justifications for fiscal years 2015 through 2022, and State's annual report on U.S. Contributions to International Organizations for fiscal years 2015 through 2020 (the most current data available).⁵ For each multilateral institution listed in State's budget justifications, we reviewed the institution's website and annual reports to determine whether the institution made funding or loans available to China. Based on this analysis, we identified three multilateral institutions that reported funding activities in China between 2018 and 2020: one trust fund—the Global Environment Facility, and two multilateral development banks—the World Bank International Bank for Reconstruction and Development and the Asian Development Bank. For each multilateral institution, we analyzed annual enacted appropriated funds for fiscal years 2015 through 2020.⁶

We also selected five United Nations (UN) agencies that the U.S. government funds—the Children's Fund, the World Health Organization, the Development Programme, the International Fund for Agricultural Development, and the Industrial Development Organization—because they were the five UN agencies with the highest expenditures in China in 2019 and 2020, according to UN documents. In addition, we discussed these data with Departments of the Treasury (Treasury) and State (State) officials and found them to be sufficiently reliable for the purposes of our reporting objectives. The funding analyzed in this objective included a range of activities such as infrastructure, education, and economic development.

We also interviewed relevant officials from State and Treasury, which obligate and disburse these contributions for the U.S. government. We reviewed the selected multilateral institutions' websites and public reports to gather information on the goals and activities of the multilateral

⁵See Department of State, *Congressional Budget Justification Department of State, Foreign Operations, and Related Programs*, for fiscal years 2017–2022; Department of the Treasury, *International Programs Congressional Justification for Appropriations*, for fiscal years 2017–2022; and Department of State, *Report to Congress on U.S. Contributions to International Organizations*, for fiscal years 2015–2020.

⁶Further Consolidated Appropriations Act, 2020, Pub. L. No. 116-94, 133 Stat. 2534 (2019); Consolidated Appropriations Act, 2019, Pub. L. No. 116-6, 133 Stat. 13; Consolidated Appropriations Act, 2018, Pub. L. No. 115-141, 132 Stat. 348; Consolidated Appropriations Act, 2017, Pub. L. No. 115-31, 131 Stat. 135; Consolidated Appropriations Act, 2016, Pub. L. No. 114-113, 129 Stat. 241 (2015); and Consolidated and Further Continuing Appropriations Act, 2015, Pub. L. No. 113-235, 128 Stat. 2130 (2014).

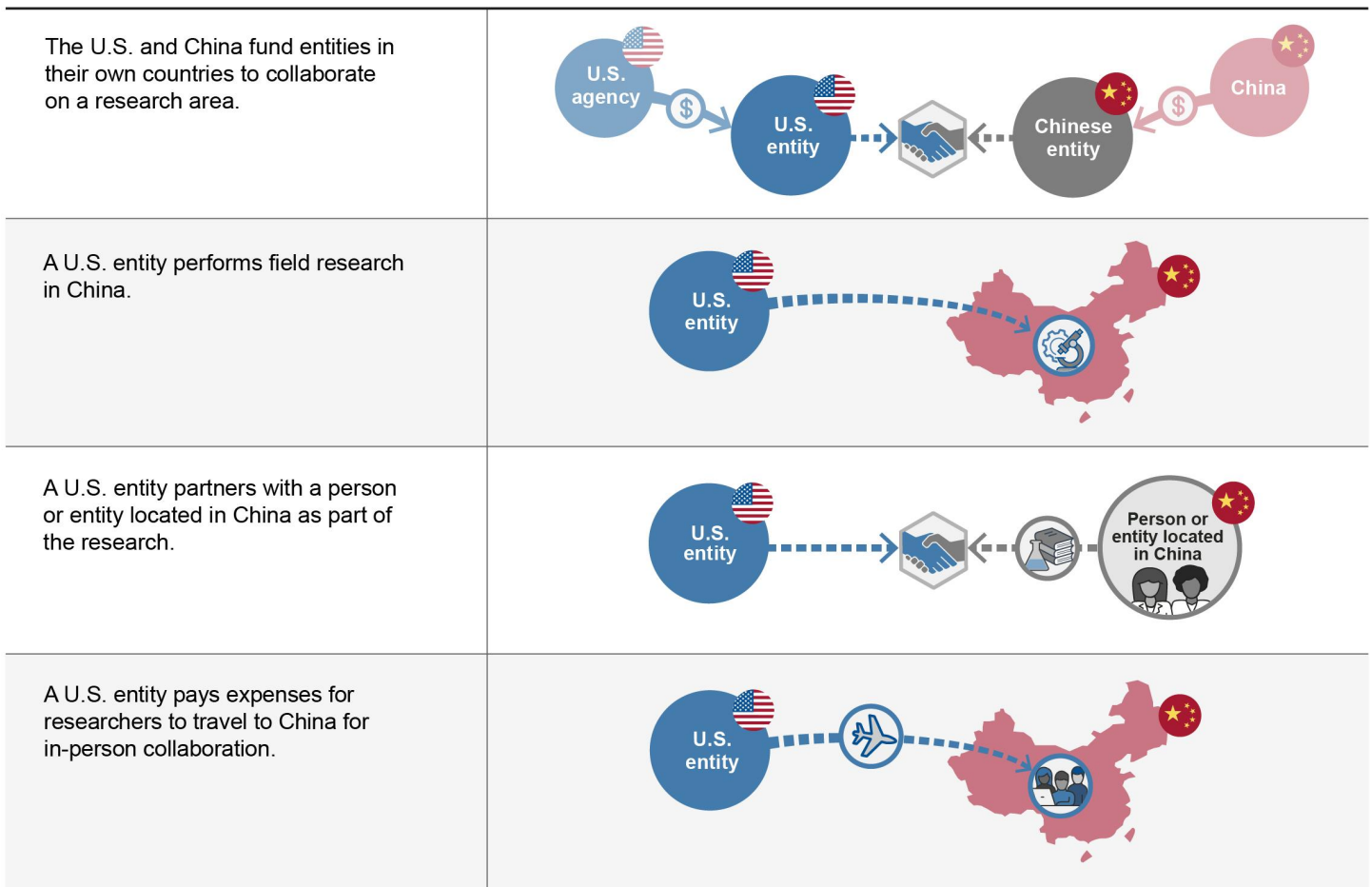
institutions, including frameworks and priorities, programming directions, and country cooperation strategies. We also reviewed other documents on the selected multilateral institutions' partnerships with China.

