

A Closer Look

The coronavirus pandemic and US federal investment in science

- Ending the SARS-CoV-2 pandemic will ultimately require scientific approaches in the form of specialized therapeutics and effective vaccines. However, the current crisis comes at a time when the US federal government has underinvested in science for many years. **In FY 2019, federal R&D spending equaled 0.6% of US GDP and 2.8% of total federal outlays, the lowest in over 60 years.**
- The historically low level of R&D may have severe consequences for the long-term advancement of science and technology in the United States. **The bulk of federal funding for R&D is for basic and applied research, which often require consistent and substantial funding over long periods, and is not easily replaced by funding from the private sector.** Many impactful innovations, including the internet and GPS, originated from publicly funded entities, including the Defense Advanced Research Projects Agency (DARPA).
- **Over the past two decades, roughly half of all federal research funding was for life science, 80% of which was appropriated to the National Institutes of Health (NIH).** Even so, funding for NIH has been essentially flat since 2004. The National Cancer Institute (NCI) is the largest institute within the NIH. The National Institute for Allergy and Infectious Diseases (NIAID) is the second largest. It is the primary federal agency responsible for conducting coronavirus-related research.
- **The Trump administration has repeatedly tried to cut funding from federal research and public health agencies.** Its FY 2021 budget released on February 10 proposed funding cuts of 18.6% for the CDC, 7.5% for NIAID, and 7.2% for NIH. Since 2017, Congress has largely ignored these proposed reductions, and has actually increased funding for these agencies. On March 17, the OMB adjusted its proposal and restored funding for CDC and NIAID to FY 2020 levels. Some additional new funding has been provided by the CARES Act.
- **Federal funding for global health security programs, which are meant to protect the United States against emerging infectious diseases around the world, has stalled in recent years.** The US government has historically been the largest contributor to the WHO. On April 14, the White House announced that, pending review, it will suspend financial contributions to the WHO, despite fears that the pandemic will seriously afflict Africa, South Asia, and other regions with poor health systems.

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Amid the ongoing coronavirus pandemic, much hope has been placed on science to provide effective therapeutics, and ultimately, vaccines to tame the COVID-19 crisis. Scientists and researchers are racing against the clock to fully understand the virus and the disease it causes. Specialized therapeutics, including those involving drugs and antibodies, are being tested in labs, while potential vaccines are in the early stages of development. The success of these endeavors will directly impact the health and economic well-being of millions of people worldwide.

However, the current crisis comes at a time when the US federal government's investments in science are at the lowest levels in many years. The federal government now plays a much smaller role in advancing science than it did in the past. The consequence of this trend is particularly damaging for basic research, which depends on the government as its main source of funding. Since coming to office, the Trump administration has repeatedly attempted to limit funding for science, both for domestic research agencies and international public health programs.

This note provides a brief overview of the US federal government's role in funding and promoting scientific research. The discussion will focus on life science research, and in particular the National Institute for Allergy and Infectious Diseases (NIAID), which is at the forefront of combating the coronavirus pandemic and finding its eventual cure or means of containment.

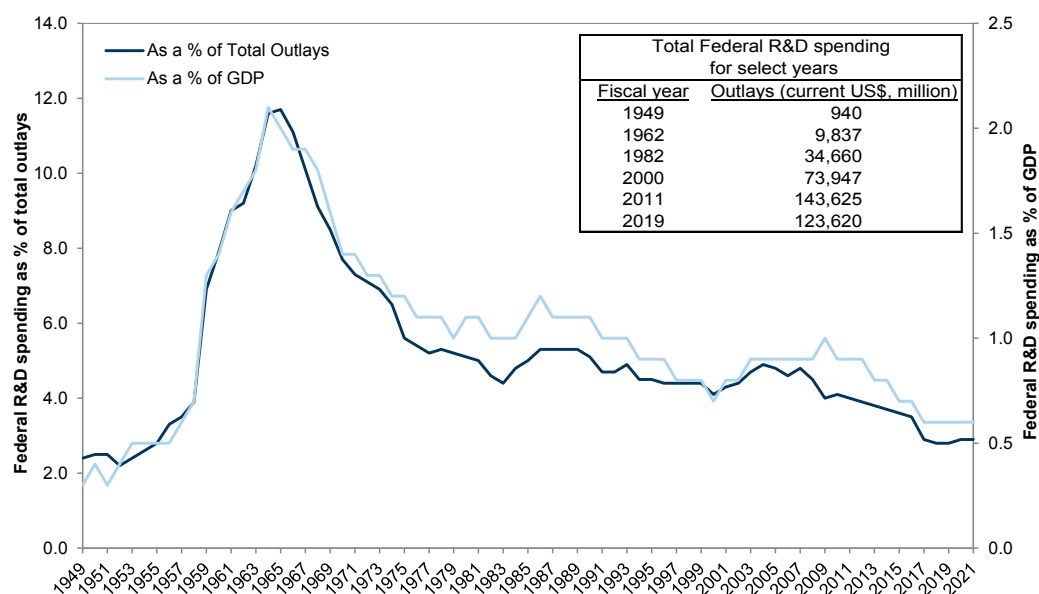
Federal expenditures on R&D now at the lowest levels in 60 years

US government spending on R&D as a percentage of total federal outlays and US GDP is now at its lowest level in over sixty years. After the former Soviet Union successfully launched a satellite called "Sputnik" in 1957, significant amounts of US government resources were devoted to winning the space race. US federal R&D spending increased dramatically from \$21.6 billion in 1957 to \$99.7 billion in 1964 in 2019 constant dollar terms, and **from 3.5% to 10.1% as a percentage of total federal outlays.**

The United States successfully first landed astronauts on the moon in 1969. With less urgency in the space race, federal R&D spending gradually decreased over the next two decades to about 4.6% of the federal budget, and stayed at around this level until the 2008 Global Financial Crisis and Great Recession. In current dollar terms, federal R&D spending peaked in FY 2011, at \$143.6 billion, and fell to \$123.6 billion in FY 2019, a decrease of 13.9%. **When adjusted for inflation, the first three years of the Trump administration had the lowest levels of federal R&D spending since FY 2002.**

