Lawrence A. Tabak, D.D.S, Ph.D.
Acting Director of the NIH

On behalf of the National Institutes of Health (NIH), I am privileged to transmit the Congressional Justification of the NIH request for the fiscal year (FY) 2023 budget. This request for a $62.5 billion total program level is critical to supporting NIH's mission to seek fundamental knowledge about the nature and behavior of living systems and to apply that knowledge to enhance health, lengthen life, and reduce illness and disability. Importantly, this budget request supports the diverse and inclusive workforce needed for developing tomorrow's life-saving medical interventions.

In December 2021, Dr. Francis Collins stepped down as head of the agency. On behalf of NIH, I extend my deep gratitude and appreciation to Dr. Collins for his years of exemplary leadership and service. During his tenure at the agency's helm, Dr. Collins tackled some of the most pressing health issues facing the Nation, including Alzheimer's disease, cancer, diabetes, health disparities, opioid use disorder, rare diseases, and the Coronavirus Disease 2019 (COVID-19) pandemic. His singular focus was ensuring the Nation's investment in biomedical research was maximally leveraged to improve health, end suffering, and provide hope. I share this commitment and, while serving as the Acting Director of NIH, I intend to continue the important initiatives that Dr. Collins and I have nurtured together over the past 12 years.

The landscape in which NIH pursues its mission has abruptly shifted over the past two years, bringing both new opportunities and historic challenges to the forefront of biomedical research. These years will be remembered not solely by the historic pandemic that caused global suffering, but also by the resurgence of recognition of the necessity of science to ensure society's resilience during challenging times. The scientific method can often take time as researchers carefully test new ideas and build upon decades of past discoveries, but it is a proven mechanism for solving complex problems such as those we face today. It took thousands of scientists over 25 years of fundamental discovery to enable the development of the messenger RNA (mRNA) vaccines for COVID-19 in less than a year. These vaccines have been shown to create a robust immune response and are safe. It is of note that the vast majority of those currently hospitalized with COVID-19 are unvaccinated, a tragic confirmation of the value of these vaccines.

The pandemic also brought into even sharper focus the impact of health disparities in America, and the need to redouble efforts to redress them. We also more clearly see the harm structural racism brings to health and the biomedical research enterprise and our workforce and are determined to act. At the same time, climate change is exacerbating existing health threats and creating new public health challenges, most evidently in communities that already experience health disparities. To meet these challenges, NIH has pivoted in real-time through the creation of several programs and initiatives and is working further to lay the groundwork for a robust

biomedical research enterprise for years to come. Therefore, this year, the agency's Congressional Justification theme is "NIH in a Changing World: Science to Enhance Human Health."

The biomedical research workforce has faced unparalleled challenges these past few years but has remained steadfastly committed to pursuit of science as a solution to pressing public health challenges. While we can celebrate the remarkable accomplishments of the biomedical research community, there is still much to do to bring the COVID-19 pandemic and other emerging threats under control. Now more than ever, scientists have a responsibility to communicate clearly and consistently with the public. We must tackle the deliberate misinformation that contributes to the reluctance of individuals and groups to get themselves and their children vaccinated. The NIH and the research community are actively engaging in numerous efforts to address the public's legitimate questions concerning COVID-19 vaccines including the COVID Community Corps and NIH initiatives such as the Vaccine Hesitancy Initiative and the Community Engagement Alliance (CEAL) Against COVID-19 Disparities**.** We are also continually improving the way we fund science to better address community concerns, such as an NIH-wide effort to increase and retain diverse participation in clinical trials so that the general public can understand and trust that the knowledge gained from the research that they fund will be applied in real-life clinical settings to allow them and their families to live longer and healthier lives.

The FY 2023 budget continues to advance NIH's long-standing commitment to investing in basic research and the arc of translation into clinical practice as the Nation adapts to meet the demands and possibilities in our changing world. Fundamental research is the key to unlocking the secrets of how living systems function and remains the foundation for developing novel treatments and cures. Just as investment in basic science led to the rapid development of COVID-19 vaccines, diagnostics, and therapeutics, basic research also serves as the foundation for the NIH Helping to End Addiction Long-term (HEAL) Initiative, which aims to curb the opioid epidemic and provide non-addictive alternatives for individuals who suffer from chronic pain. As the NIH builds upon its investments in basic research to develop innovative medical treatments, we look forward to the hard work of standing up the new Advanced Research Projects Agency for Health (ARPA-H) and leveraging its exciting new capabilities to speed the application and implementation of health breakthroughs.

In conclusion, the FY 2023 budget provides resources for NIH, and NIH-supported researchers around the country, to accelerate discoveries that will enhance our ability to prevent and cure disease.

Lawrence A. Tabak, DDS, PhD

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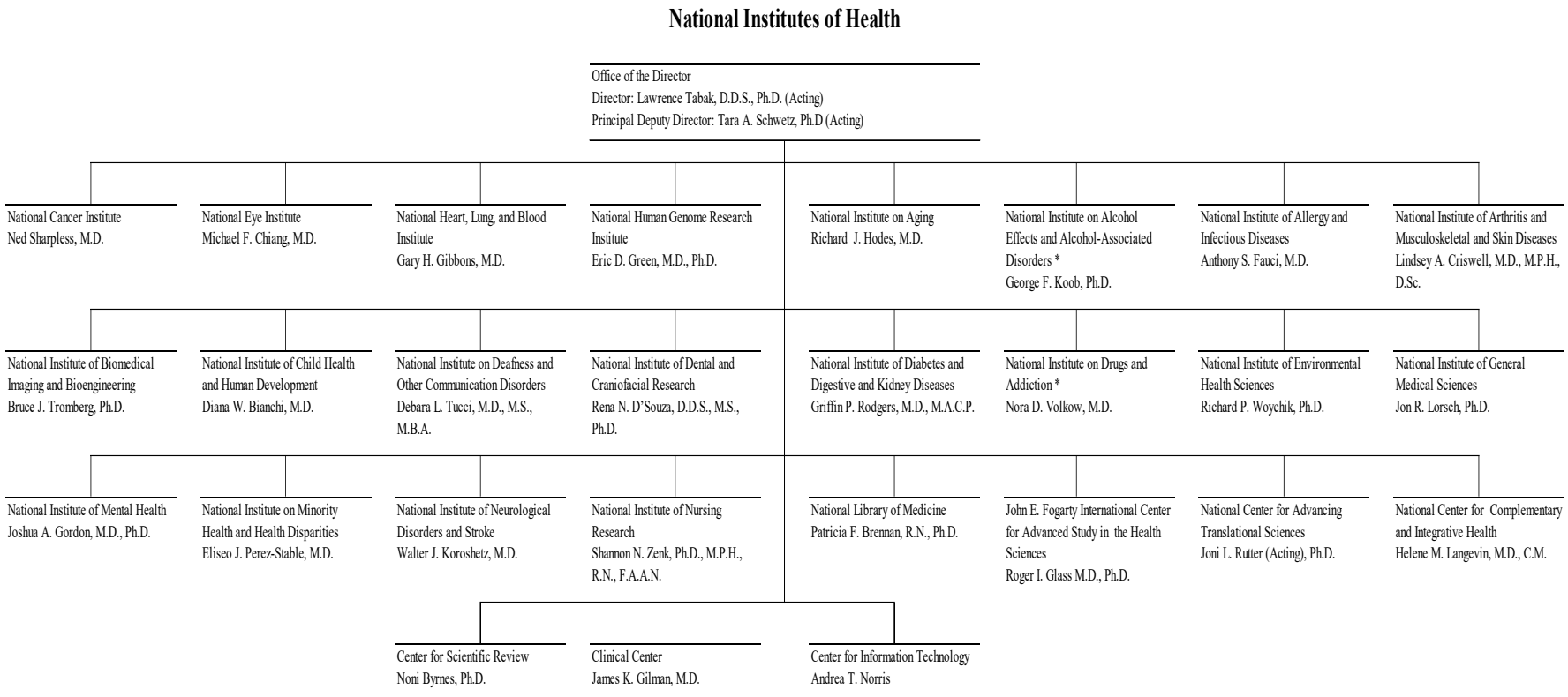


*The FY 2023 President's Budget proposes to rename the National Institute on Drug Abuse to the National Institute on Drugs and Addiction and to rename the National Institute on Alcohol Abuse and Alcoholism to the National Institute on Alcohol Effects and Alcohol-Associated Disorders.

INTRODUCTION AND MISSION

The mission of the National Institutes of Health (NIH) is to seek fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life, and reduce illness and disability. In pursuit of this mission, NIH conducts and supports biomedical research focused on fostering fundamental creative discoveries, innovative research strategies, and their applications towards improving human health.

As the Nation's premier biomedical research agency, NIH plays a critical role in advancing basic and clinical biomedical research to improve human health and lay the foundation for ensuring the Nation's economic well-being. This role has been more important than ever in the last few years as NIH has contributed to the development of testing, vaccines, treatments, and other measures necessary to face COVID-19, the greatest public health crisis of our generation. NIH also works to develop, maintain, and renew scientific, human, and physical resources that will ensure the Nation's capability to prevent disease and disability. The biomedical research enterprise depends upon not only NIH's support of cutting-edge science and technology, but also its wise investment of tax dollars. Through careful stewardship of public resources in pursuit of its mission, NIH strives to enhance the lives of all Americans.

OVERVIEW OF BUDGET REQUEST

Introduction

For FY 2023, the National Institutes of Health (NIH) requests a total program level of $62.5 billion. This budget level will support NIH's mission to seek fundamental knowledge about the nature and behavior of living systems and to apply that knowledge to enhance health, lengthen life, and reduce illness and disability. The request allows NIH to make bold new strategic investments to address several national priorities, including combatting the acute and lasting effects of the COVID-19 pandemic, fighting the opioid epidemic, eradicating HIV in the United States, expanding mental health research, addressing health disparities and inequities, researching the human health impacts of climate change, contributing to the HHS Pandemic Preparedness Plan, and continuing to fund the newly established Advanced Research Projects Agency for Health (ARPA-H) that was first proposed in the FY 2022 President's Budget.

On July 31, 2021, NIH released the NIH-Wide Strategic Plan for Fiscal Years 2021–2025 to articulate the agency's highest priorities over the next five years and fulfill requirements of the *21st Century Cures Act.*[1] The Plan will guide NIH research investments and outlines the agency's vision for the direction, capacity, and stewardship of biomedical research. It is organized around a *Framework* of three key *Objectives* that outline these priorities along with five *Cross-Cutting Themes* that are common to all *Objectives*. Individual strategic plans of NIH Institutes, Centers, and Offices, designed to address their specific congressionally mandated missions, link to the NIH-Wide Strategic Plan, and conform to the overarching principles it conveys. In developing the Plan, NIH adopted an approach designed to be transparent, focused on science and good stewardship of research, and guided by evidence. It was developed through collaboration between NIH leadership and staff and key stakeholders, including the research community, professional societies, advocacy groups, and the public. NIH research investments will be guided by the NIH-wide Strategic Plan.

The *21st Century Cures Act* provided NIH with critical tools and resources to advance biomedical research across the spectrum, from foundational basic research studies to advanced clinical trials of promising new therapies. The Innovation Fund, established in the *21st Century Cures Act*, continues to support cutting-edge research through several ongoing initiatives: the *All of Us* Research Program, the Brain Research through Advancing Innovative Neurotechnologies® (BRAIN) Initiative, and the Beau Biden Cancer Moonshot. The Budget includes $1,085.0 million from the Innovation Fund for these projects, an increase of $681.0 million from the FY 2022 Continuing Resolution (CR) level for the Innovation Fund component of the Cures program, which will allow Cures programs to continue to make important strides in FY 2023.

> *All of Us*. In FY 2021, the *All of Us* Research Program continued its mission to accelerate health research and medical breakthroughs to enable individualized prevention, treatment, and care. *All of Us* is on its way to enrolling one million or more participants, and as of February 2022, nearly 466,000 participants have consented to join the program and more than 321,000 participants had completed all steps in the initial protocol. More than 20 publications have now used *All of Us* data.

[1] www.nih.gov/sites/default/files/about-nih/strategic-plan-fy2021-2025-508.pdf

NIH BRAIN® Initiative. The BRAIN® Initiative has enabled scientific advances that provide opportunities to understand the structure and function of the brain at an unprecedented level of detail. Researchers throughout neuroscience are rapidly adopting these advances, and the BRAIN Initiative is both dramatically enhancing existing methods and developing entirely new technologies to study and manipulate brain circuits. In October 2021, the BRAIN® Initiative Cell Census Network (BICCN) unveiled an unprecedented atlas of cell types and an anatomical neuronal wiring diagram for the mammalian primary motor cortex, derived from detailed studies of mice, monkeys, and humans.[2] This atlas was created through an international collaborative effort by more than 250 scientists at more than 45 institutions across 3 continents. The BRAIN® Initiative has also taken major steps in shifting the research culture within neuroscience through its emphasis on neuroethics, diversity and inclusion in the research community, and data sharing practices to enable and enhance the scientific and technological advances from this initiative.

The Beau Biden Cancer Moonshot. Remarkable progress and scientific accomplishments in cancer research have been made in the time since the Cancer Moonshot was launched. The initiative was designed to accelerate cancer research, to make more therapies available to more patients, while also improving our ability to prevent cancer and detect it at an early stage.[3] In February 2022, President Biden announced a bold new goal to continue the progress against cancer achieved by the Cancer Moonshot: cutting America's age-adjusted death rate due to cancer by 50 percent over the next 25 years. To achieve this goal, NCI will support a range of compelling priorities that include diagnosing cancer sooner, addressing inequities that lead to disparities in cancer outcomes, and providing comprehensive support to cancer patients, survivors, and caregivers. The Budget includes an increase of $21.0 million for the Cancer Moonshot from the FY 2022 CR level, for a total of $216.0 million. The fight against cancer will also receive an important boost from creation of the recently established ARPA-H, which will drive transformational innovation in a number of health research areas, including cancer. The Moonshot and ARPA-H initiatives have the potential to impact all cancer patients, including the 1.9 million U.S. patients expected to be diagnosed with cancer in 2021, and the nearly 18 million cancer survivors in the United States, fulfilling the President's commitment to end cancer as we know it.

More than 80 percent of NIH's funding is awarded for extramural research, largely through more than 55,000 competitive grants that support the work of more than 300,000 researchers at more than 2,500 universities, medical schools, and other research institutions in every state, the District of Columbia, Puerto Rico, and several tribes. In addition, NIH supports 6,000 intramural scientists making the intramural program one of the largest biomedical research organizations in the world. To date, 165 NIH-supported researchers, including 26 intramural investigators, have been awarded the Nobel Prize. The Lasker Prize, which is often called "America's Nobel,"

[2] www.ninds.nih.gov/News-Events/News-and-Press-Releases/Press-Releases/NIH-BRAIN-Initiative-Unveils-Detailed-Atlas

[3] www.cancer.gov/research/key-initiatives/moonshot-cancer-initiative

recognizes researchers and clinicians for their contributions to medicine and has been awarded to 195 NIH-supported researchers to date, including 33 intramural investigators.

Throughout the NIH, a critical aspect of supporting the discovery of novel diagnostics, therapeutics, and cures to disease is having facilities that can house state-of-the-art imaging equipment, discover tumors at the earliest stage possible, safely develop novel treatments such as cellular therapy, and more. Facilities must co-evolve with science for NIH to achieve its full potential. A major component of the Building and Facilities (B&F) program is the Repair & Improvement (R&I) program, which enables NIH to maintain and improve the performance of existing facilities throughout their life cycle. As the responsible steward of its 261 facilities, a key aspect of NIH's strategy is to sustain the condition of existing facilities to prevent premature deterioration and the curtailment of research. These investments help reduce the likelihood and consequences of building emergencies associated with NIH's Backlog of Maintenance and Repairs (BMAR), estimated at nearly $3.0 billion across all campuses as of the end of FY 2021. The FY 2023 B&F request is $300.0 million, a $100.0 million increase from the FY 2022 CR level. This funding is critical to avoid falling even further behind in addressing BMAR.

To achieve its priorities in the facilities area, NIH plans to execute various modernization and repair projects to NIH's research hospital, replace research animal facilities with a centralized and more efficient facility, improve facilities that advance computational and data science, replace temporary and obsolete administrative support facilities with permanent buildings, improve the energy and water efficiency of buildings, and support the co-evolution of science and buildings. NIH will pursue these priorities through the proposed increase in the B&F appropriation as well as an expanded ability for Institutes and Centers (ICs) to contribute toward facilities projects. NIH proposes a revision to the Section 216 authority to eliminate the $3.5 million per project limit and add new authority to transfer IC appropriations to the B&F Account, subject to a 1 percent cap. These new flexibilities will allow NIH to take greater advantage of this important authority and use more of its B&F funds for BMAR-reducing projects.

Previous research that laid the groundwork to respond to the pandemic

Investments in basic research that generate fundamental knowledge about the nature and behavior of living systems provide the building blocks that allow us to respond effectively to new challenges. This foundational science includes basic biological, behavioral, and social research that generates the knowledge of how living systems work at the molecular, cellular, organismal, behavioral, and social levels. In pursuit of its mission, NIH invests more than half of its research budget in fundamental discovery, which provides the key for unlocking the secrets of how living systems function.[4] With this substantial level of support, NIH lays the groundwork for discoveries that will ultimately lead to improved health outcomes. In fact, a recent study found that NIH funding contributed to published research associated with every single one of the 210 new drugs approved by the U.S. Food and Drug Administration (FDA) from 2010 through 2016.[5]

[4] nexus.od.nih.gov/all/2016/03/25/nihs-commitment-to-basic-science/
[5] www.pnas.org/content/115/10/2329

From basic research to vaccines
The COVID-19 pandemic has underscored the importance of vaccines for a healthy and prosperous nation. Building on a foundation of research on molecular biology and immunology, as well as specific previous research on Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS), NIH scientists and grantees were positioned to rapidly develop COVID-19 vaccine candidates for testing in clinical trials, achieving FDA emergency use authorization in just 11 months – about five times faster than has even been achieved previously for a vaccine. The fundamental research foundations of messenger RNA technologies used in the Pfizer and Moderna COVID-19 vaccines that are currently being deployed to millions of Americans stretch back over 15 years of NIH support.

Building on existing networks to respond to the pandemic
Across the NIH, existing collaborative infrastructure was repurposed to study and respond to the emerging and ongoing pandemic. For example, at the start of the pandemic, *All of Us* was already positioned to aid researchers around the country who were interested in studying the impact of COVID-19.[6] The program's COVID-19 research initiatives included antibody serology testing participant samples, the on-going collection and expansion of electronic health record data available to researchers, and the results of the COVID-19 Participant Experience (COPE) survey in which more than 100,000 participants completed at least one survey. Meanwhile other already established networks, such as the Clinical and Translational Science Awards (CTSA) Trial Innovation Network, have been efficiently coordinating multiple clinical trials during the pandemic in partnership with the NIH Accelerating COVID-19 Therapeutic Interventions and Vaccines (ACTIV) efforts. CTSA-supported institutions are currently conducting trials testing therapeutic options for COVID-19, including the use of immunomodulators and repurposing of existing drugs already approved for other uses.

Changes in research to quickly respond to needs associated with the pandemic

The portfolio of NIH-funded research has changed in response to needs associated with the pandemic. Topics that were of high priority to the NIH before the pandemic, such as ending the opioid epidemic and developing a universal influenza vaccine, are now even more urgent. Meanwhile NIH has unfortunately added new diseases to its portfolio, including persistent symptoms after acute SARS-CoV-2 infection, known as Post-Acute Sequelae of SARS-CoV-2 Infection (PASC) or just "Long-COVID."