We conducted this performance audit from June 2021 to September 2022 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: Examples of Other U.S. Collaborations with Chinese Entities

The Department of Energy (DOE) and the National Science Foundation (NSF) provided examples of other research collaborations with Chinese entities in which the entity was neither an award recipient nor a subrecipient of federal research funds (see fig. 4).

Figure 4: Examples of Other Kinds of U.S. Research Collaboration with Chinese Entities



Source: GAO analysis of agency documents. | GAO-22-105313

Appendix II: Examples of Other U.S. Collaborations with Chinese Entities

Note: U.S. entities include agencies, universities, and national laboratories.

Table 8 provides examples of these research collaborations based on a review of select DOE and NSF documents, including annual reports, and supporting project documentation.

Table 8: Other DOE and NSF Research Collaborations with Chinese Entities, Fiscal Years 2015–2021

Agency	Research purpose
Department of Energy (DOE)	<p>Clean energy (Clean Energy Research Center)</p> <ul style="list-style-type: none"> • Contribute to improvements in technologies that have the potential to reduce emissions and dependence of commercial trucks on oil (Medium and heavy-duty trucks project) • Develop materials and a design that double thermal performance and reduces weight (Building energy efficiency project) • Investigate using additive manufacturing to print 3D molds for complex features sought by architects (Building energy efficiency project) • Develop technologies that promote energy and water security (Water and energy technologies project) • Help to develop new, efficient, low-cost, and clean transportation technologies (Clean vehicles project) <p>Fusion energy</p> <ul style="list-style-type: none"> • Understand and control plasma-material interface to improve long pulse discharge control and performance in experimental advanced superconductors • Adapt high performance scenarios from the DIII-D National Fusion Facility for the Experimental Advanced Superconducting Tokamak <p>Climate impacts</p> <ul style="list-style-type: none"> • Evaluate impacts of power grid operations from climate impacts on drought-susceptible regions • Increase understanding of climate events involving water • Develop tools for simulating physical and geochemical processes of basin-scale groundwater
National Science Foundation (NSF)	<ul style="list-style-type: none"> • Examine disease dynamics across a gradient of pathogen invasion, determine role of the environment in pathogen dynamics, and examine the role of host resistance • Examine the role that wastewater treatment plants play in antimicrobial resistance • Understand reciprocal relationships between different payments for ecosystem services • Broaden access to clean drinking water through technologies such as modular systems, water cleanup for reuse and recycle, and nanomaterials • Evaluate the interaction effects between socioeconomic and environmental processes over distances such as the trade of agricultural products on human and natural systems

Source: GAO analysis of department and agency documents. | GAO-22-105313

One example of a DOE-supported collaboration is the U.S.-China Clean Energy Research Center, a program completed in September 2021, where each country funded its own participants in their respective countries. In interviews, DOE officials described the Clean Energy Research Center as a program focused on research and development in clean coal, clean vehicles, and energy efficiency in buildings. The goal of the Center’s Clean Energy Research Center Clean Vehicles project was to develop new, efficient, low-cost, and clean transportation and to

advance technologies to the market. Scientists developed a China Vehicle Fleet Model, based on Argonne National Laboratory's U.S. model. In partnership with Aramco Services and the Chinese Society of Automotive Engineers, scientists produced a Chinese model that considered alternative vehicle technologies and fuels, potential regulations, and energy and emissions policies. As part of this work, scientists collaborated with industry partners to review and continually improve the model's methodologies and interfaces.

NSF officials characterized research with Chinese entities as collaborations or partnerships, where the entity is neither a recipient nor a subrecipient of federal research funds. According to officials, these partnerships may accelerate discovery; enable access to expertise, infrastructure, or sites; and build broader communities of researchers. In our review of NSF's progress and final performance reports, we found examples where field work was performed in China, Chinese researchers were involved in the project through a Chinese-affiliated institution, or researchers traveled to China for conferences or workshops.

For example, an NSF award to Virginia Polytechnic Institute and State University examining the role of wastewater treatment plants in antimicrobial resistance included partners from the University of Hong Kong, Hong Kong Polytechnic University, the Chinese Academy of Sciences, and Nankai University, along with partners from India, the Philippines, Portugal, Sweden, and Switzerland. In addition to drafting manuscripts evaluating the impact of wastewater treatment practices on antimicrobial resistance, researchers collected and analyzed wastewater samples for COVID-19 monitoring. According to NSF officials, partners in China provided access to key sampling sites and made intellectual contributions as internationally-recognized scholars in wastewater treatment plant-mediated dissemination.

Appendix III: GAO Contact and Staff Acknowledgment

GAO Contacts

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