Exhibit 1: US federal government outlays for R&D

Federal R&D as a % of GDP and total outlays now at the lowest levels in over 60 years



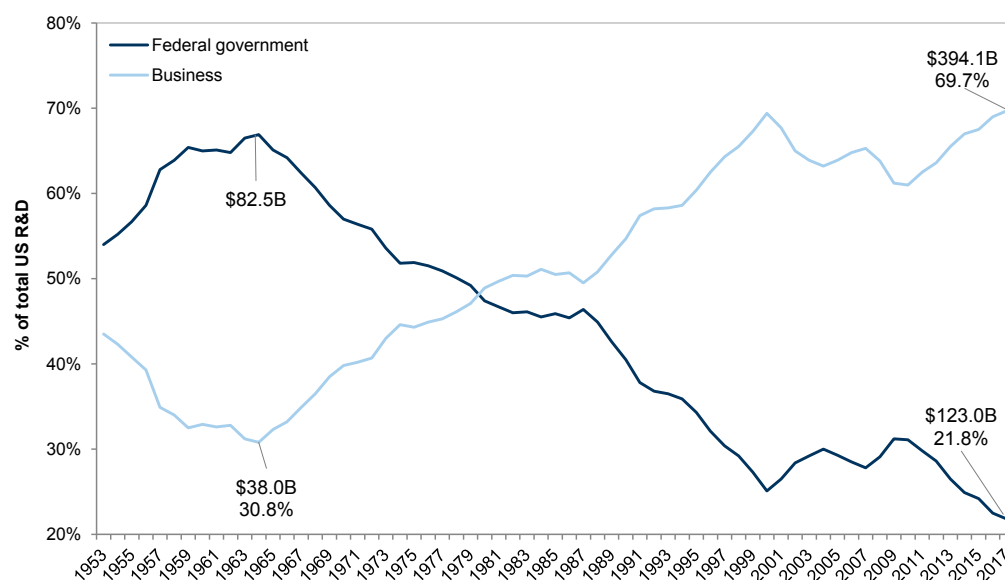
Data for FY 2020 and 2021 are based on the White House budget proposal

Source: US Office of Management and Budget, Goldman Sachs Global Investment Research

The federal government's role as a primary funding source for R&D has greatly diminished over the past few decades. In 1964, the federal government funded 66.9% of all R&D spending in the United States ([Exhibit 2](#)). This percentage has declined steadily ever the late 1960s, to 47.4% in 1980, 25.1% in 2000, and 21.8% in 2017. As government spending on R&D slowed, spending from the business sector increased steadily over time. **In 2017, 69.7% of all US R&D was funded by private companies, compared to 32.3% in 1965.** Other sources of R&D funding, including state and local governments, institutes of higher education, and non-profit organizations, made up the other 8.5% in 2017.

Exhibit 2: Funding R&D: the federal government vs. the business sector

Businesses have replaced the government as the primary source of aggregate R&D funding



Data for R&D funding are in constant 2019 dollars.

Source: National Science Foundation, Goldman Sachs Global Investment Research

The difference between research and development

The main concern in this trend is that governments and private businesses

generally do not fund the same type of R&D. The majority of federal R&D funding is used to conduct research, including basic research that focuses on the advancement of knowledge, and applied research that focuses on solving specific practical problems. In contrast, R&D spending in the private sector tends to focus on the development of specific products and processes. For example, studying the novel coronavirus and its origins would be classified as basic research, while conducting lab tests and clinical trials to find a vaccine would be applied research. Development is the process by which a vaccine is turned into a viable product that can be scaled and distributed.

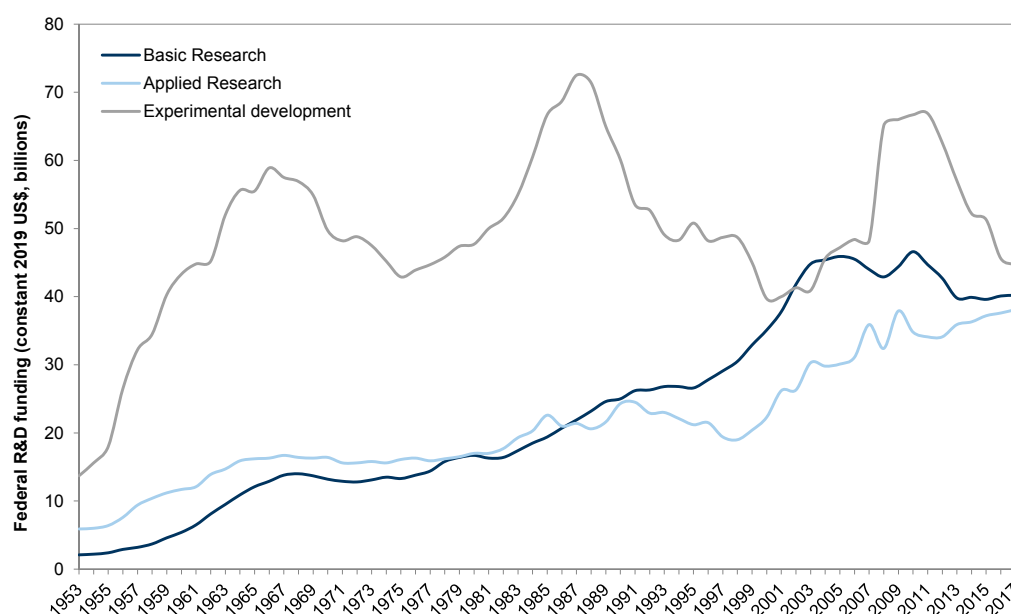
Because scientific research often leads to discoveries that have broad applications and social benefits, it is usually viewed as a public good. In contrast, business R&D activities are often winner-takes-all. Only the companies that perform the R&D will benefit initially ; their competitors do not. In addition, business funding for R&D may be highly variable, which is incompatible with basic research activities that may require steady funding over long periods of time. Because of these factors, national governments are generally the most appropriate source for funding research.