Addiction and Overdose Crisis
Since early in the pandemic, studies have found increases in the use of many kinds of drugs, including fentanyl, cocaine, heroin, methamphetamine, cannabis, and alcohol. The crisis of opioid misuse, addiction, and overdose in the United States is a rapidly evolving and urgent public health emergency. In 2020, there were over 90,000 drug overdose deaths in the United States.[7] More than 2 million Americans have opioid use disorder (OUD), and 10 million Americans misuse opioids. Additionally, more than 25 million Americans experience daily pain, putting them at increased risks for opioid use and misuse.[8] These staggering numbers are likely

[6] www.joinallofus.org/coronavirus
[7] www.cdc.gov/nchs/nvss/vsrr/drug-overdose-data.htm
[8] www.ncbi.nlm.nih.gov/pmc/articles/PMC6688196/pdf/collins-1536332.pdf

underestimated. They fail to capture the full extent of the damage of the opioid crisis, which reaches across every domain of family and community life — from lost productivity and economic opportunity, to intergenerational and childhood trauma, to extreme strain on community resources, including first responders, emergency rooms, hospitals, and treatment centers. In response to this crisis, NIH launched the Helping to End Addiction Long-term® Initiative, or NIH HEAL Initiative, to provide scientific solutions to the opioid crisis and offer new hope for individuals, families, and communities affected by this devastating crisis. This cross-cutting NIH effort spans basic, translational, clinical, and implementation science on opioid misuse, addiction, and pain. HEAL has funded over $2.0 billion in research, representing more than 600 research projects across the United States. These projects aim to identify new therapeutic targets for both pain and opioid use disorder, reduce the risk of opioids through nonpharmacological strategies for pain management, and improve opioid addiction treatment in a variety of settings.

Since the launch of HEAL, COVID-19 has collided with the opioid crisis in profound ways. Since the declaration of a public health emergency for COVID-19, overdoses increased 42 percent in May 2020 compared to May 2019.[9] The COVID-19 pandemic caused significant disruption to pain management and OUD/substance use disorder (SUD) treatment and recovery services. Furthermore, the rise of non-prescribed fentanyl in combination with other drugs requires new approaches to combat overdose in the United States.[10] In order to continue to respond to these evolving challenges, the FY 2023 President's Budget includes total funding of $2,620.8 million to address the opioid crisis across the ICOs, an increase of $626.6 million over the FY 2022 CR level. Opioid use is not the only alarming trend in addiction and overdose, the misuse of stimulants, such as methamphetamine, is also increasing; and deaths attributed to using these combinations are likewise increasing. Taking note of these trends, FY 2021 appropriation language expanded allowable used of HEAL funds to include research related to stimulant misuse and addiction. Identifying how opioids and stimulants interact in combination to produce increased toxicity will enhance our ability to develop medications to prevent and treat comorbid opioid and stimulant use disorders and overdoses associated with this combination of drugs. In addition to continued emphasis on the research ongoing under the HEAL Initiative, the National Institute on Drugs and Addiction (NIDA)[11] has been funding targeted research to ensure we understand how best to respond to the specific challenges that COVID-19 itself and the impact of the pandemic overall pose to substance use, addiction, and overdose.

Long COVID: REsearching COVID to Enhance Recovery (RECOVER) Initiative
Some people recover quickly and completely from SARS-CoV-2 infection. However, others endure persistent symptoms for weeks to months, sometimes called PASC or Long-COVID, and still others experience their first symptoms after a silent initial infection. The incidence of Long COVID is currently unknown, but potentially large given the number of individuals across the age spectrum who have been or will be infected. In December 2020, recognizing the urgency of this public health challenge, Congress appropriated $1.15 billion in supplemental NIH funding, available over four years, to support research into the long-term effects of SARS-CoV-2

[9] emergency.cdc.gov/han/2020/han00438.asp
[10] pubmed.ncbi.nlm.nih.gov/33031013/
[11] The FY 2023 President's Budget proposes to rename the National Institute on Drug Abuse to the National Institute on Drugs and Addiction.

infection.

In February 2021, NIH launched the RECOVER Initiative[12] to support research toward better understanding of Long COVID and effective ways to treat and even prevent it. At the heart of the initiative is a SARS-CoV-2 Recovery Cohort that includes children and adults, including pregnant women, from diverse racial and ethnic groups. This meta-cohort weaves together research efforts across the country, including population health studies that existed before the pandemic, to follow more than 20,000 individuals through in-person visits. A digital health platform will enable participation of millions more individuals through electronic health record data and mobile health technologies, such as smartphone apps and wearable devices, which will be used to gather real-world data in real time.

With these coordinated cohorts and the resulting data that will be generated from them, NIH hopes to answer critical questions about the population burden of Long COVID, its clinical spectrum, and its biological basis, including risk factors. This information, coupled with a patient-centric approach, will inform strategies to improve recovery from SARS-CoV-2 infection and to treat Long COVID among those suffering from it.

Developing A Universal Influenza Vaccine

The influenza virus remains a deadly and costly pathogen, placing a substantial health and economic burden on the United States and across the world each year. In the United States, the Centers for Disease Control and Prevention (CDC) estimates that the disease burden of influenza has resulted in between 9.2 million and 35.6 million illnesses, between 140,000 and 710,000 hospitalizations, and between 12,000 and 56,000 deaths annually since 2010, all of which results in an estimated $27 billion in health costs. Current influenza vaccination strategies rely on the development of an annual vaccine targeting the circulating strains that are anticipated to spread in the United States. NIH supports a research portfolio with the ultimate goal of developing a universal influenza vaccine to generate robust, long-lasting protection against multiple subtypes of influenza, eliminating the need to update the vaccine each year and protect against newly emerging strains with pandemic potential. NIH-funded researchers are making progress toward this goal by utilizing several novel approaches to develop vaccine candidates for clinical testing. Building upon the success of mRNA vaccines developed during the COVID-19 pandemic, NIH is working to expand this concept to the development of a universal influenza vaccine. Additionally, NIH-supported researchers are actively identifying and developing novel adjuvants for influenza vaccines to increase their immunogenicity and effectiveness. Continued investment in this research will enable the development of universal influenza vaccines to protect millions of people from infection. The FY 2023 budget request includes $260.0 million for universal influenza vaccine research, an increase of $40.0 million above the FY 2022 CR level.

The necessity for considering health disparities in research and medicine

The COVID-19 pandemic has brought into sharp focus the dramatic health disparities that exist across the American population, in number and severity of cases and in vaccination rates. These disparities highlight structural causes, some based on failures of the biomedical research

[12] www.nih.gov/about-nih/who-we-are/nih-director/statements/nih-makes-first-infrastructure-awards-support-research-post-covid-conditions

community that the NIH is actively working to identify and address. NIH continues to address disparities in health outcomes and in the biomedical workforce, both through bold new initiatives such as UNITE and through sustained focus on health disparities led by the National Institute on Minority Health and Health Disparities (NIMHD).

In March 2021, the NIH launched an effort to end structural racism and racial inequities in biomedical research through a new initiative called UNITE, which has already begun to identify short-term and long-term actions.[13] The UNITE initiative's efforts are being informed by 5 committees with experts across all 27 NIH ICs who are passionate about racial diversity, equity, and inclusion. These five committees are:

- Understanding stakeholder experiences through listening and learning
- New research on health disparities/minority health/health inequity
- Improving the NIH culture and structure for equity, inclusion, and excellence
- Transparency, communication, and accountability with NIH's internal and external stakeholders
- Extramural research ecosystem and changing policy, culture, and structure to promote workforce diversity

UNITE aims to establish an equitable and civil culture within the biomedical research enterprise and reduce barriers to racial equity in the biomedical research workforce. To reach this goal, UNITE is facilitating research to identify opportunities, make recommendations, and develop and implement strategies to increase inclusivity and diversity in science. These efforts will bolster the NIH's effort to continue to strive for diversity within the scientific workforce and racial equity on the NIH campus and within the extramural community.

The work of the UNITE initiative builds upon and complements the advances in health disparities research spearheaded by NIMHD. NIMHD is leading the advancement of the science of minority health and health disparities in several ways, such as by redefining minority health and health disparities research; developing a research framework that underscores the key health determinants, levels of influence, and domains of influence researchers should consider in conducting research on minority health and health disparities; and developing methods and measurements for minority health and health disparities research. The "NIH Minority Health and Health Disparities Strategic Plan (2021-2025)"[14] was developed by NIMHD, in collaboration with other NIH ICs, and outlines the agency's research, research-sustaining activities, and outreach priorities and goals for minority health and health disparities. The FY 2023 President's Budget request includes an increase of $400.0 million above the FY 2022 CR level to enhance the health disparity research agenda at NIMHD and other ICs.

One particular area of health disparities of ongoing NIH focus is maternal mortality and morbidity. In response to rising maternal mortality (MM) in the United States, the initiative known as IMPROVE (Implementing a Maternal health and PREgnancy Outcomes Vision for Everyone) will support research on how to mitigate preventable MM, decrease severe maternal morbidity (SMM), and promote health equity in the United States. The initiative invests in

[13] www.nih.gov/ending-structural-racism
[14] www.nimhd.nih.gov/about/strategic-plan/

studies to promote an integrated understanding of biological, behavioral, sociocultural, and structural factors that contribute to maternal morbidity and mortality and engages communities in the development of solutions to address the needs of pregnant and postpartum individuals. The research projects will incorporate local community needs and perspectives to expand and complement existing research efforts by developing, implementing, and evaluating community-tailored interventions to address health disparities in SMM/MM, as well as investigate biological, behavioral, sociocultural, and structural risk factors and mechanisms of the leading causes of SMM/MM. Through this multidimensional strategy, IMPROVE aims to build an evidence-based approach to reducing SMM/MM and its associated health disparities. In FY 2020 and 2021, the NIH awarded over $20 million to support 58 projects via IMPROVE. One cross-cutting NIH IMPROVE funding opportunity was announced in FY 2021 to identify biological, behavioral, sociocultural, and structural factors that contribute to disparities in maternal health. The initiative also encourages researchers to investigate the potential effects of emerging infections, such as SARS-CoV-2. The FY 2023 President's Budget request for IMPROVE is $30.0 million. In addition, the request includes $3.0 million for National Institute for Child Health and Human Development (NICHD) to support research on mitigating the effects of COVID-19 on pregnancies, lactation, and postpartum health with a focus on individuals from racial and ethnic minority groups.

A diverse biomedical workforce is critical to address health disparities.[15] Scientific workforce diversity drives biomedical innovation, facilitates translation of advances to enhance health, and prepares scientists and healthcare professionals to better serve an increasingly diverse U.S. population. Therefore, it is a priority at the NIH to create a scientific workforce that reflects the diversity of our nation and the populations the agency serves. Collaborations across the NIH are allowing the creation of new opportunities for future scholars and current researchers to advance their careers in health disparities research and transition into competitive research investigators. In one example, within the new UNITE initiative, the E committee aims to evaluate NIH extramural policies and processes to identify and change practices and structures that perpetuate a lack of inclusivity and diversity. Meanwhile, the Faculty Institutional Recruitment for Sustainable Transformation (FIRST) program is one of many other efforts at NIH to increase biomedical workforce diversity. The FIRST program aims to establish a more inclusive and diverse biomedical research workforce through support of cluster hiring and institutional culture change efforts. The transformational impact of building and sustaining a culture of diversity and inclusive excellence will be beneficial to the institutions and the biomedical research community more broadly. The FY 2023 President's Budget includes an increase of $16.0 million above the FY 2022 CR level for the Chief Officer for Scientific Workforce Diversity (COSWD) to enhance NIH's effort to diversify the national scientific workforce and expand recruitment and retention.

Research topics that need additional focus

In addition to maternal mortality and morbidity, there are other research topics of new or renewed focus at NIH that intersect with health disparities or that have been brought into focus during the COVID-19 pandemic. In particular, NIH is directing increased attention towards mental health, the health effects of climate change, nutrition, and firearms.

[15] www.pnas.org/content/112/40/12240

Mental Health

Mental illnesses are the fifth leading cause of disability in the United States, accounting for 6.6 percent of all disability-adjusted life years in 2019.[16] The NIH supports research on many facets of mental health including research on rapid interventions to reduce severe suicide risk, funding adaptive interventions to optimize adolescent mental health treatments, and aggregating data to address mental health disparities research gaps. In response to the pandemic, the NIH launched a project to support research focused on the social, behavioral, and economic impacts of COVID-19, which supports research on the secondary effects of the pandemic, such as financial hardship, reduced access to health care, and school closures.[17] The FY 2023 President's Budget requests $2,210.8 million for the National Institute of Mental Health (NIMH), an increase of $107.1 million from the FY 2022 CR level. The increase for NIMH includes targeted increases of $25.0 million to expand research on the impact of the COVID-19 pandemic on mental health, $5.0 million to undertake studies of the impact of social media on mental health, and $5.0 million to inform mental health treatment approaches, service delivery, and system transformation in support of the Administration's mental health initiatives.

Climate Change

As the climate continues to change, the risks to human health will grow, exacerbating existing health threats and creating new public health challenges. Global climate change is already directly and indirectly affecting human health in the United States and around the world. Impacts occur through changes to climate systems such as temperature, air and water quality, and extreme weather events, as well as through changes to the geography and timing of exposures. Climate change contributes to or exacerbates a wide range of health impacts, including non-communicable disease, injury and trauma, and infectious diseases. Although climate change affects everyone, certain populations are especially vulnerable to various impacts due to social determinants of health, including life stage, sex, underlying health status, access to health care, education, and economic, racial, and ethnically driven disparities. In this way, the climate change and health agenda is inextricably linked to health equity. Climate change impacts are the concern of NIH as a whole and are often at the intersection of multiple ICs. For this reason, NIH is developing an 'all of NIH' approach to building a solutions-driven climate change and health strategic framework that will build on past research investments. The NIH strategic framework will seek to understand the health impacts and factors that contribute to individual and community susceptibility, strengthen capacity for needed research and the development of a transdisciplinary workforce, and promote community-engaged research, translation, and dissemination to maximize efforts and outcomes among the United States and global communities most urgently affected. The FY 2023 President's Budget request includes a $100.0 million increase above the FY 2022 CR level for research on the human health impacts of climate change.

Transforming Nutrition Science

To reflect the priority NIH places on innovative, multidisciplinary nutrition research, in FY 2021, the NIH Director moved the Office of Nutrition Research (ONR) to the NIH Office of the Director (OD). As part of ONR's role in planning, coordinating, and tracking progress toward achieving the objectives of the 2020-2030 Strategic Plan for NIH Nutrition Research, seven

[16] Institute of Health Metrics and Evaluation. ghdx.healthdata.org/gbd-results-tool accessed October 2021.
[17] covid19.nih.gov/news-and-stories/covid19-ripple-effects

topic-based, NIH-wide Implementation Working Groups have been created to develop specific initiatives, improve coordination, and broaden cross-cutting NIH subject matter expertise in nutrition research. ONR and these groups will lead the implementation of the Strategic Plan, completed by the Nutrition Research Task Force last year. The FY 2023 President's Budget request is $97.2 million, an increase of $96.0 million over the FY 2022 CR level, for the OD to support the objectives of the Strategic Plan.

Dedicated funding is critical to ensure that the Office of Nutrition Research can operate effectively as a cross-cutting NIH entity and to accomplish the goals of the plan. Part of the funding will enable ONR to support large, time-limited, goal-driven projects of cross-cutting NIH interest developed in collaboration with the ICs that already fund nutrition research.

One new collaborative project is the Reducing Nutrition Health Disparities through Food Insecurity and Neighborhood Food Environment Research. This research will use precision regional implementation science and pragmatic research approaches to test strategies ensuring food security and access to healthy food to prevent disparities in a variety of diet-related diseases and conditions, such as cardiovascular disease, obesity, diabetes, and cancer. Elucidating the role of these social conditions on diet and nutritional status could help address and prevent diet-related health disparities and promote health equity.

Nutrition science research will also complement the Artificial Intelligence (AI) for Chronic Disease initiative, given that most chronic diseases are diet-related. The complexity of human nutrition demands that cutting-edge data science and system science methods be employed to move this field into the 21st century. Some of the funds requested will support new training programs in AI for Precision Nutrition that will focus on integration of the domains of precision nutrition, AI including machine learning, systems biology, systems science, Big Data, and computational analytics. The goal is to build a future workforce that will be able to use growing data resources to tackle complex biomedical challenges in nutrition science that are beyond human intuition.

Firearms Research

Violence is a widespread public health problem that has profound impacts on lifelong health, opportunity, and well-being. Violence results in higher risk of developing physical and mental conditions and for experiencing societal challenges. When firearms are involved with violent events, the risk for injury and mortality and acute or chronic physical, mental, and behavioral health conditions increases. In 2019, there were 39,707 firearm-related deaths in the United States. Six out of every 10 deaths were firearm suicides, and more than 3 out of every 10 were firearm homicides.[18] NIH is committed to supporting scientific research to understand and prevent firearm violence injury and mortality through public health interventions. In 2021, the NIH funded a range of types of firearm violence prevention such as suicide, intimate partner violence, and youth violence. Projects are also diverse in their inclusion of populations ranging from youth to older adults, Alaska Native populations, men and women, and those who are firearm owners or not. The FY 2023 request for firearm research is $25.0 million, $12.5 million above the FY 2022 CR level.

[18] www.cdc.gov/violenceprevention/firearms/fastfact.html

Measuring Sex, Gender Identity, and Sexual Orientation
The NIH recognizes the significant health disparities that continue to exist within sexual and gender minority (SGM) populations and remains committed to ensuring that these populations are included and represented in research across the NIH. Since its establishment in 2015, the Sexual & Gender Minority Research Office (SGMRO) together with NIH as a whole have made significant progress in developing initiatives and increasing research activities to benefit SGM populations. Though much progress has been made, there is still much more work to do in ensuring equitable representation and inclusion of SGM populations in research. Building on the significant progress since the inception of SGMRO and an ongoing National Academies of Sciences Engineering and Medicine (NASEM) consensus study on Measuring Sex, Gender Identity, and Sexual Orientation,[19] $2.0 million will be provided within the Office of the Director to support the establishment of the Center for Sexual Orientation and Gender Identity (SOGI) Research. The goal of the Center will be to disseminate best practices in SOGI data collection to be distributed on a government-wide basis.

Lessons learned – new ways of conducting research, new research mechanisms, workplace flexibilities that may enhance the ability to conduct research

In addressing the COVID-19 pandemic, NIH established public-private partnerships to develop and test vaccines, diagnostics, and therapeutics in record time, all while extending flexibilities to NIH grantees and employees. The biomedical research ecosystem has endured and overcome challenges that were unimaginable just two years ago. NIH is taking these lessons about what and how research can be done into account as the agencies look towards the future.

Advanced Research Projects Agency for Health (ARPA-H)
ARPA-H will be a key component to drive transformational innovation in health research. Modeled after the Defense Advanced Research Projects Agency (DARPA), ARPA-H will recruit visionary term-limited program managers who can identify and fund traditional and non-traditional partners to take on critical challenges that are unlikely to move forward quickly without this catalytic assistance. ARPA-H will leverage novel public-private partnerships, use directive approaches that will provide quick funding decisions to support projects that are results-driven and time-limited, and identify emergent opportunities through advanced systematic horizon scans of academic and industry efforts. Potential areas of transformative research driven by ARPA-H include development and implementation of accurate, wearable, ambulatory blood pressure technology, preparation of mRNA vaccines against common forms of cancer, or accelerating development of efficient gene/drug delivery systems to target any organ, tissue, or cell type – a zip code for the human body. Opportunities or obstacles identified by the Cancer Moonshot may become candidates for the new approach to transformational change offered by ARPA-H. The President's Budget request for ARPA-H for FY 2023 is $5.0 billion. As ARPA-H will be in the phase of rapid launch and expansion, having the FY 2023 funding available over a three-year period will be critical.

ARPA-H projects should be bounded in time, typically a few years with longer periods allowed for efforts that are highly complex. ARPA-H should expect that a significant fraction of its

[19] www.nationalacademies.org/our-work/measuring-sex-gender-identity-and-sexual-orientation-for-the-national-institutes-of-health

efforts will fail; if not, the organization is being too risk-averse. The best approach is to fail early in the process, by addressing key risks upfront. To determine which risks should be taken and to evaluate proposed programs and projects, ARPA-H should adopt an approach similar to DARPA's "Heilmeier Catechism,[20]" a set of principles that assesses the challenge, approach, relevance, risk, duration, and metrics of success.

The ARPA-H director should have substantial authority to act. To keep the entity vibrant, the director will serve a single term of five years. For ARPA-H to accomplish its goals, it will need to be provided by Congress with certain authorities parallel to those provided to DARPA, including the authority to recruit, attract with competitive pay, and quickly hire for a set term extraordinary Program Managers. Unlike DARPA's focus on a single customer, ARPA-H will need to create breakthrough innovations that serve an entire ecosystem and all populations. ARPA-H should have a senior leader responsible for ensuring issues of equity are considered in all aspects of ARPA-H's work—from scientific program development to staff recruitment and hiring.