In the United States, most federally funded research is performed at universities and government research facilities. In FY 2017, these two sectors received 44.0% and 37.2% of all federal research funding, respectively. Scientists working in publicly funded research labs have sometimes turned their scientific findings into commercial products and services by leveraging the financing, manufacturing, and marketing capabilities of the private sector.

Over the past two decades, federal funding for both basic and applied research has stalled. This followed almost fifty years of steady increases (Exhibit 3). In FY 2017, the federal government funded \$40.2 billion in basic research. Adjusted for inflation, this was 12.5% lower than the funding in FY 2005. The percentage of basic research funding provided by the federal government has steadily declined since the late 1970s. **In 2017, 41.8% of all basic research funding in the United States was provided by the federal government, compared to 57.8% in 2000 and 70.3% in 1980 (Exhibit 4).** Federal funding for development tends to be much more variable; the majority of it is for national defense and space exploration purposes. Its ebbs and flows tend to correspond to specific events or national security concerns, such as the space race and the Iraq War.

Exhibit 3: Federal funding for the three types of R&D

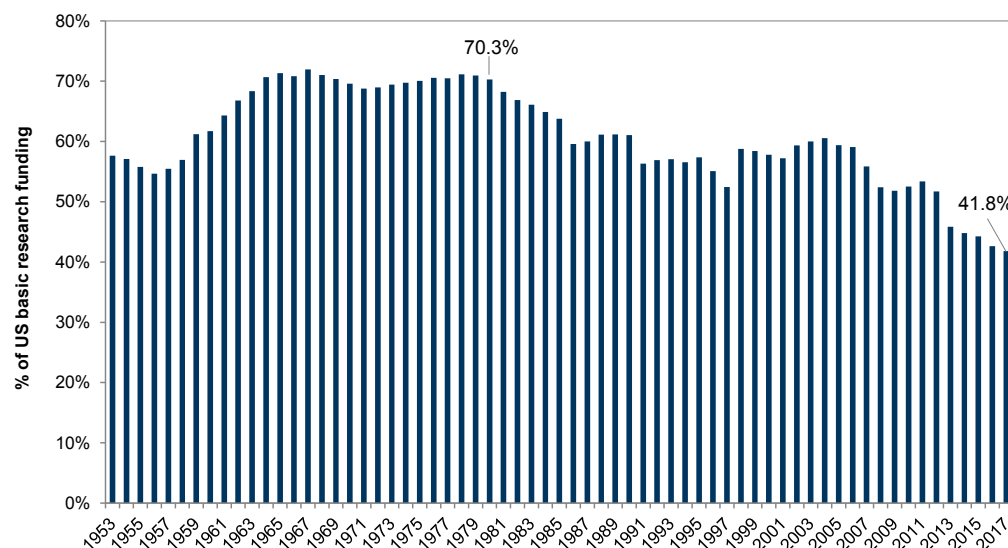
Funding for both basic and applied research have stalled



Source: National Science Foundation, Goldman Sachs Global Investment Research

Exhibit 4: Percentage of US basic research funded by the federal government

Declining since 1978

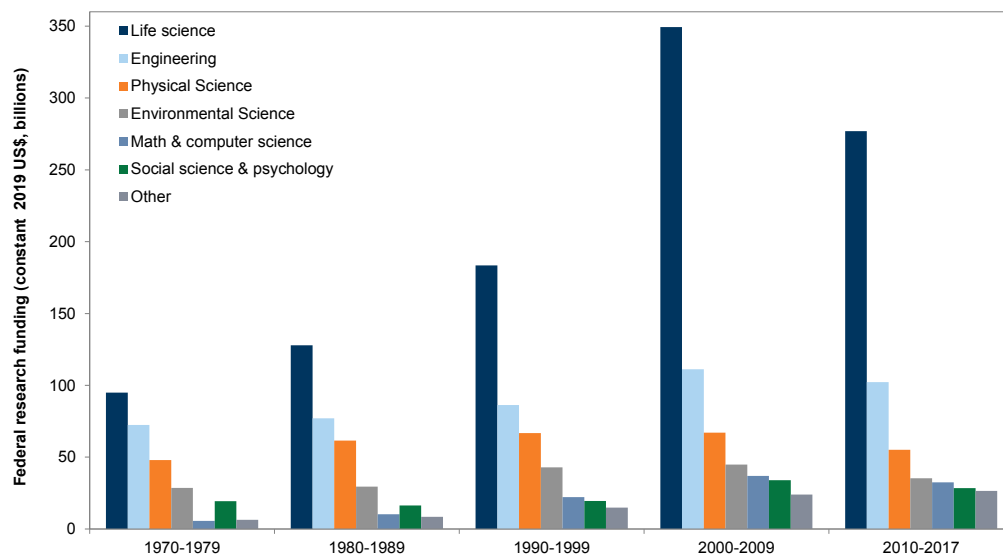


Source: National Science Foundation, Goldman Sachs Global Investment Research

Federal funding for life sciences: NIH, CDC, and their component agencies — NIAID and NIOSH

Life science research has received more federal funding than any other science discipline in every year since FY 1971 ([Exhibit 5](#)). Approximately 80% of all life science funding has been allocated to the National Institutes of Health (NIH) — the government's primary agency for biomedical and public health research. In FY 2018, NIH accounted for 50.1% of federal funding for basic research and 39.3% of applied research. Between 1998-2003, funding for NIH more than doubled, from \$16.6 billion to \$34.4 billion¹ ([Exhibit 6](#)). **Since 2004, however, life science and NIH funding have been essentially flat on an inflation-adjusted basis.**