Within the Department of Health and Human Services, it will be important for ARPA-H to collaborate with other key agencies—CDC, FDA, the Centers for Medicare and Medicaid Services, the Biomedical Advanced Research and Development Authority/Office of the Assistant Secretary for Preparedness and Response (BARDA/ASPR), the Office of Minority Health, the Administration for Community Living, the Agency for Healthcare Research and Quality, and the Health Resources and Service Administration (HRSA)—to identify critical needs and opportunities and to partner on complex projects that interact, for example, with public health infrastructure or medical regulation. DARPA should also play a role in advising ARPA-H on its experiences in driving breakthrough innovation and collaborating on specific projects of shared interest. In addition, it would be valuable to engage science-based agencies and departments, such as the National Science Foundation, the National Institute of Standards and Technology, and the Department of Energy.

It will be critical for ARPA-H to engage with the broader biomedical community, including patients and their care-givers, researchers, industry, community groups, and others, to understand the full range of problems and the practical considerations that need to be addressed for all groups and populations.

Workplace flexibilities

NIH and the biomedical research community continue to meet the challenges of developing safe and effective therapeutic treatments and vaccines, accurate and reliable testing technologies, and behavioral and community prevention practices in response to the COVID-19 pandemic. The community must also grapple with the unprecedented impacts and massive disruption to the research enterprise that the pandemic has created. Many NIH-supported research projects across the Nation ground to a halt as universities and other research institutions suspended operations during the height of pandemic-related lockdowns. In some instances, this has resulted in the loss of critical biological resources that will have to be recreated. Similarly, the research workforce, particularly early-career scientists, faces significant challenges as the opportunity to generate and collect data has been disrupted.

[20] www.darpa.mil/work-with-us/heilmeier-catechism

The COVID-19 pandemic, along with extensive mitigation measures, has adversely affected progress in many biomedical research settings. Evidence from multiple sources, including a survey NIH issued to its extramural research workforce, indicates legitimate concerns about career trajectory for early-career scientists. Therefore, within existing constraints of available funding, NIH plans to offer extra support to early-career scientists whose career trajectories have been significantly affected by the pandemic.[21] NIH is providing an opportunity for recipients of NIH Fellowship and NIH Career Development awards who have been affected by COVID-19 to request either no-cost or funded extensions. For funded extensions, grantee requests will be considered by each IC on a case-by-case basis based on grantee justification that the training or career development activities have been significantly hindered over and above lost research productivity that most individuals experienced because of COVID-19 related shutdowns, as well as availability of funds.

Advances in dissemination and implementation research and strategies

The past year has highlighted the need for clear and consistent communication about both why science is important and how the scientific process works. NIH has been working in many ways to better communicate with the public through mechanisms such as the Vaccine Hesitancy Initiative and Ending the HIV Epidemic. It is also vital that scientists share and make broadly available the results from publicly funded biomedical research. Through a new policy to establish expectations for NIH-funded researchers around responsible data management and sharing, NIH is further catalyzing the scientific process to accelerate revolutionary discoveries and medical breakthroughs.

Vaccine Hesitancy Initiative
NIH launched the Vaccine Hesitancy Initiative in December 2020 to support research strategies and interventions to address vaccine hesitancy, uptake, and implementation among populations who experience health disparities in the United States.[22] Research is needed to understand and address misinformation, distrust, and hesitancy regarding vaccines (e.g., SARS-CoV-2, pneumococcal, influenza, hepatitis B, human papilloma virus (HPV), and herpes zoster) among adults in the United States and territories. The initiative targets populations at increased risk for morbidity and mortality due to long-standing systemic health and social inequities and chronic medical conditions. NIH solicited community-engaged research to evaluate intervention strategies to facilitate vaccination uptake in clinical and community contexts; and address the barriers to increasing reach, access, and uptake of vaccinations among health disparity populations at high risk and likely to experience vaccine hesitancy.

The Community Engagement Alliance (CEAL) Against COVID-19 Disparities works closely with the communities hit hardest by COVID-19.[23] The CEAL research teams focus on COVID-19 awareness and education research, especially among African Americans, Hispanics/Latinos, and American Indians —populations that account for over half of all reported cases in the United States. They also promote and facilitate the inclusion and participation of these groups in

[21] grants.nih.gov/grants/guide/notice-files/not-od-21-052.html
[22] grants.nih.gov/grants/guide/notice-files/NOT-MD-21-008.html
[23] www.nhlbi.nih.gov/news/2020/COVID-19-nih-funds-community-engagement-research-efforts-areas-hardest-hit

vaccine and therapeutic clinical trials to prevent and treat the disease. The FY 2023 President's Budget request includes an increase of $70.0 million above the FY 2022 CR level for CEAL and other COVID-related research initiatives in other ICs, including NIMH, to expand research on the pandemic impacts on mental health, and NICHD, to fund research on COVID effects on pediatric health. In addition, as mentioned above, $3.0 million for NICHD is requested to support research on mitigating the effects of COVID-19 on pregnancies, lactation, and postpartum health with a focus on individuals from racial and ethnic minority groups.

Ending the HIV Epidemic (EHE)

HIV disproportionately affects populations and geographic areas throughout the United States. In 2016 and 2017, 50 percent of newly diagnosed HIV infections in the United States occurred in 48 counties, some territories, as well as 7 states which have a significant and disproportionate occurrence of HIV in rural areas. The EHE initiative aims to reduce new HIV infections in the United States by 75 percent by 2025 and to end the HIV epidemic by 2030. As part of the initial EHE response, the NIH Centers for AIDS Research (CFARs) and the HIV/AIDS Research Centers (ARCs) built on existing relationships with local health authorities, community-based groups, and other HHS agencies involved in the EHE initiative, including the CDC and the HRSA.[24] With these partners, researchers have identified and evaluated strategies to diagnose new cases of HIV, help connect people living with HIV or at risk of HIV acquisition with medical care and HIV prevention services, and ensure they continue to receive care to treat or prevent HIV. These locally focused activities have used proven HIV treatment and prevention tools including antiretroviral therapy that suppresses HIV to undetectable levels, which benefits people living with HIV and prevents sexual transmission of the virus to others (Undetectable=Untransmittable); pre-exposure prophylaxis (PrEP), a single pill that can reduce the risk of acquiring HIV by more than 95 percent when taken daily; and emergency post-exposure prophylaxis (PEP), which can prevent HIV infection if begun within three days of exposure and taken for an additional 28 days. As the original halfway point of this initiative approaches, it is clear that an expanded, diversified response is required to reach communities and populations that continue to be disproportionately affected by HIV. The NIH includes 27 national institutes, centers and offices with expertise to reach these populations with renewed efforts; this multi-institute response is centrally coordinated within the office of the NIH Director. The President's Budget includes a $10.0 million increase above the FY 2022 CR level to expand implementation research activities conducted by CFARs and ARCs.

The next steps in NIH's EHE response will include multiple synergistic and coordinated efforts that draw on lessons learned from past and ongoing CFAR and ARC projects, the perceived gaps in research infrastructure and workforce needs in many EHE and high HIV-burden jurisdictions, and a recognition of the persistent racial inequities in health access to HIV prevention and treatment services. Moving forward, NIH is keen to support novel research and study designs that are flexible and nimble in responding and addressing shifts in the HIV epidemic as they develop; those that incorporate new, innovative, and readily deployable technology resources; and those that intentionally include demographically diverse populations. Information dissemination and implementation science research studies are equally critical and will be prominent focus areas for NIH moving forward. Further, NIH is committed to increasing research capacity and developing a sustainable and diverse HIV research workforce, not just in

[24] www.nih.gov/news-events/news-releases/nih-bolsters-funding-hiv-implementation-research-high-burden-us-areas

EHE jurisdictions but beyond, to ensure that 2025 EHE targets are met. To this end, the inclusion of minority serving institutions and diverse investigators will be pursued. Strategies demonstrated to be implementable at additional, larger scale research locations will be shared as best practices to inform efforts in high HIV-burden jurisdictions.

Final NIH Policy for Data Management and Sharing
The novel coronavirus pandemic has highlighted the importance of making research data broadly accessible. But even as the world struggles with this acute global crisis, it is important to note that we are at an extraordinary time in biomedical science, where new technologies, data science, and understanding of fundamental biology are converging to accelerate the pace of discovery and medical advancement. Released October 2020, the Final NIH Policy for Data Management and Sharing represents the agency's continued commitment to share and make broadly available the results of publicly funded biomedical research.[25] Responsible data management and sharing is good for science; it maximizes availability of data to the best and brightest minds, underlies reproducibility, honors the participation of human participants by ensuring their data is both protected and fully utilized, and provides an element of transparency to ensure public trust and accountability.

Mandatory Pandemic Preparedness Plan

The FY 2023 President's Budget includes $81.7 billion in mandatory funding, available over five years, across the Office of the Assistant Secretary for Preparedness and Response (ASPR), CDC, NIH, and FDA to support the Administration's plan to transform U.S. capabilities to prepare for and respond rapidly and effectively to future pandemics and other high-consequence biological threats. Within this total, the Budget requests $12.05 billion in mandatory funding for NIH to carry out the activities described below to advance the Administration's vision for pandemic preparedness.

Preclinical research and development of prototype vaccines and therapeutics against high profile viral families ($4.0 billion)

There are multiple virus families without an available vaccine, and many viruses within these families have the potential to cause significant human disease. Since it is not feasible to fully characterize the over 120 viruses known to cause human disease and develop medical countermeasures (MCMs), targeted selection of prototype viruses from each family offers a viable pathway to gain knowledge that may be applicable to a particular virus family. Funding will support the prototype pathogen approach of National Institute of Allergy and Infectious Diseases (NIAID) to accelerate the discovery, design and development of prototype vaccines and vaccine platforms, antiviral drugs, monoclonal antibodies (mAbs), and novel immuno-adjuvants to provide protection against prototype pathogens selected from a preliminary group of viral families of concern. Increasing fundamental knowledge and developing MCMs for the prototype virus(es) not only improves preparedness efforts for high-risk pathogens, but also provides the strategy to develop MCMs for other viruses within a viral family should an outbreak occur.

[25] www.federalregister.gov/documents/2020/10/30/2020-23674/final-nih-policy-for-data-management-and-sharing-and-supplemental-information

Through targeted basic and applied research on prototype pathogens from each viral family, a solid foundation of knowledge and candidate MCMs will enable a rapid response to the next emerging or remerging pathogen that creates a public health emergency.

This initiative will initially support foundational research to better understand and characterize prototype pathogens, with the primary goal of rapidly advancing candidate vaccines and mAbs into Phase 1 and Phase 2 clinical trials. In addition, comprehensive reagents leading to the development of antigen-specific and serological assays would also be developed as necessary tools for vaccine development. These areas of research are part of an integrated process for developing safe and effective MCMs. Foundational research includes understanding viral biology and structure, host immune responses, mechanisms of immune evasion, correlates of protection, disease pathogenesis, mechanisms of disease transmission including identification of disease vectors, and studies to develop assays and animal models.

This foundational research will be leveraged to develop vaccines and mAbs against the prototype pathogens. Antigens/immunogens will be evaluated for proof-of-concept using multiple vaccine and mAb rapid technology platforms. For lead prototype vaccines, translational activities will include evaluation of immunogenicity and efficacy in animal models to optimize dose and schedule, development of assays and reagents, identification of surrogate markers or correlates of protection, and investigational new drug (IND)-enabling safety and toxicology studies. For mAbs, translational activities will include generation of antibody clones, structure-function analyses, *in vitro* testing, efficacy testing in animal models to optimize dose and schedule, and evaluation in IND-enabling studies such as tissue cross-reactivity, pharmacokinetics, antibody half-life, and effector function analysis. This initiative will also include process development, manufacturing, and release and stability testing of the most promising MCM candidates to advance into Phase 1/2 clinical trials. In the case of an outbreak or event, strategies for developing vaccines and mAbs against prototype pathogens could then be rapidly applied to other viruses within the same viral family.

Expansion of laboratory capacity and pilot cGMP manufacturing for Phase 1/2 clinical studies ($2.35 billion)

The expansion of manufacturing infrastructure is critical to supporting the development of MCM candidates discovered through NIH's prototype vaccine, mAb, and therapeutic initiatives. The safe operation of biomedical research infrastructure is costly for many reasons including specialized ventilation, plumbing, and electrical systems that ensure the safety of research personnel and the general public. The initial aim is to invest a significant portion of the funding to address those infrastructure needs where a gap in research support exists, and that would most likely have the greatest benefit to the Federal government in preparing for and responding to future pandemics.

The ability to rapidly develop MCMs against the preliminary group of viral families of concern is dependent on the ability to manufacture, in compliance with FDA's Good Manufacturing Practice (GMP) regulations, pilot lots of prototype MCMs of consistent quality and stability. The ability to contract outside manufacturing for the development of pilot lots can be challenging, especially during a pandemic or public health emergency where the demand for services can

exceed supply. NIAID plans to double the pilot plant GMP manufacturing capacity of the Dale and Betty Bumpers Vaccine Research Center (VRC), which will significantly increase the MCM candidates to advance to early clinical testing (increasing from an average of 3-4 candidates per year to 6-8 candidates per year). The expansion process would be initiated during the first year, in parallel with increased process development and clinical testing capacities. Candidates would be advanced through the pipeline to early clinical testing in future fiscal years.

Development and clinical evaluation (through Phase 2) of vaccines and therapeutics ($2.0 billion)

Clinical evaluation is the final phase in the integrated process for developing safe and effective MCMs. Funding will support the conduct of Phase 1 and Phase 2 clinical trials in human subjects to evaluate the safety and immunogenicity of the most promising vaccine and mAb products, by leveraging the NIH's existing clinical trial networks, which have sites throughout the world.

In addition, new programs will be launched to discover and develop therapeutic MCMs through preclinical and early clinical stages, positioning them for efficacy testing. This research will include broad spectrum antivirals against circulating viruses, new modalities (*e.g.,* nanobodies/nanodrugs), and a program of drug discovery.

The National Heart, Lung, and Blood Institute (NHLBI) will support viral MCMs by developing an integrated host-tissue-directed therapeutic development and testing platform with two strategic components: a) development and testing of up to 10 host-tissue-directed countermeasures, including a range of interventions necessary to protect as well as treat certain injured critical host-organ/tissue systems (*e.g.,* cardiac, pulmonary, vascular) that determine both short-term and long-term morbidity and mortality; and b) mechanistic studies linked to the clinical trials and that provide critically important, evidence-based insights into the appropriate selection of MCMs to be tested in specific patient populations and at specific time points in viral disease progression.

Establish, expand, and/or improve large and flexible clinical trials networks and infrastructure that can be rapidly ramped up for urgent needs and to generate real-world evidence on the performance of vaccines, therapeutics, and diagnostics ($1.7 billion)

Funding will support the expansion of clinical trial infrastructure critical to responding to a pandemic. Being able to rapidly enroll participants in clinical trials from a diverse and inclusive cross section of communities is vital to that effort. Specific actions that will leverage, maintain, and expand NIH's network of domestic and international outpatient and inpatient clinical trial sites include: investing in tools to ensure site readiness and facilitate the conduct of clinical trials; building expertise and capacity in underserved communities by enhancing preparedness of clinical facilities, training and supporting clinical research staff, and conducting Phase 2 and Phase 3 clinical trials; improving IT infrastructure to integrate health systems and to integrate real-world data around use of therapeutics; and enhancing clinical laboratory infrastructure for variant surveillance and genomic sequencing capabilities. Funding will allow the hundreds of

clinical trial sites that NIAID and NHLBI have used during the COVID-19 pandemic to be maintained or stabilized as a warm base for future clinical trials.

Biosafety and biosecurity ($1.0 billion)

In the last decade, biosafety level (BSL)-3/4 laboratories have been essential to the development of MCMs in response to outbreaks caused by Ebola virus, Zika virus, and now SARS-CoV-2. The demands of the COVID-19 pandemic have stretched these labs to the limits of their capacities and response capabilities. Investments are needed to ensure that research and development for pandemic preparedness can be conducted safely and securely. Funding would be used to sustain the capabilities of BSL-3/4 laboratories with the appropriate subject matter expertise (i.e., emerging infectious diseases, specific pathogens) and/or capabilities needed for pandemic preparedness, and to construct, expand, upgrade and/or modernize aging infrastructure. This will include creating a BSL-3 and BSL-4 laboratory at the National Center for Advancing Translational Sciences (NCATS) for MCM screening and discovery, with a repository of approved and experimental clinical trial-stage MCMs for rapid response testing.

Develop innovations in early warning and affordable, accessible, and novel diagnostics, including pathogen-agnostic clinical and environmental surveillance technologies ($1.0 billion)

The RADx-Tech program for COVID-19 diagnostics development at the National Institute of Biomedical Imaging and Bioengineering (NIBIB) has provided over 1.7 billion COVID-19 tests to the U.S. as of January 2022. Critical gaps remain to be filled, requiring development of next-generation tests and technologies. Rapid antigen tests require serial use to give a reliable result and at-home molecular tests are costly. RADx-Tech will accelerate innovations in technology and manufacturing to develop affordable at-home tests with accuracy equal to lab-based polymerase chain reaction (PCR) tests. With the continued emergence of viral variants, new diagnostics must be designed that can rapidly pivot to new SARS-CoV-2 variants and new pathogens when needed. Further, RADx-Tech proposes to develop at-home tests that are easy to use for the aging population and those with disabilities, so that at-home testing is accessible to all. As COVID-19 becomes endemic, multiplex tests that can distinguish COVID-19, influenza, and other respiratory diseases will be invaluable for directing the right treatment to patients early in their infection.

There is also a continuing need to monitor and evaluate SARS-CoV-2 variants for potential impact on diagnostic test performance as well as optimize testing technologies for variant surveillance. RADx established an interagency Variant Task Force (VTF) in January 2021. To date, the VTF has brought together the extensive RADx public-private partnership with an interagency group from FDA, CDC, ASPR, and NIH. The VTF thoroughly characterized the impact of the omicron variant on performance of all marketed tests (both lab and clinical), and tests that did not detect omicron reliably were removed from the market. The VTF also developed a genotyping surveillance method that is lower cost than sequencing and gives more immediate information about the presence and spread of variants. The recent surge of omicron underscores the need for funding to maintain the VTF capability to detect and respond to future variants and pathogens.

Conclusion

The Nation's investment in NIH is born from the recognition that a healthy population is a productive and thriving population. The benefits of NIH research may be felt in the near term through development of novel health interventions and continue well into the future, as transformations in the diagnosis, prevention, and treatment of disease today become standard practice tomorrow. As just one example, thanks in large part to NIH research, survival rates for respiratory distress syndrome in newborns have improved from 5 percent in the 1960s to 95 percent currently. The infants who now survive what was once a deadly condition will live to become productive adults, potentially with children of their own and on into future generations.

NIH investments in research stimulate increased private investment. A $1.00 increase in public basic research stimulates an estimated additional $8.38 of industry R&D investment in a particular research area after 8 years.[26] In rural states, each $1.00 of NIH spending generated an average $1.80 of total economic impact. This economic activity then generates significant revenues for state and local governments, an average of $22 million per state in 2017 for applicable taxes and fees paid by businesses and employees.[27]

A healthier nation is a more productive and economically sound nation. Each permanent 1 percent reduction in cancer deaths alone has been approximated to have a value of nearly $500 billion to current and future generations of Americans. A full cure could be worth more than three times today's GDP.[28]

As the largest supporter of biomedical research in the world, with a history of catalyzing major breakthroughs over many decades, including the development of COVID-19 vaccines in record time, NIH looks forward in FY 2023 to continuing the tradition of bettering the human condition through rigorous and innovative science.

[26] sciencepolicy.colorado.edu/students/envs_5100/Toole2007.pdf
[27] www.unitedformedicalresearch.org/wp-content/uploads/2019/03/NIH-Research-Rural-States-Executive-Summary-FINAL-3.13.19.pdf
[28] ucema.edu.ar/u/je49/capital_humano/Murphy_Topel_JPE.pdf

OVERVIEW OF PERFORMANCE

The NIH mission is to seek fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life, and reduce illness and disability. Investments in basic biomedical and behavioral research make it possible to understand the causes of disease onset and progression, design preventive interventions, develop better diagnostics, and discover new treatments and cures. Realizing the benefits of fundamental biomedical discoveries depends on the translation of that knowledge into the development of new diagnostics, therapeutics, and preventive measures to improve health. Investments in translational research are leading to the identification of new targets and pathways for the development of new therapeutics.