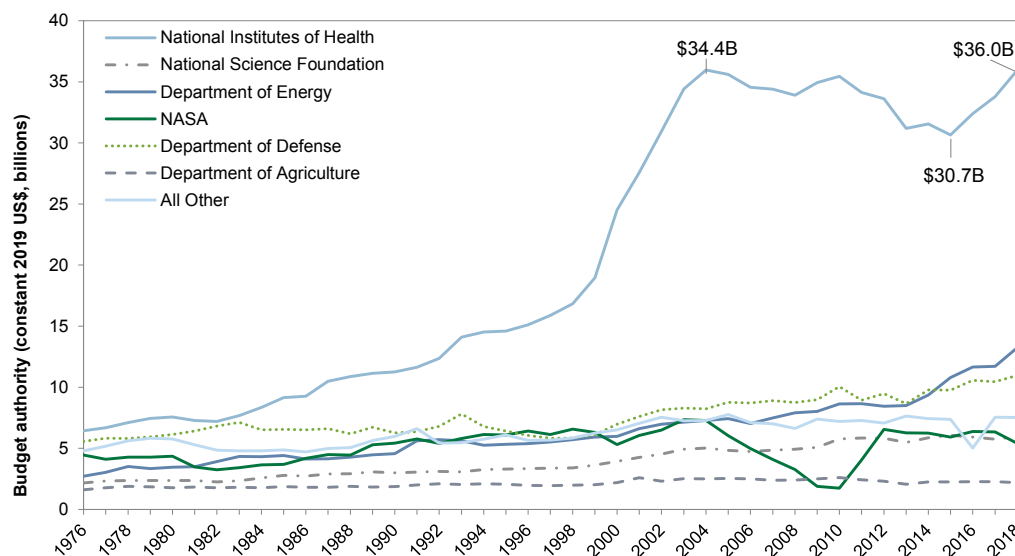
¹ Figures in 2019 constant USD.

Exhibit 5: Federal research funding by discipline

Source: American Association for the Advancement of Science, Goldman Sachs Global Investment Research

Exhibit 6: Federal research funding by agency

NIH funding more than doubled during 1998-2003, but has been essentially flat since then



Data for fiscal years

Source: American Association for the Advancement of Science, Goldman Sachs Global Investment Research

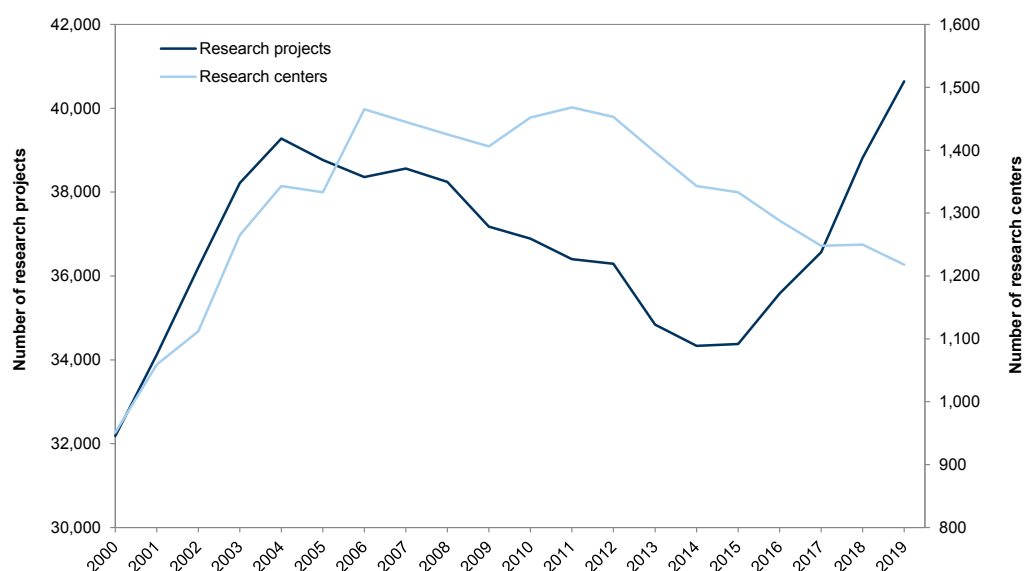
The prominence of the life sciences in federal research funding can be attributed to several factors. First, there is genuine need for scientific breakthroughs to understand disease mechanisms and enhance human life, especially as Americans are living longer and the median age is rising. Second, because of the advanced technologies involved, medical research laboratories are often very costly to build and operate. Third, medical sciences tend to enjoy extensive support from the American public and their

representatives in Congress. This helps to provide considerable political backing for NIH funding.

The NIH had a budget of \$39.2 billion in FY 2019. Approximately 80% of it was awarded to researchers at US universities through a peer-reviewed grant-making process. Another 10% was used to conduct research at the NIH headquarters in Maryland. In FY 2019, the NIH provided funding to 40,667 research projects and 1,222 research centers. The number of research projects and research centers receiving NIH grants decreased sharply over the past 15 years until a more recent reversal ([Exhibit 7](#)).