The FY 2023 budget request reflects the Agency's longstanding commitment to invest strategically using performance-based analysis, as emphasized in the Government Performance and Results Act (GPRA) (P.L. 103-62), as amended by the GPRA Modernization Act of 2010 (P.L. 111-352). Through the continuous evaluation and strategic management of its research portfolio, NIH focuses on funding research that shows the greatest promise for improving the overall health of the American people. In addition, NIH continually seeks to identify and address high-priority scientific opportunities and emerging public health needs. By managing its research portfolio to support key research priorities, NIH ensures the most effective use of funds to achieve the greatest impact on the health and welfare of the Nation. In particular, NIH's strong peer-review process, site visits, performance monitoring, program evaluation, and performance-based contracting enable the Agency to ensure that its investments generate results for the American people.

NIH strives to achieve transparency and accountability by regularly reporting results, achievements, and the impact of its activities. NIH supports a wide spectrum of biomedical and behavioral research and engages in a full range of activities that enable research, its management, and the communication of research results. Because of this diversity and complexity, NIH uses a set of performance measures that is representative of its activities and is useful for tracking progress in achieving performance priorities. This representative approach has helped NIH to share progress of its performance priorities with HHS, the rest of the Executive Branch, the Congress, and the public.

Collectively, the NIH performance measures reflect the Agency's overall goals to: 1) advance the full continuum of biomedical research; 2) strengthen the scientific workforce and biomedical research infrastructure; 3) facilitate the communication of research findings and transfer of knowledge to other sectors for further development; and 4) enhance internal management processes, policies, and systems to support programmatic and organizational oversight. Furthermore, the measures support the Administration's goal of protecting and improving the health and well-being of the American people. They reflect NIH's ongoing efforts to address a variety of public health challenges and to further the U.S.'s biomedical research enterprise, including the need to identify effective prevention interventions for substance use disorders; support the development of diagnostic technologies and antiviral drugs to enhance pandemic preparedness; leverage health information technologies to improve minority health and reduce

health disparities; and diversify and foster the next generation of biomedical and behavioral scientists.

Performance Management

Performance management at NIH is an integrated and collaborative process to ensure that the Agency is achieving its mission to conduct and support research to improve public health. At the Agency level, the NIH Director sets priorities, monitors performance, and reviews results across the 27 Institutes and Centers (ICs) and the Office of the Director (OD). OD is the central office responsible for setting policy for NIH, and for planning, managing, and coordinating the programs and activities of all NIH components. The NIH Director provides leadership to the ICs and helps identify needs and opportunities, especially for efforts that involve multiple ICs. ICs and OD offices carry out priority setting, performance monitoring, and progress reviews, and also make adjustments based on progress achieved in their respective areas of science. In addition to the performance management processes that occur for the NIH research program, there are equivalent processes for research capacity-building programs and administrative management functions.

The NIH performance framework includes: 1) priority setting with input from key stakeholders; 2) implementation and management of activities that support priorities; 3) monitoring and assessment of progress, and identification of successes and challenges; 4) oversight by IC leadership and OD office directors in assessing overall progress toward priorities and identification of best practices, appropriate next steps, and corrective actions (as needed); 5) incorporation of regular feedback from IC and OD office leadership to enhance activities; 6) regular reviews of priorities, progress, and outcomes by the NIH Director and IC Directors; and 7) regular review of performance and priorities by external expert review groups including grant peer-review groups, Advisory Councils, and ad hoc working groups.

Qualitative and quantitative information is used to monitor progress and help to identify successes, as well as obstacles in achieving short- and long-term goals. Supporting high-performing research is a process of adapting to new developments or newly identified barriers, or shifting resources to pursue promising unanticipated results that may provide critical new information. Moreover, the impact of research may not be immediately known and may depend on additional development or on advances in other fields. Despite these challenges, NIH leadership is able to manage performance effectively by using the best available information to assess progress toward achieving priorities and making appropriate adjustments.

All scientific research carried out through NIH support is subjected to a rigorous and consistently applied review process. For example, the Extramural Research Program, which accounts for the majority of NIH-funded research, utilizes two levels of peer review. The first level, in which scientific excellence is assessed, consists of chartered scientific review groups composed of outside experts in particular scientific disciplines. The second level, in which public health relevance is assessed, is conducted by National Advisory Councils of the ICs. For the Intramural Research Program, the progress of individual scientists and their laboratories is evaluated once every four years by Boards of Scientific Counselors composed of external experts. These reviews enable ongoing assessments of all intramural labs and the accomplishments of the

scientists who contribute to them. It is through this well-honed system of peer review that NIH maintains its focus on supporting research of the highest possible quality with the greatest potential of furthering NIH's mission.

The NIH approach to performance management is undergirded by the NIH Governance Structure. That structure includes the NIH Steering Committee and standing Working Groups.[29, 30] Ad-hoc working groups are established, as needed, to address emerging issues. The premise of the structure is that shared governance, which depends on the active participation of the IC Directors with the NIH Director, will foster the collaborative identification of corporate issues and a transparent decision-making process. With active participation by the IC Directors in NIH-wide governance, NIH can maximize its perspective and expertise in the development and oversight of policies common to NIH and its ICs. Through the governance process, corporate decisions are made; these may be long-term and strategic (e.g., facilities planning, budget strategy, and research policy direction) or short-term and tactical (e.g., stipend levels, resource allocations, and compliance oversight). This process does not include issues related to the setting of scientific priorities, which is reserved for meetings of all IC Directors. The NIH Director meets with the IC Directors on a bi-weekly basis, and scientific initiatives are discussed, as well as major management issues that affect the Agency. In addition, scientists – from within and outside the Agency – are invited to present on new or emerging research opportunities. The NIH Director stays informed of priorities through regular meetings with IC and OD Office Directors. Similarly, the IC Directors monitor performance through regular meetings with the Division Directors and Scientific/Clinical Directors in their respective ICs.

Based on these reviews, leadership and their staff take appropriate actions to support research activities. For example, the reviews may lead to the development of new award programs for early-career researchers, the development of new funding announcements for promising research areas, or new collaborations across NIH and/or with other Federal and non-Federal partners. The NIH Director and senior leadership receive regular updates on the progress of the priorities, provide feedback, and incorporate the latest information into the NIH's overall planning and management efforts. This constant feedback loop enables NIH to make critical adjustments periodically to align activities and target resources in support of its research priorities.

[29] The NIH Steering Committee is composed of the NIH Director, Deputy Director (ex-officio), the Directors of the National Cancer Institute, National Heart, Lung, and Blood Institute, and National Institute of Allergy and Infectious Diseases, as well as a balance of Directors from the smaller and medium-sized institutes.
[30] The standing working groups are: Extramural Activities, Diversity, Facilities, Management and Budget, Scientific Data Council, Administrative Data Council, Data Science Policy Council, Clinical Center Governing Board, Board of Scientific Directors, and Research Services Working Group.

ALL-PURPOSE TABLE

National Institutes of Health
FY 2023 Congressional Justification

All Purpose Table
(Dollars in Thousands)

(Dollars in Thousands)[1,2]	FY 2021		FY 2022		FY 2023	
	Final[5]	**Supplemental Funding[6]**	**Continuing Resolution (CR)[7,8]**	**Supplemental Funding**	**President's Budget[7]**	**FY 2023 +/- FY 2022 CR**
Total, NIH Program Level	**$42,812,323**	**$1,250,000**	**$42,918,641**	**$0**	**$62,502,703**	**$19,584,062**
Less mandatory and funds allocated from different sources:						
PHS Program Evaluation	1,271,505		1,271,505		1,271,505	0
Mandatory Type 1 Diabetes Research[3]	150,000		141,450		141,450	0
Mandatory pandemic preparedness	0		0		12,050,000	12,050,000
Total, NIH Discretionary Budget Authority	**$41,390,818**	**$1,250,000**	**$41,505,686**	**$0**	**$49,039,748**	**$7,534,062**
Interior Budget Authority	81,500		81,500		83,035	1,535
Total, NIH Labor/HHS Budget Authority	**$41,309,318**	**$1,250,000**	**$41,424,186**	**$0**	**$48,956,713**	**$7,532,527**
Number of Competing RPGs	*11,258*		*9,806*		*11,878*	*2,072*
Total Number of RPGs	*41,613*		*41,145*		*43,129*	*1,984*
FTE[4]	*18,412*		*19,679*		*20,306*	*627*

[1] Numbers may not add due to rounding.
[2] Includes 21st Century Cures Act funding.
[3] Amounts in FY 2022 and FY 2023 reflect a reduction of $8.550 million for Budget Control Act sequestration.
[4] Includes 4 NIH FTEs funded by PHS trust funds in FY 2021 through FY 2023.
[5] Reduced by a transfer of $5.0 million from OD to the HHS Office of Inspector General and a Secretary's Transfer of $123.177 million.
[6] Reflects funding appropriated in P.L. 116-260.
[7] Reduced by a transfer of $5.0 million from OD to the HHS Office of Inspector General.
[8] Reflects the annualized amounts provided in the continuing resolution ending 3/11/2022.

IMPACT OF BUDGET LEVEL ON PERFORMANCE

Programs and Measures (Dollars in Millions, except where noted)	**FY 2022 CR**[1]	**FY 2023 President's Budget**	**FY 2023 +/- FY 2022**
Research Project Grants	$24,185.206	$25,932.792	7.2%
Competing Average Cost (in thousands)	$571.465	$572.862	0.2%
Number of Competing Awards (whole number)	9,806	11,878	21.1%
Estimated Competing RPG Success Rate	16.9%	19.8%	17.2%
Research Centers	$2,774.182	$2,805.697	1.1%
Other Research	$2,880.055	$2,915.942	1.2%
Training	$983.585	$1,032.679	5.0%
Research & Development Contracts	$3,420.727	$3,568.852	4.3%
Intramural Research	$4,638.391	$4,763.453	2.7%
Research Management and Support	$2,145.807	$2,255.892	5.1%
Common Fund (non-add)	*$640.230*	*$658.539*	*2.9%*
Advanced Research Projects Agency for Health	$0.000	$5,000.000	NA
Pandemic Preparedness	$0.000	$12,050.000	NA
Buildings & Facilities Appropriation	$200.000	$300.000	50.0%
Other Mechanisms[2,3]	$1,690.686	$1,877.396	11.0%
Total, Program Level[4]	**$42,918.641**	**$62,502.703**	**45.6%**

[1] Reflects the annualized amounts provided in the continuing resolution ending 3/11/2022.

[2] Includes Office of the Director-Other, Buildings and Facilities funding in the National Cancer Institute, and Superfund Research activities funded from the Interior appropriations bill.

[3] Amounts reflect directive transfer of $5.0 million to the HHS Office of Inspector General.

[4] Includes discretionary budget authority received from Labor/HHS appropriations bill and the Interior appropriations bill (Superfund). Also includes program evaluation financing and mandatory budget authority derived from the Type 1 Diabetes account and the Pandemic Preparedness Program.

APPROPRIATIONS LANGUAGE

NATIONAL CANCER INSTITUTE

For carrying out section 301 and title IV of the PHS Act with respect to cancer, $6,497,851,000, of which up to $30,000,000 may be used for facilities repairs and improvements at the National Cancer Institute—Frederick Federally Funded Research and Development Center in Frederick, Maryland.

NATIONAL HEART, LUNG, AND BLOOD INSTITUTE

For carrying out section 301 and title IV of the PHS Act with respect to cardiovascular, lung, and blood diseases, and blood and blood products, $3,822,961,000.

NATIONAL INSTITUTE OF DENTAL AND CRANIOFACIAL RESEARCH

For carrying out section 301 and title IV of the PHS Act with respect to dental and craniofacial diseases, $513,191,000.

NATIONAL INSTITUTE OF DIABETES AND DIGESTIVE AND KIDNEY DISEASES

For carrying out section 301 and title IV of the PHS Act with respect to diabetes and digestive and kidney disease, $2,206,080,000.

NATIONAL INSTITUTE OF NEUROLOGICAL DISORDERS AND STROKE

For carrying out section 301 and title IV of the PHS Act with respect to neurological disorders and stroke, $2,543,043,000.

NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES

For carrying out section 301 and title IV of the PHS Act with respect to allergy and infectious diseases, $6,268,313,000.

NATIONAL INSTITUTE OF GENERAL MEDICAL SCIENCES

For carrying out section 301 and title IV of the PHS Act with respect to general medical sciences, $3,097,557,000, of which $1,271,505,000 shall be from funds available under section 241 of the PHS Act: Provided, That not less than $410,644,000 is provided for the Institutional Development Awards program.

EUNICE KENNEDY SHRIVER NATIONAL INSTITUTE OF CHILD HEALTH AND HUMAN DEVELOPMENT

For carrying out section 301 and title IV of the PHS Act with respect to child health and human development, $1,674,941,000.

NATIONAL EYE INSTITUTE

For carrying out section 301 and title IV of the PHS Act with respect to eye diseases and visual disorders, $853,355,000.

NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES

For carrying out section 301 and title IV of the PHS Act with respect to environmental health sciences, $932,056,000.

NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES

For necessary expenses for the National Institute of Environmental Health Sciences in carrying out activities set forth in section 311(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9660(a)) and section 126(g) of the Superfund Amendments and Reauthorization Act of 1986, $83,035,000.

NATIONAL INSTITUTE ON AGING

For carrying out section 301 and title IV of the PHS Act with respect to aging, $4,011,413,000.

NATIONAL INSTITUTE OF ARTHRITIS AND MUSCULOSKELETAL AND SKIN DISEASES

For carrying out section 301 and title IV of the PHS Act with respect to arthritis and musculoskeletal and skin diseases, $676,254,000.

NATIONAL INSTITUTE ON DEAFNESS AND OTHER COMMUNICATION DISORDERS

For carrying out section 301 and title IV of the PHS Act with respect to deafness and other communication disorders, $508,704,000.

NATIONAL INSTITUTE OF NURSING RESEARCH

For carrying out section 301 and title IV of the PHS Act with respect to nursing research, $198,670,000.

NATIONAL INSTITUTE ON ALCOHOL EFFECTS AND ALCOHOL-ASSOCIATED DISORDERS

For carrying out section 301 and title IV of the PHS Act with respect to alcohol misuse, alcohol use disorder, and other alcohol-associated disorders, $566,725,000.

NATIONAL INSTITUTE ON DRUGS AND ADDICTION

For carrying out section 301 and title IV of the PHS Act with respect to drugs and addiction, $1,843,326,000.

NATIONAL INSTITUTE OF MENTAL HEALTH

For carrying out section 301 and title IV of the PHS Act with respect to mental health, $1,985,828,000.

NATIONAL HUMAN GENOME RESEARCH INSTITUTE

For carrying out section 301 and title IV of the PHS Act with respect to human genome research, $629,154,000.

NATIONAL INSTITUTE OF BIOMEDICAL IMAGING AND BIOENGINEERING

For carrying out section 301 and title IV of the PHS Act with respect to biomedical imaging and bioengineering research, $419,493,000.

NATIONAL CENTER FOR COMPLEMENTARY AND INTEGRATIVE HEALTH

For carrying out section 301 and title IV of the PHS Act with respect to complementary and integrative health, $183,368,000.

NATIONAL INSTITUTE ON MINORITY HEALTH AND HEALTH DISPARITIES

For carrying out section 301 and title IV of the PHS Act with respect to minority health and health disparities research, $659,817,000.

JOHN E. FOGARTY INTERNATIONAL CENTER

For carrying out the activities of the John E. Fogarty International Center (described in subpart 2 of part E of title IV of the PHS Act), $95,801,000.

NATIONAL LIBRARY OF MEDICINE

For carrying out section 301 and title IV of the PHS Act with respect to health information communications, $471,998,000: Provided, That of the amounts available for improvement of information systems, $4,000,000 shall be available until September 30, 2024: Provided further, That in fiscal year 2023, the National Library of Medicine may enter into personal services contracts for the provision of services in facilities owned, operated, or constructed under the jurisdiction of the National Institutes of Health (referred to in this title as "NIH").

NATIONAL CENTER FOR ADVANCING TRANSLATIONAL SCIENCES

For carrying out section 301 and title IV of the PHS Act with respect to translational sciences, $873,654,000: Provided, That up to $90,000,000 shall be available to implement section 480 of the PHS Act, relating to the Cures Acceleration Network: Provided further, That at least $599,349,000 is provided to the Clinical and Translational Sciences Awards program.

OFFICE OF THE DIRECTOR

(INCLUDING TRANSFER OF FUNDS)

For carrying out the responsibilities of the Office of the Director, NIH, $2,302,065,000: Provided, That funding shall be available for the purchase of not to exceed 29 passenger motor vehicles for replacement only: Provided further, That all funds credited to the NIH Management Fund shall remain available for one fiscal year after the fiscal year in which they are deposited: Provided further, That $645,939,000 shall be available for the Common Fund established under section 402A(c)(1) of the PHS Act: Provided further, That of the funds provided, $10,000 shall be for official reception and representation expenses when specifically approved by the Director of the NIH: Provided further, That the Office of AIDS Research within the Office of the Director of the NIH may spend up to $8,000,000 to make grants for construction or renovation of facilities as provided for in section 2354(a)(5)(B) of the PHS Act: Provided further, That up to $30,000,000 shall be used to carry out section 404I of the PHS Act (42 U.S.C. 283k) with respect to the National Primate Research Centers and Caribbean Primate Research Center: Provided further, That $5,000,000 shall be transferred to and merged with the appropriation for the "Office of Inspector General" for oversight of grant programs and operations of the NIH, including agency efforts to ensure the integrity of its grant application evaluation and selection processes, and shall be in addition to funds otherwise made available for oversight of the NIH: Provided further, That the funds provided in the previous proviso may be transferred from one specified activity to another with 15 days prior notification to the Committees on Appropriations of the House of Representatives and the Senate: Provided further, That the Inspector General shall consult with the Committees on Appropriations of the House of Representatives and the Senate before submitting to the Committees an audit plan for fiscal years 2023 and 2024 no later than 30 days after the date of enactment of this Act: Provided further, That amounts available

under this heading are also available to establish, operate, and support the Research Policy Board authorized by section 2034(f) of the 21st Century Cures Act.

In addition to other funds appropriated for the Common Fund established under section 402A(c) of the PHS Act, $12,600,000 is appropriated to the Common Fund from the 10-year Pediatric Research Initiative Fund described in section 9008 of title 26, United States Code, for the purpose of carrying out section 402(b)(7)(B)(ii) of the PHS Act (relating to pediatric research), as authorized in the Gabriella Miller Kids First Research Act.

BUILDINGS AND FACILITIES

For the study of, construction of, demolition of, renovation of, and acquisition of equipment for, facilities of or used by NIH, including the acquisition of real property, $300,000,000, to remain available through September 30, 2027.

ADVANCED RESEARCH PROJECTS AGENCY FOR HEALTH

For carrying out section 301 and title IV of the PHS Act with respect to advanced research projects for health, $5,000,000,000, to remain available through September 30, 2025.

NIH INNOVATION ACCOUNT, CURES ACT

(INCLUDING TRANSFER OF FUNDS)

For necessary expenses to carry out the purposes described in section 1001(b)(4) of the 21st Century Cures Act, in addition to amounts available for such purposes in the appropriations provided to the NIH in this Act, $1,085,000,000, to remain available until expended: Provided, That such amounts are appropriated pursuant to section 1001(b)(3) of such Act, are to be

derived from amounts transferred under section 1001(b)(2)(A) of such Act, and may be transferred by the Director of the National Institutes of Health to other accounts of the National Institutes of Health solely for the purposes provided in such Act: Provided further, That upon a determination by the Director that funds transferred pursuant to the previous proviso are not necessary for the purposes provided, such amounts may be transferred back to the Account: Provided further, That the transfer authority provided under this heading is in addition to any other transfer authority provided by law.

GENERAL PROVISIONS

SEC. 214. Not to exceed 1 percent of funds appropriated by this Act to the offices, institutes, and centers of the National Institutes of Health may be transferred to and merged with funds appropriated under the heading "National Institutes of Health-Buildings and Facilities": Provided, That the use of such transferred funds shall be subject to a centralized prioritization and governance process: Provided further, That the Director of the National Institutes of Health shall notify the Committees on Appropriations of the House of Representatives and the Senate at least 15 days in advance of any such transfer: Provided further, That this transfer authority is in addition to any other transfer authority provided by law.

SEC. 240. (a) The Public Health Service Act (42 U.S.C. 201 et seq.), the Controlled Substances Act (21 U.S.C. 801 et seq.), the Comprehensive Smoking Education Act (15 U.S.C. 1331 et seq.), the Comprehensive Addiction and Recovery Act of 2016 (Public Law 114–198), the Drug Abuse Prevention, Treatment, and Rehabilitation Act (21 U.S.C. 1101 et seq.), the Omnibus Crime Control and Safe Streets Act of 1968 (34 U.S.C. 10101 et seq.), and title 5 of the United States Code are each amended—

(1) by striking "National Institute on Drug Abuse" each place it appears and inserting "National Institute on Drugs and Addiction"; and

(2) by striking "National Advisory Council on Drug Abuse" each place it appears and inserting "National Advisory Council on Drugs and Addiction".

(b) Title IV of the Public Health Service Act (42 U.S.C. 281 et seq.) is amended—

(1) in section 464H(b)(5), by striking "National Institute of Drug Abuse" and inserting "National Institute on Drugs and Addiction";

(2) in sections 464L, 464M(a), 464O, and 494A, by striking "drug abuse" each place it appears and inserting "drug use";

(3) in section 464L(a), by striking "treatment of drug abusers" and inserting "treatment of drug addiction";

(4) in section 464M(a), by striking "prevention of such abuse" and inserting "prevention of such use";

(5) in section 464N—

(A) in the section heading, by striking "DRUG ABUSE RESEARCH CENTERS" and inserting "DRUGS AND ADDICTION RESEARCH CENTERS";

(B) in subsection (a)—

(i) in matter preceding paragraph (1), by striking "National Drug Abuse Research Centers" and inserting "National Drugs and Addiction Research Centers"; and

(ii) in paragraph (1)(C), by striking "treatment of drug abuse" and inserting "treatment of drug addiction"; and

(C) in subsection (c)—

(i) by striking "DRUG ABUSE AND ADDICTION RESEARCH" and inserting "DRUGS AND ADDICTION RESEARCH CENTERS";

(ii) in paragraph (1), by striking "National Drug Abuse Treatment Clinical Trials Network" and inserting "National Drug Addiction Treatment Clinical Trials Network"; and

(iii) in paragraph (2)(H), by striking "reasons that individuals abuse drugs, or refrain from abusing drugs" and inserting "reasons that individuals use drugs or refrain from using drugs"; and

(6) in section 464P—

(A) in subsection (a)—

(i) in paragraph (1), by striking "drug abuse treatments" and inserting "drug addiction treatments"; and

(ii) in paragraph (6), by striking "treatment of drug abuse" and inserting "treatment of drug addiction"; and

(B) in subsection (d)—

(i) by striking "disease of drug abuse" and inserting "disease of drug addiction";

(ii) by striking "abused drugs" each place it appears and inserting "addictive drugs"; and

(iii) by striking "drugs of abuse" and inserting "drugs of addiction".

(c) Section 464N of the Public Health Service Act (42 U.S.C. 285o–2), as amended by subsection (b)(5), is further amended by striking "drug abuse" each place it appears and inserting "drug use".

(d) Any reference in any law, regulation, map, document, paper, or other record of the United States to the National Institute on Drug Abuse shall be considered to be a reference to the National Institute on Drugs and Addiction.

SEC. 241. (a) The Public Health Service Act (42 U.S.C. 201 et seq.) and the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment, and Rehabilitation

Act of 1970 (42 U.S.C. 4541 et seq.) are each amended—

(1) by striking "National Institute on Alcohol Abuse and Alcoholism" each place it appears and inserting "National Institute on Alcohol Effects and Alcohol-Associated Disorders"; and

(2) by striking "National Advisory Council on Alcohol Abuse and Alcoholism" each place it appears and inserting "National Advisory Council on Alcohol Effects and Alcohol-Associated Disorders".

(b) Title IV of the Public Health Service Act (42 U.S.C. 281 et seq.) is amended—

(1) in section 464H—

(A) in subsection (a)—

(i) by striking "prevention of alcohol abuse" and inserting "prevention of alcohol misuse"; and

(ii) by striking "treatment of alcoholism" and inserting "treatment of alcohol-associated disorders"; and

(B) in subsection (b)—

(i) in paragraph (3)—

(I) in subparagraph (A), by striking "alcohol abuse and domestic violence" and inserting "alcohol misuse and domestic violence";

(II) in subparagraph (D), by striking "abuse of alcohol" and inserting "misuse of alcohol";

(III) by striking subparagraph (E) and inserting "(E) the effect of social pressures, legal requirements regarding the use of alcoholic beverages, the cost of such beverages, and the economic status and education of users of such beverages on the incidence of alcohol misuse, alcohol use disorder, and other alcohol-associated disorders,"; and

(ii) in paragraph (5), by striking "impact of alcohol abuse" and inserting "impact of alcohol misuse";

(2) in sections 464H(b), 464I, and 494A, by striking "alcohol abuse and alcoholism" each place it appears and inserting "alcohol misuse, alcohol use disorder, and other alcohol-associated disorders";

(3) in sections 464H(b) and 464J(a), by striking "alcoholism and alcohol abuse" each place it appears and inserting "alcohol misuse, alcohol use disorder, and other alcohol-associated disorders"; and

(4) in section 464J(a)—

(A) by striking "alcoholism and other alcohol problems" each place it appears and inserting "alcohol misuse, alcohol use disorder, and other alcohol-associated disorders";

(B) in the matter preceding paragraph (1), by striking "interdisciplinary research related to alcoholism" and inserting "interdisciplinary research related to alcohol-associated disorders"; and

(C) in paragraph (1)(E), by striking "alcohol problems" each place it appears and inserting "alcohol misuse, alcohol use disorder, and other alcohol-associated disorders".

(c) Any reference in any law, regulation, map, document, paper, or other record of the United States to the National Institute on Alcohol Abuse and Alcoholism shall be considered to be a reference to the National Institute on Alcohol Effects and Alcohol-Associated Disorders.

LANGUAGE ANALYSIS

Language Provision to be Changed[1]	Explanation/Justification
NATIONAL INSTITUTE ON ALCOHOL EFFECTS AND ALCOHOL-ASSOCIATED DISORDERS *For carrying out section 301 and title IV of the PHS Act with respect to alcohol misuse, alcohol use disorder, and other alcohol-associated disorders, $566,725,000.*	This revision reflects the President's Budget proposal to change the name of the National Institute on Alcohol Abuse and Alcoholism to the National Institute on Alcohol Effects and Alcohol-Associated Disorders (NIAAA).
NATIONAL INSTITUTE ON DRUGS AND ADDICTION *For carrying out section 301 and title IV of the PHS Act with respect to drugs and addiction, $1,843,326,000.*	This revision reflects the President's Budget proposal to change the name of the National Institute on Drug Abuse to the National Institute on Drugs and Addiction (NIDA).
NATIONAL CENTER FOR ADVANCING TRANSLATIONAL SCIENCES *For carrying out section 301 and title IV of the PHS Act with respect to translational sciences, $873,654,000: Provided, That up to $90,000,000 shall be available to implement section 480 of the PHS Act, relating to the Cures Acceleration Network: Provided further, That at least $599,349,000 is provided to the Clinical and Translational Sciences Awards program.*	This provision removes the reference to a percentage limit for the Cures Acceleration Network (CAN) and restores a specified dollar amount consistent with prior appropriations. It also restores a specified dollar amount for the Clinical and Translational Sciences Awards program consistent with prior appropriations.
OFFICE OF THE DIRECTOR *In addition to other funds appropriated for the Common Fund established under section 402A(c) of the PHS Act, $12,600,000 is appropriated to the Common Fund from the 10-year Pediatric Research Initiative Fund described in section 9008 of title 26, United States Code, for the purpose of carrying out section 402(b)(7)(B)(ii) of the PHS Act (relating to pediatric research), as authorized in the Gabriella Miller Kids First Research Act.*	This provision specifies that the 10-Year Pediatric Research Initiative Fund will provide the full authorized $12.6 million appropriation to the Common Fund. In FY 2022, the Pediatric Fund did not have sufficient balances to support making the full appropriation, but in FY 2023, Pediatric Fund balances are expected to be sufficient.

Language Provision to be Changed[1]	Explanation/Justification
GENERAL PROVISIONS *SEC. 240. (a) The Public Health Service Act (42 U.S.C. 201 et seq.), the Controlled Substances Act (21 U.S.C. 801 et seq.), the Comprehensive Smoking Education Act (15 U.S.C. 1331 et seq.), the Comprehensive Addiction and Recovery Act of 2016 (Public Law 114–198), the Drug Abuse Prevention, Treatment, and Rehabilitation Act (21 U.S.C. 1101 et seq.), the Omnibus Crime Control and Safe Streets Act of 1968 (34 U.S.C. 10101 et seq.), and title 5 of the United States Code are each amended—* *(1) by striking "National Institute on Drug Abuse" each place it appears and inserting "National Institute on Drugs and Addiction"; and* *(2) by striking "National Advisory Council on Drug Abuse" each place it appears and inserting "National Advisory Council on Drugs and Addiction".* *(b) Title IV of the Public Health Service Act (42 U.S.C. 281 et seq.) is amended—* *(1) in section 464H(b)(5), by striking "National Institute of Drug Abuse" and inserting "National Institute on Drugs and Addiction";* *(2) in sections 464L, 464M(a), 464O, and 494A, by striking "drug abuse" each place it appears and inserting "drug use";* *(3) in section 464L(a), by striking "treatment of drug abusers" and inserting "treatment of drug addiction";* *(4) in section 464M(a), by striking "prevention of such abuse" and inserting "prevention of such use";* *(5) in section 464N—* *(A) in the section heading, by striking "DRUG ABUSE RESEARCH CENTERS" and inserting "DRUGS AND ADDICTION RESEARCH CENTERS";* *(B) in subsection (a)—* *(i) in matter preceding paragraph (1), by striking "National Drug Abuse Research*	This provision amends the Public Health Service Act to change the name of the National Institute on Drug Abuse to the National Institute on Drugs and Addiction and makes related conforming changes in other provisions of the U.S. Code.

Language Provision to be Changed[1]	Explanation/Justification
Centers" and inserting "National Drugs and Addiction Research Centers"; and *(ii) in paragraph (1)(C), by striking "treatment of drug abuse" and inserting "treatment of drug addiction"; and* *(C) in subsection (c)—* *(i) by striking "DRUG ABUSE AND ADDICTION RESEARCH" and inserting "DRUGS AND ADDICTION RESEARCH CENTERS";* *(ii) in paragraph (1), by striking "National Drug Abuse Treatment Clinical Trials Network" and inserting "National Drug Addiction Treatment Clinical Trials Network"; and* *(iii) in paragraph (2)(H), by striking "reasons that individuals abuse drugs, or refrain from abusing drugs" and inserting "reasons that individuals use drugs or refrain from using drugs"; and* *(6) in section 464P—* *(A) in subsection (a)—* *(i) in paragraph (1), by striking "drug abuse treatments" and inserting "drug addiction treatments"; and* *(ii) in paragraph (6), by striking "treatment of drug abuse" and inserting "treatment of drug addiction"; and* *(B) in subsection (d)—* *(i) by striking "disease of drug abuse" and inserting "disease of drug addiction";* *(ii) by striking "abused drugs" each place it appears and inserting "addictive drugs"; and* *(iii) by striking "drugs of abuse" and inserting "drugs of addiction".* *(c) Section 464N of the Public Health Service Act (42 U.S.C. 285o–2), as amended by subsection (b)(5), is further amended by striking "drug abuse" each place it appears and inserting "drug use".* *(d) Any reference in any law, regulation, map, document, paper, or other record of the United States to the National Institute on Drug Abuse shall be considered to be a*	

Language Provision to be Changed[1]	Explanation/Justification
reference to the National Institute on Drugs and Addiction.	
GENERAL PROVISIONS *SEC. 241. (a) The Public Health Service Act (42 U.S.C. 201 et seq.) and the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment, and Rehabilitation* *Act of 1970 (42 U.S.C. 4541 et seq.) are each amended—* *(1) by striking "National Institute on Alcohol Abuse and Alcoholism" each place it appears and inserting "National Institute on Alcohol Effects and Alcohol-Associated Disorders"; and* *(2) by striking "National Advisory Council on Alcohol Abuse and Alcoholism" each place it appears and inserting "National Advisory Council on Alcohol Effects and Alcohol-Associated Disorders".* *(b) Title IV of the Public Health Service Act (42 U.S.C. 281 et seq.) is amended—* *(1) in section 464H—* *(A) in subsection (a)—* *(i) by striking "prevention of alcohol abuse" and inserting "prevention of alcohol misuse"; and* *(ii) by striking "treatment of alcoholism" and inserting "treatment of alcohol-associated disorders"; and* *(B) in subsection (b)—* *(i) in paragraph (3)—* *(I) in subparagraph (A), by striking "alcohol abuse and domestic violence" and inserting "alcohol misuse and domestic violence";* *(II) in subparagraph (D), by striking "abuse of alcohol" and inserting "misuse of alcohol";* *(III) by striking subparagraph (E) and inserting "(E) the effect of social pressures, legal requirements regarding the use of*	This provision amends the Public Health Service Act to change the name of the National Institute on Alcohol Abuse and Alcoholism to the National Institute on Alcohol Effects and Alcohol-Associated Disorders and makes related conforming changes in other provisions of the U.S. Code.

Language Provision to be Changed[1]	Explanation/Justification
alcoholic beverages, the cost of such beverages, and the economic status and education of users of such beverages on the incidence of alcohol misuse, alcohol use disorder, and other alcohol-associated disorders,"; and *(ii) in paragraph (5), by striking "impact of alcohol abuse" and inserting "impact of alcohol misuse";* *(2) in sections 464H(b), 464I, and 494A, by striking "alcohol abuse and alcoholism" each place it appears and inserting "alcohol misuse, alcohol use disorder, and other alcohol-associated disorders";* *(3) in sections 464H(b) and 464J(a), by striking "alcoholism and alcohol abuse" each place it appears and inserting "alcohol misuse, alcohol use disorder, and other alcohol-associated disorders"; and* *(4) in section 464J(a)—* *(A) by striking "alcoholism and other alcohol problems" each place it appears and inserting "alcohol misuse, alcohol use disorder, and other alcohol-associated disorders";* *(B) in the matter preceding paragraph (1), by striking "interdisciplinary research related to alcoholism" and inserting "interdisciplinary research related to alcohol-associated disorders"; and* *(C) in paragraph (1)(E), by striking "alcohol problems" each place it appears and inserting "alcohol misuse, alcohol use disorder, and other alcohol-associated disorders".* *(c) Any reference in any law, regulation, map, document, paper, or other record of the United States to the National Institute on Alcohol Abuse and Alcoholism shall be considered to be a reference to the National Institute on Alcohol Effects and Alcohol-Associated Disorders.*	

[1] Language changes are relative to the appropriations language proposed in the FY 2022 President's Budget.

BUDGET MECHANISM TABLE

Budget Mechanism - Total[1,2,3]

(Dollars in Thousands)[1,2,3]	FY 2021 Final[8,9]		FY 2022 Continuing Resolution (CR)[9,10]		FY 2023 President's Budget[9]		FY 2023 +/- FY 2022 CR	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount
Research Projects:								
Noncompeting	28,492	$15,937,228	29,502	$17,090,998	29,301	$17,543,339	-201	$452,341
Administrative Supplements[3]	*(2,912)*	483,523	*(2,326)*	331,645	*(2,285)*	356,660	*(-41)*	25,015
Competing	11,258	$6,748,930	9,806	$5,603,786	11,878	$6,804,460	2,072	$1,200,674
Subtotal, RPGs	39,750	$23,169,681	39,308	$23,026,429	41,179	$24,704,459	1,871	$1,678,030
SBIR/STTR	1,863	1,176,827	1,837	1,158,777	1,950	1,228,333	113	69,556
Research Project Grants	41,613	$24,346,508	41,145	$24,185,206	43,129	$25,932,792	1,984	$1,747,585
Research Centers:								
Specialized/Comprehensive	1,024	$2,034,952	1,047	$2,047,849	1,122	$2,173,695	75	$125,846
Clinical Research	71	421,204	68	418,049	53	313,820	-15	-104,230
Biotechnology	61	92,492	59	89,489	60	92,791	1	3,302
Comparative Medicine	48	143,583	48	140,554	47	138,903	-1	-1,651
Research Centers in Minority Institutions	21	78,151	21	78,241	25	86,489	4	8,248
Research Centers	1,225	$2,770,381	1,243	$2,774,182	1,307	$2,805,697	64	$31,515
Other Research:								
Research Careers	4,684	$880,798	4,736	$903,266	4,851	$923,027	115	$19,762
Cancer Education	68	17,633	25	17,650	30	21,439	5	3,789
Cooperative Clinical Research	249	487,472	244	447,241	279	483,142	35	35,901
Biomedical Research Support	138	103,688	113	88,872	118	91,872	5	3,000
Minority Biomedical Research Support	282	95,012	263	82,094	137	50,957	-126	-31,137
Other	2,183	1,356,525	2,309	1,340,933	2,329	1,345,505	20	4,572
Other Research	7,604	$2,941,127	7,690	$2,880,055	7,744	$2,915,942	54	$35,887
Total Research Grants	50,442	$30,058,017	50,078	$29,839,444	52,180	$31,654,431	2,102	$1,814,987
Ruth L Kirchstein Training Awards:	FTTPs		FTTPs		FTTPs		FTTPs	
Individual Awards	4,196	$200,745	4,238	$207,387	4,264	$212,933	26	$5,546
Institutional Awards	12,792	725,697	13,570	776,198	13,845	819,746	275	43,548
Total Research Training	16,988	$926,442	17,808	$983,585	18,109	$1,032,679	301	$49,094
Research & Develop. Contracts	2,427	$3,355,475	2,450	$3,420,727	2,576	$3,568,852	126	$148,125
(SBIR/STTR) (non-add)[3]	*(103)*	*(60,525)*	*(102)*	*(58,412)*	*(101)*	*(62,482)*	*(-1)*	*(4,070)*
Intramural Research		$4,538,642		$4,638,391		$4,763,453		$125,062
Res. Management & Support		2,049,666		2,145,807		2,255,892		110,084
Res. Management & Support (SBIR Admin) (non-add)[3]		*(7,493)*		*(10,362)*		*(10,467)*		*(105)*
Office of the Director - Appropriation[3,4]		*(2,521,605)*		*(2,519,401)*		*(2,728,665)*		*(209,264)*
Office of the Director - Other		1,573,180		1,579,186		1,764,361		185,174
ORIP (non-add)[3,4]		*(299,885)*		*(299,985)*		*(305,765)*		*(5,781)*
Common Fund (non-add)[3,4]		*(648,539)*		*(640,230)*		*(658,539)*		*(18,309)*
ARPA-H		0		0		5,000,000		5,000,000
Buildings and Facilities[5]		229,400		230,000		330,000		100,000
Appropriation[3]		*(199,400)*		*(200,000)*		*(300,000)*		*(100,000)*
Type 1 Diabetes[6,7]		-150,000		-141,450		-141,450		0
Program Evaluation Financing[6]		-1,271,505		-1,271,505		-1,271,505		0
Subtotal, Labor/HHS Budget Authority		**$41,309,318**		**$41,424,186**		**$48,956,713**		**$7,532,527**
Interior Appropriation for Superfund Research		81,500		81,500		83,035		1,535
Total, NIH Discretionary Budget Authority		**$41,390,818**		**$41,505,686**		**$49,039,748**		**$7,534,062**
Type 1 Diabetes[7]		150,000		141,450		141,450		0
Pandemic preparedness		0		0		12,050,000		12,050,000
Total, NIH Budget Authority		**$41,540,818**		**$41,647,136**		**$61,231,198**		**$19,584,062**
Program Evaluation Financing		1,271,505		1,271,505		1,271,505		0
Total, Program Level		**$42,812,323**		**$42,918,641**		**$62,502,703**		**$19,584,062**

1 All Subtotal and Total numbers may not add due to rounding.
2 Includes 21st Century Cures Act funding and excludes supplemental financing.
3 All numbers in italics and brackets are non-add.
4 Number of grants and dollars for the Common Fund and ORIP components of OD are distributed by mechanism and are noted here as non-adds. Office of the Director - Appropriation is the non-add total of these amounts and the funds accounted for under OD - Other.
5 Includes B&F appropriation and monies allocated pursuant to appropriations acts provisions such that funding may be used for facilities repairs and improvements at the NCI Federally Funded Research and Development Center in Frederick,
6 Number of grants and dollars for mandatory Type 1 Diabetes (T1D) and NIGMS Program Evaluation financing are distributed by mechanism above; therefore, T1D and Program Evaluation financing amounts are deducted to provide subtotals for Labor/HHS Budget Authority.
7 Amounts in FY 2022 and FY 2023 reflect a reduction of $8.550 million for Budget Control Act sequestration.
8 Reduced by a Secretary's Transfer of $123.177 million.
9 Reduced by a transfer of $5.0 million from OD to the HHS Office of Inspector General.
10 Reflects the annualized amounts provided in the continuing resolution ending 3/11/2022. Appropriation from the 10-Year Pediatric Research Initiative Fund is reduced as limited by fund balances.