Exhibit 7: Number of research projects and research centers receiving NIH grants

Down significantly since mid-2000s, number of projects has since recovered



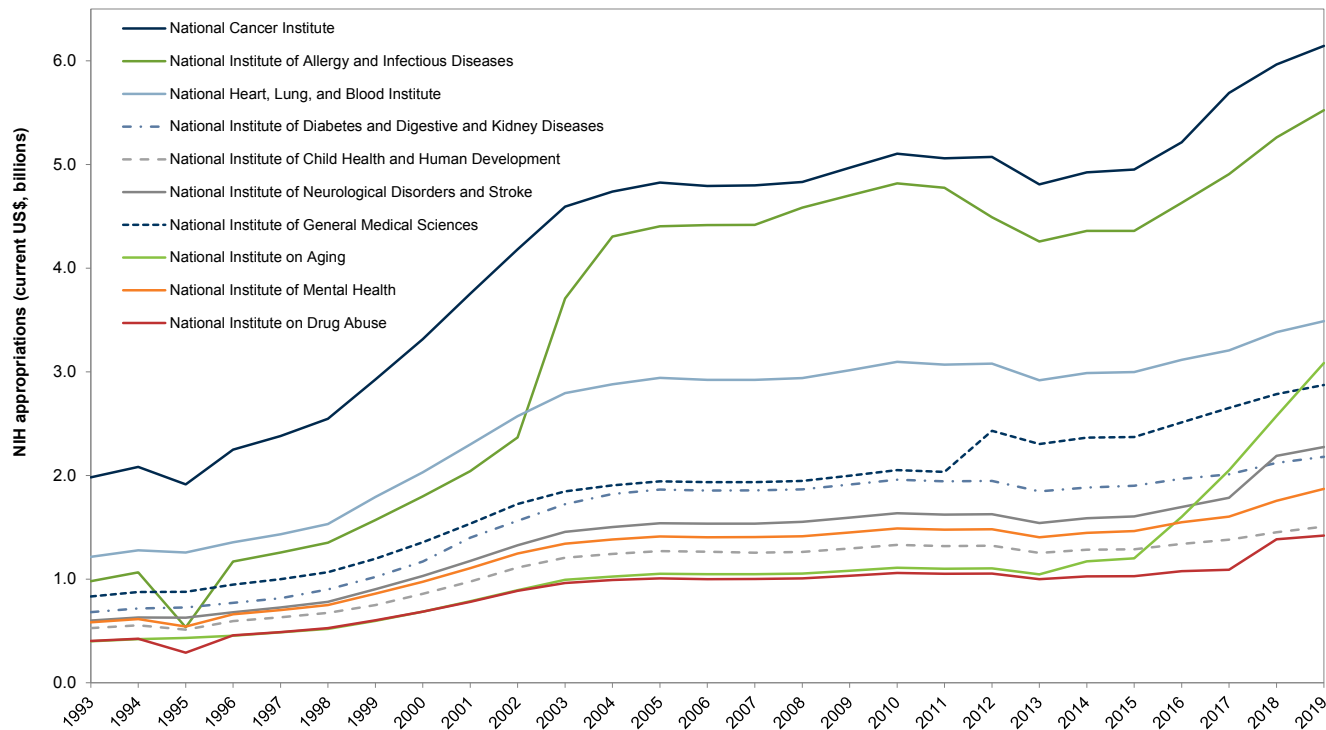
Data for fiscal years

Source: National Institutes of Health, Goldman Sachs Global Investment Research

The NIH is comprised of twenty research institutes and six operational centers. Funding for each institute largely corresponds to the prevalence and severity of the health concerns they are tasked to research. The National Cancer Institute (NCI) and the National Heart, Lung, and Blood Institute (NHLBI) have historically received the most funding ([Exhibit 8](#)). Heart disease and cancer were the two leading causes of death in the United States before the current COVID-19 crisis. Funding for the National Institute on Aging has more than doubled since 2015, a reflection of the demographic trends in the country. The National Institute on Drug Abuse receive a 26.8% budget increase in FY 2018, in response to the ongoing opioid crisis.

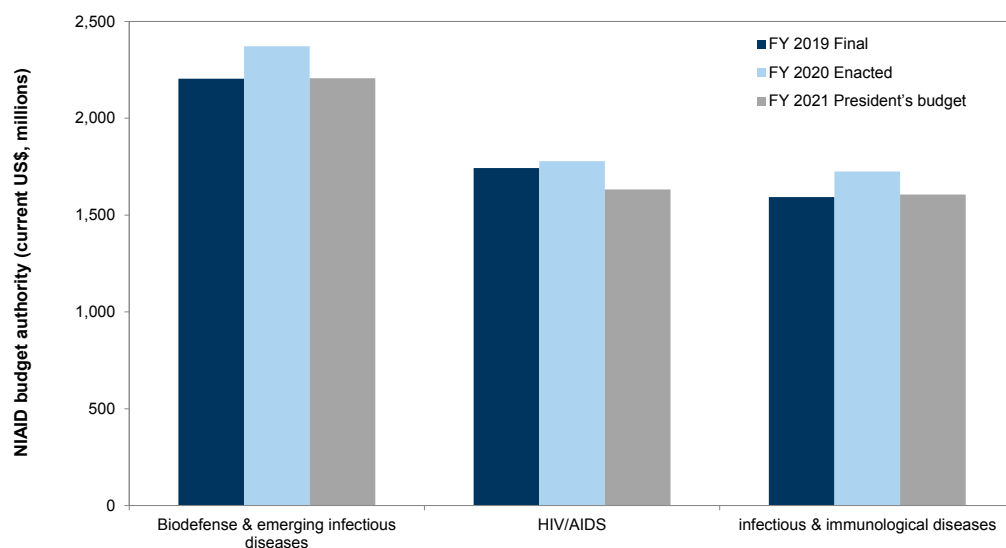
Exhibit 8: NIH funding by institutes

Top 10 highest-funded institutes as of FY 2019



Source: National Institutes of Health, Goldman Sachs Global Investment Research

The National Institute of Allergy and Infectious Diseases (NIAID), led by Dr. Anthony Fauci since 1984, has the dual mandate of conducting relevant research and responding to the threat of emerging infectious diseases. In 2003, after the anthrax letter attacks, NIAID received almost \$1.4 billion, or 56.6%, in additional funding specifically for bioterrorism and biodefense research. This propelled it to become the second largest institute within the NIH. Prior to the current pandemic, approximately 40% of NIAID's \$5.5 billion budget was appropriated for biodefense and emerging infectious diseases, 30% for HIV/AIDS research, and another 30% for existing infectious and immunological diseases ([Exhibit 9](#)).

Exhibit 9: NIAID budget authority by research activity

FY 2021 data based on White House budget proposal released on February 11, 2020. The OMB has revised its funding request for NIAID on March 17, 2020.