AUTHORIZING LEGISLATION

(Dollars in Thousands)	FY 2022 Amount Authorized	FY 2022 Amount Appropriated[1]	FY 2023 Amount Authorized	FY 2023 President's Budget
National Institutes of Health Activity:				
1. Biomedical Research under Section 301 and Title IV of the PHS Act:				
General Authorization: Section 402A(a)(1) of the PHS Act[2]	TBD	42,292,400	TBD	50,635,618
Pediatric Research Initiative: Section 402A(a)(2) of the PHS Act[3]	12,600	4,291	12,600	12,600
2. Superfund Research Program: Section 311(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, and Section 126(g) of the Superfund Amendments and Reauthorization Act of 1986	Indefinite	81,500	Indefinite	83,035
3. 21st Century Cures Act:				
Precision Medicine: Section 1001(b)(4)(A)	150,000	109,000	419,000	419,000
BRAIN Initiative: Section 1001(b)(4)(B)	152,000	100,000	450,000	450,000
Cancer Moonshot: Section 1001(b)(4)(C)	194,000	195,000	216,000	216,000
4. Special Diabetes Programs: Section 330B(b) of the PHS Act[4]	150,000	141,450	150,000	141,450

[1]Reflects annualized amounts under the FY 2022 Continuing Resolution.

[2]The authorization of appropriations expired as of September 30, 2020.

[3]The amount for the Pediatric Research Initiative in the FY 2022 Amount Appropriated column reflects the amount available in the the 10-Year Pediatric Research Initiative Fund.

[4]The amount for the Special Diabetes Programs in the FY 2022 Amount Appropriated column and FY 2023 President's Budget column reflects the reduction due to sequestration.

APPROPRIATIONS HISTORY

Fiscal Year	Budget Request to Congress	House Allowance	Senate Allowance	Appropriation [1]
FY 2014	$31,323,187,000		$31,176,187,000	$30,142,653,000
FY 2015	$30,353,453,000		$30,084,304,000	$30,311,349,000 [2]
FY 2016	$31,311,349,000 [3]	$31,411,349,000	$32,311,349,000	$32,311,349,000 [4]
FY 2017	$33,136,349,000 [5]	$33,463,438,000	$34,311,349,000	$34,229,139,000 [6]
FY 2018	$26,919,710,000 [7]	$35,184,000,000	$36,084,000,000	$37,311,349,000 [8]
FY 2019	$34,766,707,000 [9]	$38,564,000,000	$39,312,349,000	$39,313,000,000 [10]
FY 2020	$34,367,629,000 [9]	$41,154,000,000	$42,084,000,000	$41,690,000,000 [11]
FY 2021	$39,133,215,000 [9]	$42,071,000,000	$43,536,500,000	$42,940,500,000 [12]
FY 2022	$51,957,703,000 [13]	$49,520,540,000	$48,007,431,000	$42,923,640,600 [14]
FY 2023 PB	$62,507,703,000 [15]			

[1] Does not reflect comparability adjustments. Interior appropriation's Superfund Research allocation included for all years. Special Type 1 Diabetes Research mandatory funding included. Includes CURES amounts of $352,000,000 in FY 2017, $496,000,000 in FY 2018, $711,000,000 in FY 2019, $492,000,000 in FY 2020, $404,000,000 in FY 2021, $404,000,000 under the FY 2022 Continuing Resolution (CR), and $1,085,000,000 in the FY 2023 Request.

[2] Includes Program Evaluation Financing of $715,000,000. Excludes Ebola-related funding.

[3] Includes Program Evaluation Financing of $847,489,000.

[4] Includes Program Evaluation Financing of $780,000,000. Excludes Ebola-related and Zika-related funding.

[5] Includes Program Evaluation Financing of $847,489,000.

[6] Includes Program Evaluation Financing of $824,443,000.

[7] Includes Program Evaluation Financing of $780,000,000.

[8] Includes Program Evaluation Financing of $922,871,000. Excludes supplemental hurricane funding of $50,000,000 to the Office of the Director for extramural construction.

[9] Includes Program Evaluation Financing of $741,000,000.

[10] Includes Program Evaluation Financing of $1,146,821,000. Does not reflect $5,000,000 transfer from NIH to the HHS Office of the Inspector General or hurricane disaster supplemental of $1,000,000 for National Institute of Environment Health Sciences.

[11] Includes Program Evaluation Financing of $1,230,821,000. Does not reflect $5,000,000 transfer from NIH to HHS Office of the Inspector General. Also does not reflect three COVID-19 supplementals totaling $3,587,400,000: $836,000,000 in P.L. 116-123, $945,400,000 in P.L. 116-136, and $1,806,000,000 in P.L. 116-139 that was provided to NIH through directive transfer from the PHSSEF.

[12] Includes Program Evaluation Financing of $1,271,505,000. Does not reflect $5,000,000 transfer from NIH to HHS Office of the Inspector General. Also does not reflect COVID-19 supplemental of $1,250,000,000 in P.L. 116-260 for the Office of the Director.

[13] Includes Program Evaluation Financing of $1,271,505,000 and reflects the sequestration of the mandatory funding for the Special Type 1 Diabetes Research account. Does not reflect $5,000,000 transfer from NIH to HHS Office of the Inspector General.

[14] Reflects annualized levels under the FY 2022 CR, as limited by the amounts available in the 10-Year Pediatric Research Initiative Fund, and the sequestration of the mandatory funding for the Special Type 1 Diabetes Research account. Does not reflect $5,000,000 transfer from NIH to HHS Office of the Inspector General.

[15] Includes Program Evaluation Financing of $1,271,505,000 and reflects the sequestration of the mandatory funding for the Special Type 1 Diabetes Research account. Does not reflect $5,000,000 transfer from NIH to HHS Office of the Inspector General.

APPROPRIATIONS NOT AUTHORIZED BY LAW

	Last Year of Authorization	Authorization Level	Appropriations in Last Year of Authorization	Appropriations in FY 2022[1]
NIH Labor/HHS Budget Authority[2]	FY 2020	$36,472,442,775	$40,954,400,000	$42,292,400,000

[1]Reflects annualized levels under the FY 2022 Continuing Resolution.

[2]Appropriations under general authorization of appropriations in Section 402A(a)(1) of the PHS Act. Excludes appropriations related to the Cures Act and the Gabriella Miller Pediatric Research Initiative.

NARRATIVE BY ACTIVITY TABLE/HEADER TABLE

	FY 2021	FY 2022	FY 2023	
(Dollars in Thousands)	Final[3,4]	Continuing Resolution (CR)[4,5]	President's Budget[4]	+/- FY 2022 CR
Program Level[1,2]	$42,812,323	$42,918,641	$62,502,703	$19,584,062
FTE	18,412	19,679	20,306	627

[1] All columns exclude supplemental funds.

[2] Includes 21st Century Cures Act funding, Mandatory Type 1 Diabetes, and Superfund in all years; includes NIGMS Program Evaluation funding of (in thousands) $1,271,505 in FY 2021, FY 2022, and FY 2023.

[3] Reduced by a Secretary's Transfer of $123.177 million.

[4] All years reduced by a transfer of $5.0 million from OD to the HHS Office of Inspector General.

[5] Reflects the annualized amounts provided in the continuing resolution ending 3/11/2022.

Authorizing Legislation: For existing NIH program, Section 301 and Title IV of the Public Health Act, as amended.

Allocation Methods: Competitive Grants; Contract; Intramural; Other

PROGRAM DESCRIPTIONS AND ACCOMPLISHMENTS

NIH Contributions and Scientific Advances Towards Improving Human Health

The NIH works to improve health by promoting treatment and prevention, contributing to society by stimulating economic growth and productivity, expanding the biomedical knowledge base by supporting cutting-edge research and investing in the biomedical workforce of the future. To achieve its mission, NIH invests over $42 billion in taxpayer dollars annually to research programs designed to enhance health, lengthen life, and reduce illness and disability.

In 2021, the NIH published its new *NIH-Wide Strategic Plan for Fiscal Years 2021–2025*[31] which details priorities for research in three key areas: foundational science; disease prevention and health promotion; and treatments, interventions, and cures. Under the FY 2021-2025 Plan, NIH seeks to build a strong, diverse workforce and maintain high standards for research conduct and stewardship, while expanding its infrastructure and resource capacity. The Plan will guide innovative and bold research agendas for all areas of biomedical inquiry for the next five years.

Examples of NIH-funded accomplishments and goals that reflect the priorities identified in the *NIH-Wide Strategic Plan for Fiscal Years 2021–2025* are below.

Research Response to the COVID-19 Pandemic

Since the SARS-CoV-2 virus first arrived in the United States, the NIH has mounted a vigorous research response against COVID-19 in coordination with Congress, HHS, and partners in the private and public sectors. Major NIH efforts launched early on have shown substantial success. The Acceleration of COVID-19 Therapeutic Interventions and Vaccines (ACTIV) public-private partnership (PPP) has moved at an unprecedented speed. Currently, ACTIV is testing over 15 agents designed to treat patients with COVID-19. Many of these projects are already in late-stage clinical trials. Examples include the ACTIV-6 phase 3 trial, which will investigate possible over-the-counter treatments that could lessen the impact of mild-to-moderate COVID-19, and the ACTIV-4 phase 3 trial, investigating the safety and effectiveness of blood thinners to prevent life-threatening blood clots in adults diagnosed with COVID-19. Looking toward the future, ACTIV seeks to develop orally administered drugs designed to block replication of SARS-CoV-2, as well as drugs designed to shorten the course of the virus or prevent symptom development in individuals who have been recently diagnosed. This work may be a steppingstone toward the development of antiviral medications for all types of coronaviruses, including variants.

Another major and ongoing initiative within the NIH is the Rapid Acceleration of Diagnostics (RADx) effort, an effort designed to address the COVID-19 pandemic by speeding innovation, commercialization, and implementation of diagnostic testing. RADx Tech and RADx Advanced Technology Platforms (RADx-ATP) – two programs within the RADx focused on the acceleration, evaluation, validation, and scale up of promising testing technologies – have supported companies which have together expanded testing capacity across the United States by more than 150 million tests and have compressed the typical multi-year tech commercialization process to approximately 6 months.[32] The RADx Underserved Populations (RADx-UP) program supports the development of community-engaged projects across the United States to assess and

[31] www.nih.gov/sites/default/files/about-nih/strategic-plan-fy2021-2025-508.pdf

[32] nlmdirector.nlm.nih.gov/2021/03/31/one-year-of-rapid-acceleration-of-diagnostics-and-anticipating-new-challenges/

expand COVID-19 testing for underserved or vulnerable populations. The Safe Return to School Diagnostic Testing Initiative, launched in 2021 under RADx-UP, will award up to $58 million over two years to build evidence related to safely returning students, teachers, and support staff to in-person school in areas with vulnerable and underserved populations.

As our understanding of the virus evolves, NIH efforts have adapted to address timely needs such as ongoing health disparities both caused and exacerbated by the pandemic. Grant funding allocated to the NIH Community Engagement Alliance (CEAL) Against COVID-19 Disparities will foster research in communities which have been hit hardest by the pandemic and help strengthen COVID-19 vaccine confidence and access, as well as testing and treatment. The Collaboration to Assess Risk and Identify Long-term Outcomes for Children with COVID (CARING for Children with COVID) is developing and funding studies to investigate how COVID-19 impacts children and how to identify patients at risk for multisystem inflammatory syndrome in children (MIS-C), a life-threatening condition marked by severe inflammation of one or more parts of the body. Additionally, the NIH is dedicated to understanding and reducing widespread effects of COVID-19 within vulnerable communities. The Social, Behavioral, and Economic Health Impacts of COVID-19 in Vulnerable and Health Disparity Populations initiative will fund research devoted to assessing the best public health efforts to curb the pandemic, the impacts of the pandemic on everyday life and routine health care, and relevant community health efforts.

Learning from the Challenges of the COVID-19 Pandemic

The demands of the COVID-19 pandemic have spurred an unprecedented level of innovation and creativity in the biomedical research enterprise. Despite challenging circumstances, the scientists and staff at the NIH were able to rapidly respond to the growing crisis of COVID-19 by shifting resources to better understand the coronavirus and the disease, changing policies to allow new flexibilities in grant making, and efficiently communicating emerging knowledge and recommendations with the public. Ultimately, the NIH was able to support the record-breaking development of safe and effective vaccines for COVID-19 by leveraging critical partnerships and innovative research paradigms like ACTIV. As the pandemic has evolved, the public health needs have changed, and the NIH is now able to evaluate its response and begin to adopt best practices for future emergencies and health challenges.

The intergovernmental partnerships and PPPs leveraged during the pandemic have demonstrated the ability of diverse groups to coordinate large scale efforts to achieve public health goals. The pandemic highlighted the urgent need for increased representation of diverse communities across the research process from study design to implementation in order to better engage critical stakeholders. Finally, streamlined administrative processes and policies allowed the NIH and funded researchers to respond flexibly to changing needs.

To fulfill its mission the NIH will identify best practices used during the pandemic and maintain a flexible, adaptable infrastructure to support research programs that aim to understand the foundational biology of new organisms and emerging diseases, the role of behavioral and social factors, and their potential impact on human health. Building on the advances made during the COVID-19 crisis, NIH will continue to act swiftly to turn discoveries into health.

Addressing Racial Disparities in Biomedical Research

The NIH has long recognized that the most critical assets in the biomedical research enterprise are the scientists who comprise its workforce. The advancement of researchers with diverse backgrounds and experiences increases creativity and performance in science. Diversity is a key component of innovation and achievement in the workforce. To that end the NIH UNITE Initiative was launched in early 2021.

UNITE is an NIH-wide effort committed to ending racial inequities across the biomedical research enterprise. It is composed of 5 committees with representatives from all 27 NIH Institutes and Centers (ICs). This broad participation reflects the collective dedication to achieving UNITE's significant goals. Each committee has a specific, targeted focus: (U)nderstanding stakeholder experiences through listening and learning; (N)ew research on health disparities/minority health/health inequity; (I)mproving the NIH culture and structure for equity, inclusion, and excellence; (T)ransparency, communication, and accountability with NIH's internal and external stakeholders; and (E)xtramural research ecosystem and changing policy, culture, and structure to promote workforce diversity.

In response to the UNITE Initiative's first Request for Information (RFI), issued in March 2021,[33] stakeholders and members of the public submitted over 1,100 responses. Responses provided input on practical and effective approaches to improve and strengthen racial equity, diversity, and inclusion across all facets of the biomedical research workforce, both within NIH and the external community, and expand research to eliminate or lessen health disparities and inequities. The NIH will use this input to assist in identifying, developing, and implementing actions and solutions — through policy, procedure, or practice — to promote positive culture and structural change. The UNITE Initiative hosted an extensive series of listening sessions, focus groups, and town halls to gain input from the NIH community as to how to best foster diversity and inclusion, both internally and externally.

The NIH has a range of advisory groups, both internal and external, that guide the agency on diversity, equity, and inclusion efforts. Internal groups include the Anti-Harassment Steering Committee, the Black/African American Senior Scientists, and Supporters of 8 Changes for Racial Equity (8CRE). The UNITE Initiative was born from a series of conversations between NIH leadership and these internal affinity groups. External groups that advise the NIH on issues relevant to diversity include various Advisory Council to the Director (ACD) Working Groups and the Next Generation Researchers Initiative Working Group. The ACD Working Group on Diversity took significant steps within the past year, releasing its final *Racism in Science* report in February 2021.[34] The report provides recommendations as to how the NIH can best address systemic racism in the workforce. In brief, the Working Group recommended: (1) acknowledging racism and inequities, (2) conducting research to better understand system racism, (3) monitoring acts of bias and changing the culture, and (4) making structural changes to mitigate the impact of bias and racism.

Developing the Future Biomedical Workforce

Ensuring the future of U.S. competitiveness and innovation in biomedical research is of utmost importance to the NIH. Developing the future biomedical, behavioral, clinical, and social

[33] grants.nih.gov/grants/guide/notice-files/NOT-OD-21-066.html
[34] acd.od.nih.gov/documents/presentations/02142021_DiversityReport.pdf

sciences research workforce is critical to ensuring the most pioneering minds can contribute to our national health. For these reasons, the NIH supports multiple programs for early career scientists. This includes the Diversity Program Consortium (DPC), a large network of institutions focused on developing, implementing, and determining the effectiveness of new approaches to strengthen institutional capacity to engage individuals from diverse backgrounds. This initiative, funded by the NIH, allows DPC scholars to receive training and mentorship that prepares them for success in research careers down the line.

In line with these efforts, the Office of Intramural Research (OIR) launched the Independent Research Scholar Program (IRSP) in 2021. This program aims to build workforce diversity by recruiting and training scholars who have a commitment to building a strong NIH Intramural Research Program (IRP). IRSP scholars will receive targeted training and mentorship to develop a cohort of competitive researchers ready for Investigator positions in the IRP or at extramural research organizations. Similarly, the Future Research Leaders Conference (FRLC) provides career development opportunities for talented early-career scientists interested in pursuing careers within the NIH IRP. The June 2021 FRLC allowed a cohort of early-career scientists to showcase their research, learn about pathways to joining the IRP, and connect with a large network of scientists from across ICs. Additional opportunities are available for early career researchers through the Director's Challenge Innovation Award Program, designed to identify and fund projects that foster cross-cutting NIH collaborations. This award provides seed money from the OIR for high-impact research showing significant benefit to a variety of endeavors throughout the IRP.

The NIH Office of the Director (OD) also provides more targeted opportunities for upcoming researchers to grow and expand their careers and research portfolios. Examples include the new Office of Dietary Supplements (ODS) Research Scholars Program, a one-year competitive scholarship opportunity for early career NIH intramural scientists to study the role of dietary supplements and/or their ingredients in health promotion and disease prevention. Additionally, the Medical Research Scholars Program (MRSP) provides one year of residential immersion training for medical, dental, and veterinary students seeking careers as clinician-scientists. The MRSP is supported with private co-sponsorship through the Foundation for the NIH.

Advances in Rigor and Reproducibility

Scientific advancement hinges on transparency within biomedical research. Rigor in application of the scientific method and reproducibility of methods, results, and inferences ensures robust and well-controlled experimental design, methodology, analysis, interpretation, and reporting of results. These factors ultimately affect translation into the clinic and human health. The NIH OD is committed to supporting high quality research through policies and processes that incentivize rigorous and reproducible research. To expand these efforts, assess the current landscape, and make recommendations toward improving rigor and reproducibility in animal research, the ACD Working Group on Enhancing Rigor, Transparency, and Translatability in Animal Research, organized in 2017, was tasked with identifying gaps and opportunities to improve rigor and reproducibility of animal studies, to evaluate how animal models of human disease are developed and how they may be improved, and to consider all aspects of the process for validating alternative models for animal research.

In June 2021, the Working Group released its final report, *Enhancing Rigor, Transparency, and Translatability in Animal Research*.[35] Recommendations from the report cover five key needs: 1) Improving study design and data analysis; 2) Addressing incomplete reporting and questionable research practices; 3) Improving selection, design, and relevance of animal models; 4) Improving methodological documentation and results reporting; and 5) Crosscutting needs related to measuring and evaluating the costs and effectiveness of these efforts. Each of the five components includes specific opportunities for the NIH to improve scientific design and awareness of challenges and opportunities in these areas. The report provides a roadmap for the NIH and the broader research community to deliver lasting enhancements to research integrity. In working to improve rigor and reproducibility, the NIH will next begin implementing the Working Group's recommendations to enhance its mission of pursuing discovery and health.

Scientific Breakthroughs Ushered by NIH

Each NIH IC aims to support scientific research in specific areas of health, the human body, and disease to advance the NIH mission of enhancing public health and advancing scientific breakthroughs. Across the NIH, these unique approaches to research have led to critical scientific discoveries. Among many examples of accomplishments supported by the ICs this past year are those provided below:

- Anarthria, the loss of the ability to articulate speech, can be caused by neurodegenerative diseases or stroke. Researchers supported by the National Institute on Deafness and Other Communication Disorders (NIDCD) recently developed a device that interfaces with the brain to decode signals into words and sentences, a major leap beyond existing technology which requires individuals to spell out messages letter by letter.[36] The device learns from its wearer and uses speech pattern recognition software to translate speech-related brain activity to language. This advance could lead to dramatic improvements in quality of life for countless anarthria patients.

- A National Institute on Minority Health and Health Disparities (NIMHD) trial this year compared several types of remote mental health care for homebound or disabled older adults struggling with symptoms of depression.[37] Researchers supported by the NIMHD found that therapy via videoconference from trainees could be a viable alternative to telephone support from research assistants. With advances in telehealth spurred by COVID-19, better understanding of virtual treatment effectiveness will be critical to caring for remote patients.

- A study supported by the National Institute on Drugs and Addiction (NIDA)[38] has utilized wastewater-based epidemiology to measure opioid exposure in communities.[39] Similar to the technology developed for COVID-19 testing, this novel approach will automatically sample wastewater across a community and collect data on the presence of

[35] acd.od.nih.gov/documents/presentations/06112021_ACD_WorkingGroup_FinalReport.pdf
[36] www.nih.gov/news-events/nih-research-matters/device-allows-paralyzed-man-communicate-words
[37] www.nimhd.nih.gov/news-events/research-spotlights/research-spotlights-telehealth-depression.html
[38] The FY 2023 President's Budget proposes to rename the National Institute on Drug Abuse to the National Institute on Drugs and Addiction.
[39] www.nida.nih.gov.gov/new-events/nida-notes/2021/02/human-opioid-exposure-can-be-measured-using-wastewater

opioid metabolites. This allows researchers and public health officials to more effectively allocate resources including medical services and community outreach programs to the hardest hit areas. Wastewater tracking could also be used to measure the effectiveness of community programs and call attention to rising opioid crises in previously unaffected communities.

- Researchers funded by the National Eye Institute (NEI) have developed a new gene therapy for the treatment of Fuchs' endothelial corneal dystrophy, a genetic eye disease impairing vision in roughly one in 2,000 people worldwide. Currently, the only treatment available is an invasive and risky corneal transplant. This new approach could rescue non-reproducing cells from disease progression for the first time and could lead to new and safer treatments for Fuchs' endothelial corneal dystrophy and diseases with similar degeneration of non-reproducing cells including neurological and immune diseases and genetic disorders affecting joints.[40]

- Scientists and clinicians funded by the National Center for Complementary and Integrative Health (NCCIH), the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), and the National Institute of Allergy and Infectious Diseases (NIAID) identified an intestinal fungus which could be impairing healing in individuals with Crohn's disease.[41] The fungus, a type of yeast called *Debaryomyces hansenii*, is used in the food industry and could be a new target for Crohn's disease treatments or diet-based prevention strategies for over 3 million people in the United States affected by gastrointestinal disorders.

These and other discoveries of NIH funded scientists and clinicians drive new technologies, ideas, and knowledge to communities and patients across the world. In FY 2023, the NIH will continue to fulfill its mission of advancing research to enhance knowledge of health and disease. The NIH will pursue the goals outlined in the *NIH-wide Strategic Plan for Fiscal Years 2021-2025* by making bold investments in innovative ideas and enabling the scientific workforce with cutting-edge resources and opportunities.[42]

Expanding Sex and Gender Research

Significant progress has been made in research related to sex and gender, but gaps remain in our understanding of how these factors impact health and well-being. The NIH has multiple initiatives aimed at enhancing our understanding of sex as a biological variable (SABV), the social construction of gender and its effect on health, and the health and well-being of sexual and gender minorities.

The Office of Research on Women's Health (ORWH) supports NIH-wide research policies and programs that focus on all aspects of women's health. This year for its 30th anniversary, ORWH hosted a full-day symposium on a wide range of topics, including women's mental health, environmental factors affecting women's health, pain management for women, and sex as a biological variable. In 2021, ORWH launched a collection of new independent, interactive online modules designed to help the biomedical research community—including researchers, NIH grant

[40] www.nei.nih.gov/about/news-and-events/news/university-oregon-researchers-develop-gene-therapy-eye-disease
[41] www.nih.gov/news-events/nih-research-matters/fungi-may-impair-wound-healing-crohns-disease
[42] www.nih.gov/sites/default/files/about-nih/strategic-plan-fy2021-2025-508.pdf

applicants, and peer reviewers—account for and appropriately integrate SABV across the full spectrum of biomedical sciences.

The Centers for Disease Control and Prevention (CDC) estimates 700 women die each year in the United States of pregnancy-related deaths, 60 percent of which are preventable, and over 50,000 experience severe pregnancy-related morbidity.[43] To address this alarming trend, the OD leads the Maternal Morbidity and Mortality Task Force, an NIH-wide collaboration with ORWH and the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD). The Task Force coordinates the Implementing a Maternal health and PRegnancy Outcomes Vision for Everyone (IMPROVE) Initiative, which invests in studies to promote an integrated understanding of biological, behavioral, sociocultural, and structural factors that contribute to maternal morbidity and mortality and engages communities in the development of solutions to address the needs of pregnant and postpartum individuals. In FY 2021, the NIH awarded over $13 million to support 22 projects via IMPROVE and is set to fund additional projects in FY 2022.

The Sexual & Gender Minority Research Office (SGMRO) continues to coordinate and encourage sexual and gender minority (SGM) research across NIH. In September 2020, the SGMRO released the *Strategic Plan to Advance Research on the Health and Well-being of Sexual & Gender Minorities*.[44] The Plan details how the SGMRO will pursue rigorous research on the health of SGM populations, strategic partnerships, a skilled and diverse workforce in SGM health research, and high-quality data analysis on SGM populations in research.

With support and leadership from the SGRMO, NIH has continued to advance research on sexual orientation and gender identity (SOGI). Gender identity information is collected at the NIH Clinical Center. The National Human Genome Research Institute (NHGRI) and several other ICOs support the PhenX Toolkit, which provides investigators with standard protocols for inquiring about SOGI and sex assigned at birth. The *All of Us* Research Program includes questions on SOGI, sex assigned at birth, and intersex status in its surveys and maintains a targeted focus on participants who typically are underrepresented in biomedical research, including SGM individuals.

Confronting the Ongoing Crisis of HIV/AIDS

The NIH has made critical investments into HIV research in the decades since the AIDS pandemic emerged and has supported groundbreaking advances in virology, immunology, and pathogenesis of HIV as well as in care and treatment for those affected by HIV. However, HIV remains a global public health concern. NIAID and the Office of AIDS Research (OAR) have led the way to innovative methods for understanding disease prevention and progression. Investigators supported by the NIH have created opportunities for discovery and development or technologies and tools for preventing HIV transmission, improving quality of life for people with HIV, and ending the ongoing pandemic.

The NIH aims to reduce the incidence of HIV by prioritizing the development of a safe, effective preventative vaccine against HIV and preventative approaches such as pre-exposure prophylaxis (PrEP), a daily antiretroviral therapy. Most recently, NIH has expanded research into long-

[43] www.cdc.gov/vitalsigns/maternal-deaths/
[44] dpcpsi.nih.gov/sites/default/files/SGMStrategicPlan_2021_2025.pdf

acting formulations of PrEP and other antiretroviral agents for prevention and HIV treatment. Early studies done with participation from several at-risk populations have indicated that the injectable, long-acting PrEP regimen is more effective than daily treatments due largely to the increased ease of use. Strategies for preventing the transmission must acknowledge the disproportionate impacts of HIV on marginalized groups across the United States. A recent series, HIV in the USA,[45] outlines recommendations for overcoming societal barriers for implementing HIV services such as counseling, testing, and treatment. Funded by NIDA, NIH-funded Centers for AIDS Research, and NIAID, the series showed that HIV services are critical to preventing transmission and recommended allocating additional resources for the hardest-hit areas such as the U.S. South and in communities with high proportions of at-risk individuals such as Black/African American and Latin communities, women, people who use drugs, and men who have sex with men.

In 2020, the NIH released the *FY 2021-2025 NIH Strategic Plan for HIV and HIV Related Research*.[46] NIH prioritizes research extending across the lifespan and inclusive of all people at risk of HIV. The Plan provides a framework for the NIH-wide HIV research agenda and outlines the specific role of OAR in supporting HIV-related research across the agency. Top priorities for the HIV research community at the NIH include advancing research to end the HIV pandemic, stewarding a flexible research portfolio to respond to emerging needs and opportunities, promoting the implementation of high impact health discoveries across the U.S. government, and building human and research infrastructure that includes a diverse, multidisciplinary workforce. The Plan aligns NIH-supported research with the newly released HIV National Strategic Plan and the U.S. President's Emergency Plan for AIDS Relief.[47,48]

Applying Data Science Tools and Technologies to Biomedical Research

To leverage the full scope of technologies and tools available to biomedical research, NIH applies data science techniques, such as artificial intelligence and machine learning (AI/ML), to systematically enhance the ability of investigators and clinicians to improve public health. Researchers across the biomedical research landscape use computational tools and data science to unlock complex biological mechanisms and leverage the power of large datasets to better understand the processes behind health, disease, and aging.

For example, the NIH Common Fund is supporting the Bridge to Artificial Intelligence (Bridge2AI) program which sets the stage for the broad adoption of AI in research by generating "flagship" data sets suitable for machine learning and best practices for machine learning analyses. The program will bring together data scientists and biomedical experts with social scientists to create automated tools for integrating, disseminating, and analyzing interoperable, ethically sourced data sets. In 2021, Bridge2AI released two opportunities for funding to support a center to integrate, disseminate, and evaluate results of the program and to generate datasets that could address health challenges for AI/ML analysis.

Led by the Office of Data Science Strategy (ODSS), NIH's Artificial Intelligence/Machine Learning Consortium to Advance Health Equity and Researcher Diversity (AIM-AHEAD)

[45] www.niaid.nih.gov/news-events/end-hiv-epidemic-we-must-address-health-disparities
[46] oar.nih.gov/about/directors-corner/fiscal-year-2021-2025-nih-strategic-plan-for-hiv-and-hiv-related-research
[47] www.hiv.gov/federal-response/hiv-national-strategic-plan/hiv-plan-2021-2025
[48] www.state.gov/pepfar/

program will establish partnerships between researchers and underrepresented communities to enhance emerging AI/ML technology.[49] Currently, the field lacks diversity in its workforce and in data which creates a risk of perpetuating biases in health-related algorithms and research results. The program will begin to address those gaps first by creating mutually beneficial research networks to engage underrepresented scientists, utilizing electronic health records to apply AI approaches to address health inequities, and supporting coordinated training and infrastructure resources. AIM-AHEAD has begun its work by soliciting applications for the development of a Coordinating Center with cores focused on leadership, training, data and research, and infrastructure.[50]

Emerging public health needs and the growing availability of data tools have demonstrated the need for the scientific community to openly share interoperable data and analysis tools. NIH has addressed this need by working with researchers, study participants, developers, and others to create a policy designed to shift the culture toward transparency and engagement. In FY 2021, NIH released a new *Final NIH Policy for Data Management and Sharing*, which requires funded investigators to submit a plan for how they will manage and share scientific data.[51] The requirement will reinforce NIH's commitment to making research accessible and to promote multidisciplinary collaboration and responsible research management. The new policy will go into effect in January 2023.

Public Health in a Changing Climate

The changing climate has become a critical public health concern affecting community health and well-being by worsening chronic diseases, increasing infectious diseases by exposure to pests and pathogens, triggering extreme weather events, and risking access to medical care and basic resources. Research has shown the impact of climate change differs across populations depending on socioeconomic advantages, adaptive capabilities, and life stage. NIH aims to expand investments in scientific research to identify and respond to the range of human health outcomes associated with climate change.

In the immediate future, the National Institute of Environmental Health Sciences (NIEHS) will lead collaborative new research in the impact of climate change on health. Critical priorities for innovative research include studies of climate-related vulnerability with special attention to health disparities populations, the development of new tools to assess health impacts associated with climate and extreme weather, research on gene-environment interactions, and the design and implementation of strategies for building health resilience. Most recently, the NIH Climate Change and Human Health Working Group has solicited feedback from the public on approaches the agency could take to enhance research on the health implications of climate change.[52] Public input will provide a critical framework for planning the NIH's research goals.

To enable research on the interaction of climate and health, NIEHS has developed a number of widely accessible tools for researchers. The Disaster Research Response Resources Portal (DR2) provides researchers with tools to quickly collect data and build trust with communities

[49] datascience.nih.gov/artificial-intelligence/aim-ahead
[50] datascience.nih.gov/sites/default/files/AIM-AHEAD-ROA-202107013-final-508.pdf
[51] grants.nih.gov/grants/guide/notice-files/NOT-OD-21-013.html
[52] grants.nih.gov/grants/guide/notice-files/NOT-ES-21-009.html

during and immediately after extreme weather and disaster situations.[53] The Climate Change and Human Health Literature Portal is a curated database of peer-reviewed research and general literature on the science of health and climate change.[54] Investigators and the public can access regularly updated research in biomedical and geological science using over 300 keywords. Finally, the Research to Action (R2A) program enables scientists to collaborate with community organizations to address local environmental health concerns and translate research findings into an action plan.[55] R2A awardees develop education programs to improve understanding of risks and promote actions to prevent harmful exposures. The future of climate research will depend on tools and programs that bring together researchers and communities to learn about and address common concerns.

Helping to End Addiction Long-Term (HEAL) Initiative

Through the NIH Helping to End Addiction Long-term (HEAL) Initiative, NIH has supported over $2.0 billion for more than 600 research projects across the United States. Through these projects, HEAL aims to identify new therapeutic targets for both pain and opioid use disorder, reduce the risk of opioids through nonpharmacological strategies for pain management, and improve opioid addiction treatment in a variety of settings. The NIH-wide initiative was launched in 2018 to address the historic rise in opioid misuse and addiction and better understand pain in the United States by advancing multidisciplinary research across basic, translational, clinical, and implementation science.

During the COVID-19 pandemic, opioid misuse, addiction, and overdoses have risen dramatically. In addition, the use of stimulants and other illicit drugs together with opioids is also increasing, leading to an overall dramatic rise in overdose and overdose death. The compounding crises have been made worse by limited access to support systems, medications for treating opioid use disorder (OUD), and mental health care as services are interrupted. As the COVID-19 pandemic has intensified the factors that commonly contribute to pain and addiction, like economic stressors, the NIH HEAL Initiative has adapted existing knowledge of OUD prevention and treatment and leveraged infrastructure and research capacity to meet changing needs. NIH leadership, intramural and extramural investigators, and key stakeholders have collaborated to monitor the impact of COVID-19 on communities, provision of treatment services, and available outcomes data.

NIH HEAL responded quickly to supplement ongoing research to collect additional measures related to the impact of the pandemic on HEAL research participants. Many HEAL programs including the HEALthy Brain and Child Development Study[56] and the HEALing Communities Study[57] have transitioned to virtual participant recruitment, patient consenting, and data collection. Others such as the HEAL Prevention and the Behavioral Research to Address Medications for the Treatment of OUD Program have adapted their behavioral intervention strategies to virtual environments and implemented telemedicine for clinical decision-making.

[53] tools.niehs.nih.gov/dr2/
[54] tools.niehs.nih.gov/cchhl/
[55] www.niehs.nih.gov/research/supported/translational/rta/index.cfm
[56] heal.nih.gov/research/infants-and-children/healthy-brain
[57] heal.nih.gov/research/research-to-practice/healing-communities

Today, NIH HEAL is addressing the many crosscutting issues exposed by the pandemic by prioritizing new research on diversity, equity, and inclusion in research and healthcare and enhancing access to novel telehealth practices for those with co-occurring disparities or limited health and technical literacy. This year, NIH HEAL hosted a workshop on "Achieving Health Equity in the NIH HEAL Initiative" which brought together experts to discuss factors that impact diversity in research participation and highlighted innovative recruitment strategies to increase underrepresented populations in HEAL studies.[58] Finally, the NIH HEAL funds Justice Community Opioid Innovation Network[59] which investigates the effectiveness of treatment programs in justice-involved populations, telehealth technologies, and trainings to enable continued research and community engagement.

All of Us Genomic Program

In the past year, the *All of Us* Research Program has celebrated several milestones in its mission to build one of the largest and most diverse datasets to advance health research. In December 2020, the program began releasing the first genetic results to participants who have donated their biosamples, demonstrating *All of Us'* commitment to give back information to its research participants. Now, participants have the opportunity to understand how their DNA and genetic variants may affect their body's response to certain types of medicines or increase their risk of certain diseases. Genetic data will also be available to researchers in the next year—with strict privacy and security safeguards—that will allow scientists to learn more about how to tailor health care to individual genetic needs. Since 2018, when the program opened its enrollment, more than 270,000 people have contributed biosamples, more than 80 percent of which are from communities historically underrepresented in biomedical research.[60]

The Research Workbench has allowed *All of Us* to continue its groundbreaking research. The Workbench now includes information from more than 315,000 participants in total, more than three-quarters of whom are from communities that are underrepresented in biomedical research and about half of whom are racial and ethnic minorities.[61] The newly expanded dataset represents a 40 percent increase in participants with survey information and a 60 percent increase in participants with electronic health record information over the original beta release in May 2020. As of February 2022, more than 1,400 researchers have gained access to the Researcher Workbench, over 1,100 research projects have been launched, and nearly 300 institutions have signed on to the Data Use and Registration Agreement. In 2021, the first peer-reviewed publication using *All of Us* data by researchers outside of the program was published,[62] examining health care access by cancer survivors.

For the first time, researchers utilizing the program's Research Workbench have access to information about study participants' experience with the pandemic through survey responses on mental health, social distancing, and economic impacts. Over 63,000 participants have completed the COVID-19 Participant Experience (COPE) Survey, which covers topics including

[58] heal.nih.gov/news/events/achieving-health-equity-workshop
[59] heal.nih.gov/research/research-to-practice/jcoin
[60] allofus.nih.gov/news-events-and-media/announcements/nihs-all-us-research-program-returns-first-genetic-results-participants
[61] allofus.nih.gov/news-events-and-media/announcements/researchers-guide-and-drive-workbenchs-first-year
[62] onlinelibrary.wiley.com/doi/full/10.1002/cam4.3924

stress, mood, discrimination, social distancing, and economic and work changes.[63] This data set is the largest infusion of mental health information for the program so far.

This year, *All of Us* has expanded its commitment to working with and respectfully engaging American Indian and Alaska Native (AI/AN) people and supporting their inclusion in precision medicine research. In response to tribal leader input gathered from a nearly two-year consultation process, the program will initiate specialized education efforts for researchers, take steps to ensure the perspectives and needs of AI/AN communities are integrated into the program, and support ongoing engagement activities with Tribal Nations to pave the way for expanded collaborations in the future. There are 574 federally recognized tribes within the United States, each with its own government and laws. The formal Tribal Consultation process supports engagement with Tribal Nations on a government-to-government basis, respecting tribal sovereignty. The *All of Us* consultation was one of the most extensive Tribal Consultations that NIH has held to date and was scaled to match *All of Us*'s national scope, which reflects a growing momentum across the agency to expand tribal engagement efforts generally.