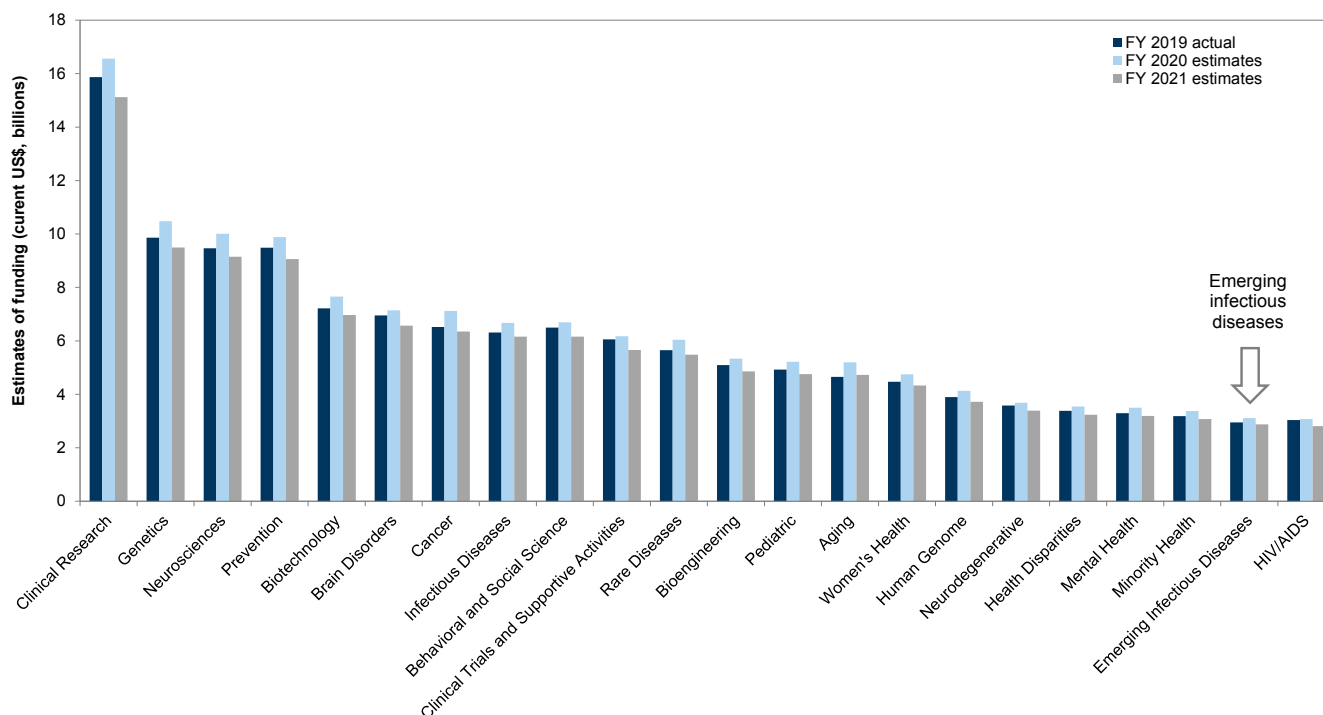
Source: National Institute of Allergy and Infectious Diseases, Goldman Sachs Global Investment Research

Exhibit 10 shows how NIH funding is distributed among various research, health condition, and disease categories. It shows actual data for FY 2019 and estimates thereafter. **Estimates for FY 2020 and 2021 were made based on funding levels before the coronavirus pandemic hit the United States.**

Clinical research was expected to receive the most funding, followed by genetics, neuroscience, and biotechnology. These three areas have been at the cutting edge of biomedical research in recent years. **Research in emerging infectious disease received a total funding of \$3.0 billion in FY 2019, ranking it 21st among all listed categories. Its estimated level of funding was \$2.9 billion for FY 2021, a 7.5% reduction from 2020(E).**

Exhibit 10: Estimates of NIH funding by research area, health condition, and disease

FY 2021 estimates below FY 2019 and 2020 levels for all research areas



Data for research categories are not mutually exclusive. Data as of February 24, 2020. Top 22 of 292 categories listed.

Source: National Institutes of Health, Goldman Sachs Global Investment Research

The National Institute for Occupational Safety and Health (NIOSH) is a research agency within the Centers for Disease Control and Prevention (CDC). It is responsible for conducting research and making recommendations on health and safety issues in the workplace. **A relatively small agency with a budget of \$335 million for FY 2019, NIOSH may play an important role in the coming months as businesses from across the country resume operations.** It could most appropriately be tasked with recommending policies and best practices for various work settings, including small businesses, transportation hubs, and healthcare facilities. These practices, such as maintaining physical distance and wearing personal protective equipment, will help Americans navigate a new way of life before effective vaccines can be found.

Science funding during the Trump administration

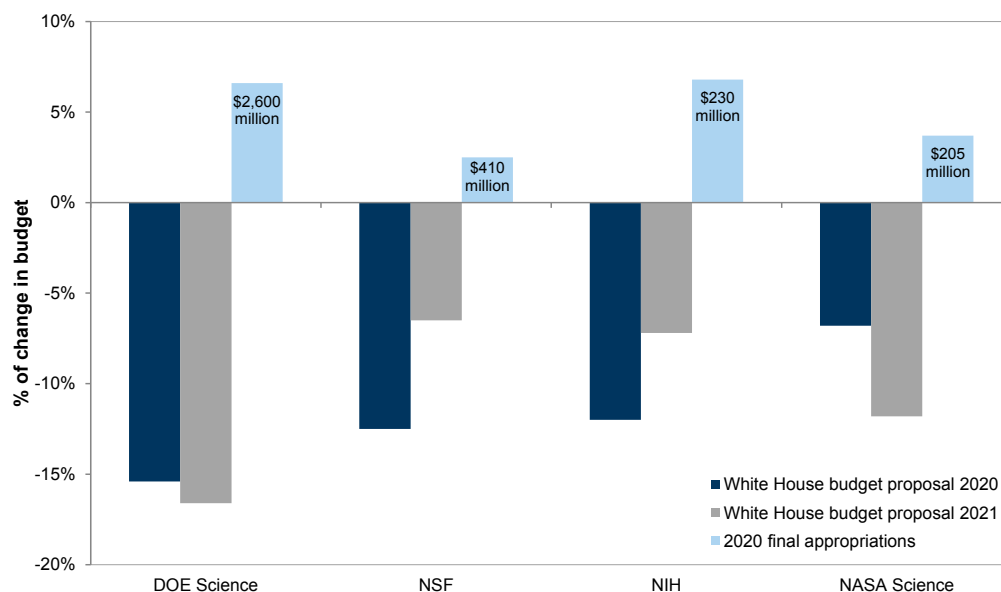
Since taking office, the Trump administration has consistently and significantly cut funding for science programs in its annual budget proposals. On February 10, 2020, eleven days after the World Health Organization (WHO) declared the novel coronavirus “a public health emergency of international concern,” the White House released its budget for FY 2021. It proposed across-the-board cuts for research agencies, including 7.2% for NIH, 6.5% for the National Science Foundation, and 16.6% for the science programs at the Department of Energy. **The CDC, the federal agency responsible for promoting public health and preventing the spread of diseases, received a**

proposed budget cut of 18.6%, including a 44.6% cut for occupational safety and health.

The United States Congress, which has authority over the appropriations process, had largely rejected the Trump administration's proposed cuts to federal research agencies in prior years. For example, the budget legislation enacted for FY 2020 included substantial increases for research funding from FY 2019 levels ([Exhibit 11](#)).

Exhibit 11: Federal research budget, White House proposals vs. Congressional legislation

The enacted budget substantially increased funding for most research agencies



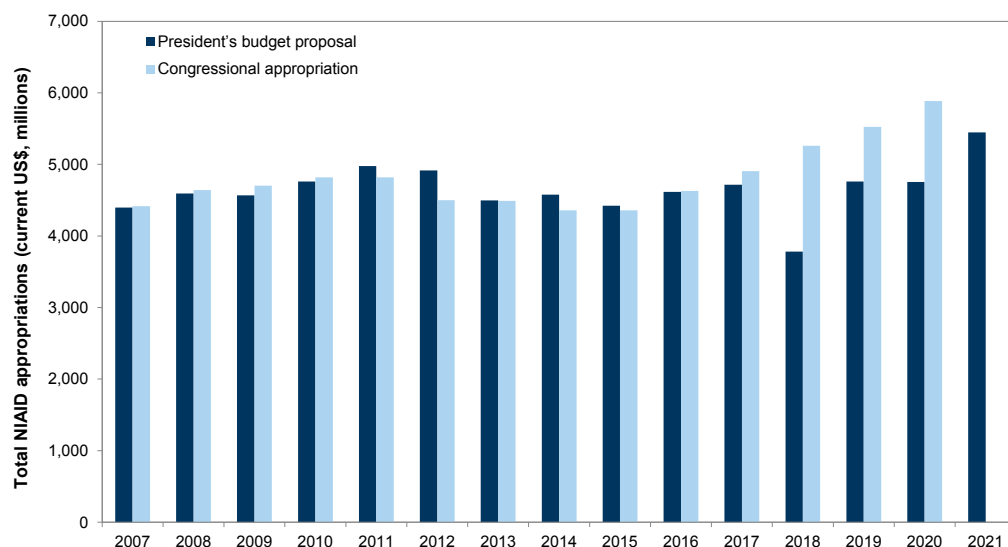
FY 2021 final appropriations have not yet been made.

Source: Science Magazine, Goldman Sachs Global Investment Research

The funding dynamic at NIAID can help illustrate what has happened to many federal research agencies in recent years. In the budget proposals for FY 2018-2020, the Trump administration slashed funding for NIAID by an average of 15.4% from the previous year's enacted levels. However, the budget legislation passed by Congress increased the Institute's funding by an average of 26.3% from the president's proposals, and by 6.3% from the prior year's budgets ([Exhibit 12](#)). For FY 2021, the Trump administration initially proposed a 7.5% funding cut for NIAID, affecting all aspects of the Institute's granting and research operations ([Exhibit 13](#)). **On March 17, 2020, five weeks after the budget's initial release, the Office of Management and Budget (OMB) issued an amendment that restored budget authority for both the CDC and the NIAID to their FY 2020 levels.**

Exhibit 12: NIAID appropriations history

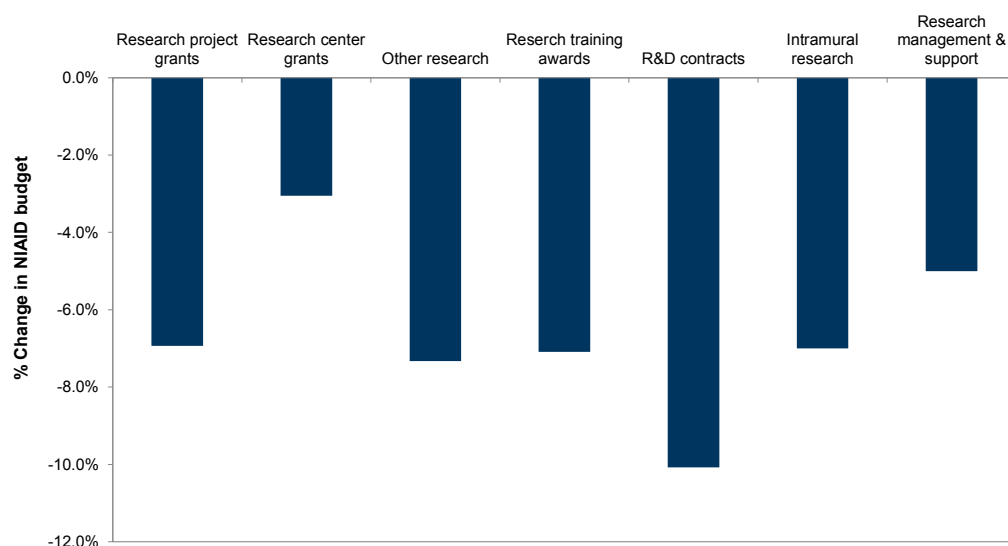
Congress rejected the Trump administration's proposals to cut funding beginning in FY 2018



Source: National Institute of Allergy and Infectious Diseases, Goldman Sachs Global Investment Research

Exhibit 13: Changes in NIAID budget: FY 2021 proposal vs. FY 2020 enacted

White House proposed across-the-board cuts in February



Data based on White House budget proposal released on February 11, 2020.

Source: National Institute of Allergy and Infectious Diseases, Goldman Sachs Global Investment Research

The recently-passed CARES Act appropriated nearly \$1.3 billion for federal research agencies to conduct coronavirus-related research. The NIH would receive \$945.4 million of this funding, including \$706.0 million for NIAID and \$103.4 million for NHLBI.

By comparison, the 2009 Recovery Act passed in response to the Great Recession was far more generous; it included \$14.5 billion for research, \$1.9 billion for development, and \$2.9 billion for R&D facilities and equipment during FY 2009-2010.

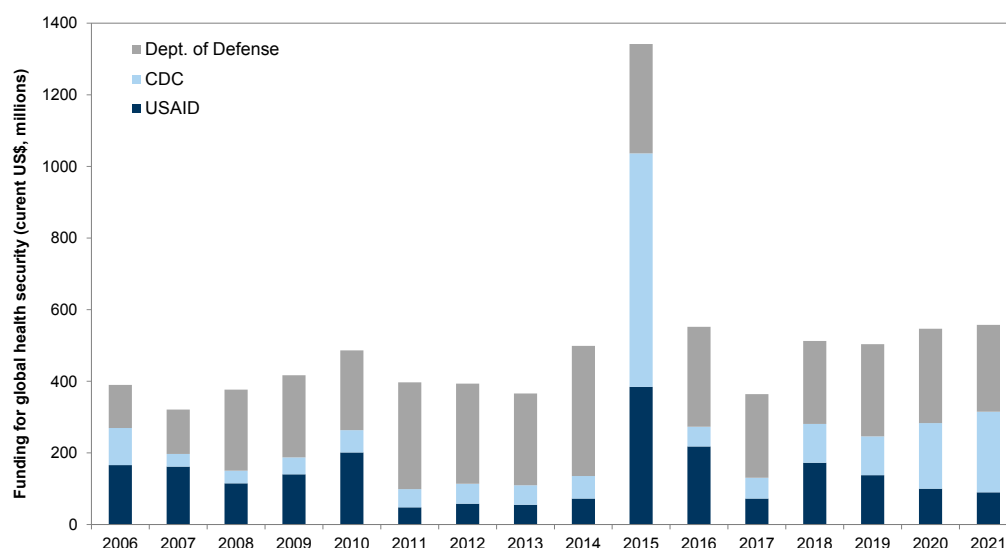
US funding for global health security and the WHO

Funding for government programs that promote and protect global health security has also decreased in recent years. These programs, run independently at various federal agencies including the Agency for International Development (USAID), CDC, and Department of Defense, aim to reduce the threat of emerging infectious diseases overseas. For example, the Global Disease Detection Program at the CDC is tasked with detecting, identifying, and containing potential viral outbreaks **before they can reach the United States.**

Funding for global health security tends to fluctuate in response to specific outbreaks. In FY 2015 and FY 2016, Congress provided emergency funding of \$1.0 billion and \$145.5 million, respectively, after the emergence of Ebola and Zika. This allowed US agencies to build critical infrastructure and train front-line workers in countries that were most vulnerable to these emerging epidemics. After the additional money had run out, funding for global health security largely returned to pre-2015 levels. **According to the Kaiser Family Foundation, the Trump administration requested \$557.3 million in global health security for FY 2021, a 2.0% increase over FY 2020 levels (Exhibit 14).**

Exhibit 14: Funding for global health security

Decreasing in recent years after emerging funding for Ebola and Zika ran out



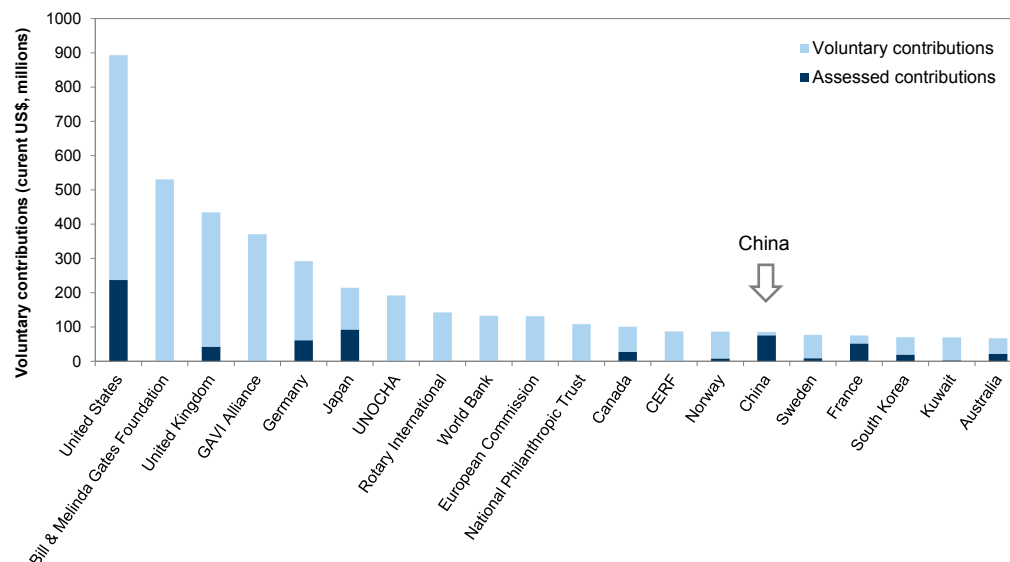
Data for FY 2021 are based on the White House budget proposal released on February 11, 2020.

Source: Kaiser Family Foundation, Goldman Sachs Global Investment Research

On April 14, 2020, the White House announced that it will withhold future funding to the World Health Organization pending a 60-90 day review of the organization's actions during the COVID-19 pandemic. As is the case for many multinational organizations, the United States has been a leading supporter and fund provider for the WHO and other global health and disease prevention initiatives. Funding from the US government comprised approximately 14.3% of WHO's \$6.3 billion biennial budget for 2018-2019, including \$236.9 million in assessed contributions and \$656.1 million in

voluntary contributions² (Exhibit 15). About 27.4% of the United States' contributions went to polio eradication programs, while 17.4% funded initiatives that increased access to essential health and nutrition services. The Bill and Melinda Gates Foundation was the second-largest donor to the WHO. The Gates Foundation is also the main donor of the GAVI Alliance, a global health partnership that aims to increase vaccination levels in poor countries. In recent weeks, China has donated a total of \$50 million to support WHO's efforts in the fight against COVID-19. By comparison, China's voluntary contribution for 2018-2019 was only \$10.2 million.

Exhibit 15: Top 20 largest contributors to WHO's 2018-2019 biennial budget



Source: World Health Organization, Goldman Sachs Global Investment Research

² Assessed contributions are dues paid by each member state based on its GDP and population.

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Reg AC

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