[63] allofus.nih.gov/news-events-and-media/announcements/all-us-releases-initial-covid-19-survey-data-researchers

FUNDING HISTORY (FIVE YEAR FUNDING TABLE)

Fiscal Year	Amount[1, 2]
2019	$39,313,000,000
2020	$41,690,000,000
2021	$42,940,500,000
2022[3]	$42,923,640,600
2023 Budget Request[4]	$62,507,703,000

[1] Appropriated amounts include discretionary budget authority received from both Labor/HHS appropriations that fund ICs as well as the Interior, Environment & Related Agencies appropriation that supports NIH Superfund Research activities. Also includes mandatory budget authority derived from the Special Type 1 Diabetes account. Includes NIGMS Program Evaluation financing of $1,146,821,000 in FY 2019, $1,230,821,000 in FY 2020, $1,271,505,000 in FY 2021, $1,271,505,000 under the FY 2022 Continuing Resolution (CR) and $1,271,505,000 in the FY 2023 request. Includes CURES amounts of $711,000,000 in FY 2019, $492,000,000 in FY 2020, $404,000,000 in FY 2021, $404,000,000 under the FY 2022 CR and $1,085,000,000 in the FY 2023 request.

[2] Excludes supplemental appropriations and permissive and directive transfers.

[3] Reflects annualized levels under the FY 2022 CR, as limited by the amounts available in the 10-Year Pediatric Research Initiative Fund, and the sequestration of the mandatory funding for the Special Type 1 Diabetes Research account.

[4] Reflects the sequestration of the mandatory funding for the Special Type 1 Diabetes Research account.

SUMMARY OF REQUEST NARRATIVE

The FY 2023 President's Budget request provides a program level of $62.5 billion for NIH, which is $19.6 billion more than the FY 2022 Continuing Resolution (CR) level of $42.9 billion.[64] This request includes $5.0 billion to continue funding the recently established Advanced Research Projects Agency for Health (ARPA-H) and $12.1 billion in new mandatory funding for NIH, available through FY 2027, to prepare for pandemics and other biological threats.

The following summary references program level funding, which is the sum of discretionary budget authority in the Department of Labor, Health and Human Services, and Education, and Related Agencies appropriations ($49.0 billion in FY 2023); discretionary budget authority in the Department of the Interior, Environment, and Related Agencies appropriations dedicated to the Superfund Research Program ($83.0 million in FY 2023); mandatory budget authority provided for Type 1 Diabetes research ($141.5 million in FY 2023[65]) and for pandemic preparedness ($12.1 billion in FY 2023); and Program Evaluation Financing for the National Institute of General Medical Sciences under Section 241 of the Public Health Service Act ($1,271.5 million in FY 2023).

The primary budget mechanisms discussed below include allocations by mechanism of Program Evaluation Financing and Type 1 Diabetes funds. The Superfund Research program, ARPA-H, and funding for pandemic preparedness activities are lump-sum amounts within the NIH mechanism tables.

In FY 2023, NIH will continue providing upfront funding for certain research projects, as appropriate, to facilitate efficient management of resources across multiple years. In general, NIH discretionary research project grants are awarded for more than one year and funded incrementally; each year's commitment is obligated from that year's appropriation. Grants are classified as Competing in the first year of award or renewal, and Non-competing in the remaining years of each award. Certain categories of NIH grants are awarded for multiple years with the full funding provided up front. This includes the NIH Director's New Innovator Award (DP2) and the NIH Research Enhancement Award (R15). The latter consists of two programs, the Academic Research Enhancement Award (AREA) for Undergraduate-Focused Institutions, and the Research Enhancement Award Program (REAP) for Health Professional Schools and Graduate Schools. In addition, full funding can be provided up front for other NIH grants and cooperative agreements as appropriate in special circumstances. Situations that may benefit from such an approach can include, but are not limited to, appropriations for new programs, rapid increases in funding, or variable outyear funding streams (e.g., under the 21st Century Cures Act). The use of upfront funding for new programs makes some base funding available for competing awards in the following year. Up-front funding has increased over the last few years, due in part to the large Congressional increases for Alzheimer's disease research.

[64] At the time the President's Budget was prepared, NIH and other agencies were operating under a CR providing a funding level that was flat to FY 2021 enacted appropriations.
[65] Reflects a mandatory appropriation of $150.0 million, reduced by $8.6 million for sequestration pursuant to the Budget Control Act.

Research Project Grants (RPGs)
The FY 2023 President's Budget provides $25.9 billion for RPGs, which is $1.7 billion more than the FY 2022 CR level. This amount would fund 11,878 Competing RPGs, or 2,072 more than the FY 2022 CR level. It would also support 29,301 Noncompeting RPGs, 201 less than the FY 2022 CR level. In addition, the projected average cost for Competing RPGs of approximately $573,000 would be 0.4% above the FY 2022 CR level projected average cost of $571,000.

- **Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) RPGs.** The FY 2023 President's Budget provides $1,228.3 million for SBIR/STTR program grants, which is $69.6 million above the FY 2022 CR level. The statutory minimum set-aside requirement of 3.65% for NIH-wide SBIR/STTR support is achieved in FY 2023.

Research Centers
The FY 2023 President's Budget provides $2,805.7 million for Research Centers, which is $31.5 million more than the FY 2022 CR level. This amount would fund 1,307 grants, 64 more than the FY 2022 CR level.

Other Research
The FY 2023 President's Budget provides $2,915.9 million for this mechanism, which is $35.9 million more than the FY 2022 CR level. This amount would fund 7,744 grants, which is 54 more than the number of awards projected in the FY 2022 CR level.

Training
The FY 2023 President's Budget provides $1,032.7 million for research training, which is $49.1 million above the FY 2022 CR level. This amount would fund 18,109 Full-Time Trainee Positions (FTTPs), which is 301 more than planned for in the FY 2022 CR level, and would continue to fund the new childcare subsidy allowance for individual and institutional trainees that was phased in starting in FY 2021.

Research & Development (R&D) Contracts
The FY 2023 President's Budget provides $3,568.9 million for R&D contracts, which is $148.1 million more than the FY 2022 CR level. The requested amount would fund an estimated 2,576 contracts, or 126 more than the FY 2022 CR level.

- **SBIR/STTR R&D Contracts.** The FY 2023 President's Budget includes a $62.5 million set-aside within the R&D Contracts mechanism for support of qualified SBIR/STTR contracts.

Intramural Research (IR)
The FY 2023 President's Budget provides $4,763.5 million for IR, which is $125.1 million more than the FY 2022 CR level.

Research Management and Support (RMS)
The FY 2023 President's Budget provides $2,255.9 million for RMS, which is $110.1 million more the FY 2022 CR level.

Office of the Director (OD)
The FY 2023 President's Budget provides $2,728.7 million for OD, which is $209.3 million more than the FY 2022 CR level.

- **Common Fund (CF)**
  Funding of $658.5 million is allocated for CF-supported programs. This amount is $18.3 million more than the FY 2022 CR level.

- **Office of Research Infrastructure Programs (ORIP)**
  Funding of $305.8 million is allocated for ORIP. This amount is $5.8 million above the FY 2022 CR level.

- **Other**
  The $1,764.4 million allocated for OD components other than the Common Fund or ORIP is a net increase of $185.2 million from the FY 2022 CR level.

Advanced Research Projects Agency for Health (ARPA-H)
The FY 2023 President's Budget provides $5.0 billion to support the recently established ARPA-H.

Buildings & Facilities (B&F)
The FY 2023 President's Budget provides $330.0 million for infrastructure sustainment projects associated with the B&F program, which is $100.0 million more than the FY 2022 CR level. This amount includes $300.0 million for NIH's Buildings and Facilities appropriation, an increase of $100.0 million from the FY 2022 CR level, and $30.0 million within the appropriation for the National Cancer Institute (NCI) for facility repair and improvement activities at NCI's Frederick, Maryland, facility.

Superfund Research Program
The FY 2023 President's Budget provides $83.0 million for the Superfund Research Program, which is $1.5 million more than the FY 2022 CR level.

Program Evaluation Financing
The FY 2023 President's Budget provides $1,271.5 million for Program Evaluation Financing purposes in NIGMS, which is the same as the FY 2022 CR level.

OUTPUTS AND OUTCOMES

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2022 Target	FY 2023 Target	FY 2023 Target +/-FY 2022 Target
SRO-2.1 By 2021, develop, optimize, and evaluate the effectiveness of nano-enabled immunotherapy (nano-immunotherapy) for one cancer type. (Output)	FY 2021: While the two nanodelivery systems are being tested in clinical trials, they have been further optimized to increase their effectiveness. Early results in an animal model showed that they can successfully deliver multiple interventions simultaneously to induce an immune response to eradicate both local and distant tumors. Target: Further optimize the top candidate nanoformulation for co-delivery of antigens, adjuvants and immuno-modulators and evaluate its efficacy towards near and distance metastatic lesions in preclinical models with established tumors. (Target Met)	N/A	N/A	N/A
SRO-2.4 By 2025, increase the number of potential treatment options for communication disorders that are being tested in clinical trials by adding one new treatment option per year. (Outcome)	FY 2021: This study is not currently enrolling participants due to COVID-19 restrictions. Target: Initiate testing one new potential treatment option for a disorder affecting voice, speech, or language. (Target Not Met)	Initiate testing one new potential treatment option for a disorder affecting language.	To be determined[66]	N/A
SRO-2.5 By 2021, develop three non-invasive imaging technologies that can image retinal cell	FY 2021: All five teams in the Audacious Goals Functional Imaging Consortium have developed novel non-invasive imaging technologies. Some of the	N/A	N/A	N/A

[66] The longer-term impact of COVID-19 on patient recruitment and treatment implementation is unknown at this time.

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2022 Target	FY 2023 Target	FY 2023 Target +/-FY 2022 Target
function and circuitry. (Output)	teams have completed their work ahead of schedule and are showing results in human participants. Target: Complete development of three non-invasive imaging technologies which image retinal cell function and circuitry. (Target Exceeded)			
SRO-2.7 By 2021, file Phase II Investigational New Drug (IND) application with the FDA for a therapy to treat geographic atrophy in age-related macular degeneration (AMD) using patient-derived stem cells. (Outcome)	FY 2021: The COVID-19 pandemic prevented both enrollment and treatment of 12 AMD patients (three are enrolled and zero completed treatment). Cell therapy product manufacturing was completed for one patient but was not able to be transplanted, and cell manufacturing has begun for a second patient. Target: Complete Phase I trial enrollment to treat a total of 12 AMD patients. (Target Not Met)	N/A	N/A	N/A
SRO-2.8 By 2023, advance the development of three novel drug or biologic therapeutic candidates for Alzheimer's disease (AD) or related dementias toward the point of entry into Phase I human studies. (Output)	FY 2021: Investigational New Drug (IND)-enabling studies were initiated for three novel drug candidates. Target: Initiate Investigational New Drug (IND)-enabling studies for 2-3 new candidate therapeutics. (Target Met)	Complete IND-enabling studies for 2-3 new candidate therapeutics.	Advance the development of three novel drug or biologic therapeutic candidates for AD or related dementias toward the point of entry into Phase I human studies.	N/A
SRO-2.9 By 2022, evaluate the safety and effectiveness of 1-3 long-acting strategies	FY 2021: NIH-funded investigators analyzed data from the two studies and published their findings	Complete enrollment of two open label extension studies (HPTN 083	N/A	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2022 Target	FY 2023 Target	FY 2023 Target +/-FY 2022 Target
for the prevention of HIV. (Outcome)	online in March 2021. Target: Strategy 1: Analyze data of two studies testing the safety, tolerability, and effectiveness of VRC01 broadly neutralizing antibody (bnAb). (Target Met)	and HPTN 084) investigating the safety and efficacy of the long-acting injectable antiretroviral drug cabotegravir (CAB LA).		
SRO-2.10 By 2022, develop methods for the regeneration of functional tissues of the human dental, oral, and craniofacial complex to enable initiation of human Phase I clinical trials. (Outcome)	FY 2021: Ten Interdisciplinary Translational Projects have completed or nearly completed Stage 3 (Verification) of the process that ends at Stage 5 with the IDE/IND preparation and submission. Target: The Resource Centers will facilitate the development of five Investigational New Drug (IND)/Investigational Device Exemption (IDE) applications from the current pool of Interdisciplinary Translational Projects. (Target Exceeded)	One FDA application for a tissue regeneration combination product will be approved and one Phase 1 clinical trial protocol will be developed.	N/A	N/A
SRO-2.12 By 2021, develop, validate, and/or disseminate 3-5 new research tools or technologies that enable better understanding of brain function at the cellular and/or circuit level. (Output)	FY 2021: The Brain Research Through Advancing Innovative Neurotechnologies (BRAIN) Initiative's investigators have used multiple new tools and technologies to expand our understanding of brain function at the cellular or circuit level. Target: Expand our understanding of brain function at the cellular or circuit level using 3-5 new tools and technologies.	N/A	N/A	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2022 Target	FY 2023 Target	FY 2023 Target +/-FY 2022 Target
	(Target Met)			
SRO-2.13 By 2023, advance the development of 1-2 new drugs and/or other therapeutic candidates for neurological diseases from lead optimization or device development toward the point of preparedness for first-in-human studies. (Output)	FY 2021: Studies on 14 therapeutic or device candidates have provided sufficient evidence of safety for testing in people to proceed. Target: Determine the margin of safety for 1-2 therapeutic or device candidates. (Target Exceeded)	Demonstrate efficacy of trial-ready formulation of 1-2 therapeutic or device candidates in preclinical disease models.	Advance the development of 1-2 new drugs and/or other therapeutic candidates for neurological diseases from lead optimization or device development toward the point of preparedness for first-in-human studies.	N/A
SRO-3.1 By 2025, identify neurobehavioral precursors or consequences of adolescent substance use or other childhood experiences. (Outcome)	FY 2021: Researchers found that adolescent alcohol consumption may result in reduced neurogenesis in the hippocampus as well as an inflammatory response and investigated whether these neurological changes could be prevented by the drug galantamine in a preclinical model of adolescent alcohol exposure. Target: Conduct preclinical studies to identify persistent neurobiological adaptations that occur as a result of exposure to alcohol during adolescence. (Target Met)	Continue preclinical research to identify brain-based predictors of alcohol use initiation and misuse among adolescents.	Conduct preclinical and clinical studies to better understand the predictors and consequences associated with adolescent alcohol misuse.	N/A
SRO-3.2 By 2022, establish the feasibility of using one emerging technology to safely and non-invasively obtain real time data on human placenta development and function during pregnancy. (Outcome)	FY 2021: NIH-funded researchers used a novel ultrasound technique and blood oxygen-level dependent magnetic resonance imaging (MRI) to collect longitudinal data and outcomes for 625 healthy pregnancies, and to generate comparative data between	Establish the feasibility of using one emerging technology to safely and non-invasively obtain real time data on human placenta development and	N/A	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2022 Target	FY 2023 Target	FY 2023 Target +/-FY 2022 Target
	pregnancies with normal vs. abnormal placenta. Target: Utilize one innovative technology to characterize longitudinal changes in normal vs. abnormal placenta during pregnancy. (Target Met)	function during pregnancy.		
SRO-4.9 By 2023, evaluate the efficacy of new or refined interventions to treat opioid use disorders (OUD). (Output)	FY 2021: NIH conducted one Phase I clinical trial to test the safety and efficacy of an anti-opioid vaccine, and two Phase I clinical trials to test the safety and efficacy of two novel treatment drugs for OUD. Target: Conduct a Phase I clinical trial of an anti-opioid vaccine and a new medication to treat OUD. (Target Met)	Conduct a clinical trial of a medication for relapse prevention of OUD or overdose.	Complete a Phase 2 trial of a long-acting formulation of an opioid antagonist.	N/A
SRO-4.15 By 2025, develop, refine, and evaluate the effectiveness of evidence-based intervention strategies for facilitating treatment of alcohol misuse in underage populations. (Output)	FY 2021: Researchers tested the effectiveness of motivation enhancement therapy and cognitive-behavioral therapy in reducing alcohol and cannabis use and co-occurring depression among adolescents. Target: Test another behavioral therapy for intervening with alcohol misuse in an underage population. (Target Met)	Evaluate the effectiveness of a digital-based alcohol screening and brief intervention for adolescents.	Evaluate the effectiveness of an alcohol intervention in reducing alcohol misuse among emerging adults outside of college settings.	N/A
SRO-5.2 By 2025, develop or evaluate the efficacy or effectiveness of new or	FY 2021: Two clinical trials were launched as part of the Helping to End Addiction Long-term (HEAL)	Conduct 1-2 studies to test the effectiveness of prevention	Launch 1-2 clinical trials testing multi-level approaches to prevent opioid and	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2022 Target	FY 2023 Target	FY 2023 Target +/-FY 2022 Target
adapted prevention interventions for substance use disorders (SUD). (Outcome)	Initiative®. Target: Launch 1-2 clinical trials, based on pilot study results, to test the effects of a prevention intervention for opioid use disorder. (Target Met)	interventions focused on electronic nicotine delivery systems (including vaping).	other substance misuse by intervening on social determinants of health in addition to individual level risk factors.	
SRO-5.3 By 2023, identify risk and protective alleles that lead to one novel therapeutic approach, drug target, or pathway to prevention for late-onset Alzheimer's disease. (Output)	FY 2021: Data analysis for the Alzheimer's Disease Sequencing Project (ADSP) Discovery Follow-up Study continued and an initiative was launched to expand the ADSP sample sets to represent more diverse populations. The ADSP continued its confirmation of genomic regions of interest in ethnically diverse cohorts and identified important functional genomic elements that characterize the architecture of the Alzheimer's Disease genome. The ADSP continued to quality control check and harmonize genetic data across all cohorts and all phases of the study. Target: Continue analysis of ADSP Discovery Follow-Up Study in ethnically diverse cohorts. Continue confirmation of genomic regions of interest from Discovery Phase and Discovery Follow-Up Phase in ethnically diverse datasets. Begin harmonization of phenotypic data with ADSP genetic data across multiple types of study approaches from large epidemiology and clinical cohorts that are outside of the ADSP.	Continue analysis of ADSP Discovery Follow-Up Study in ethnically diverse cohorts. Continue confirmation of genomic regions of interest from Discovery Phase and Discovery Follow-Up Phase in ethnically diverse datasets. Continue harmonization of phenotypic data with ADSP genetic data across multiple types of study approaches from large epidemiology and clinical cohorts that are outside of the ADSP. Begin analysis of ADSP genetic data using artificial intelligence approaches.	Identify risk and protective alleles that lead to one novel therapeutic approach, drug target, or pathway to prevention for late-onset Alzheimer's disease.	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2022 Target	FY 2023 Target	FY 2023 Target +/-FY 2022 Target
	(Target Met)			
SRO-5.8 By 2022, obtain pre-clinical and clinical data from newly initiated and current studies to evaluate 1-2 HIV vaccine candidate(s). (Outcome)	FY 2021: HIV Vaccine Trials Network (HVTN) 706 Mosaico, a Phase 3 clinical trial, completed enrollment in September 2021 with 3,903 participants. Target: Enroll 25 percent-50 percent of the 3,800 participants needed for a Phase 3 vaccine study. (Target Exceeded)	Analyze laboratory data from a Phase 2b vaccine efficacy study.	N/A	N/A
SRO-5.13 By 2022, complete research to the pre-clinical stage of development of a new or significantly improved targeted, minimally invasive biomodulation technology for therapy. (Outcome)	FY 2021: Researchers have created an ultrasound-based technique called electromechanical wave imaging (EWI) that noninvasively creates three-dimensional cardiac maps of the areas that cause arrhythmias during treatment procedures. Target: Conduct research on continued development and preliminary testing of one prototype technology that uses acoustic, optical, or electromagnetic waves to manipulate cells for treatment of a specific disease and begin to develop a plan for initiating the regulatory process. (Target Met)	Evaluate the feasibility and safety of one pre-clinical prototype technology that uses acoustic, optical, or electromagnetic waves to manipulate cells for treatment of a specific disease.	N/A	N/A
SRO-5.15 By 2025, develop, refine and evaluate evidence-based intervention strategies and promote their use to prevent substance misuse and substance use disorders	FY 2021: NIH hosted webinars and developed fact sheets to disseminate information about evidence-based interventions for underage populations. Target: Disseminate	Develop and/or evaluate preventive interventions to address underage alcohol use among specific underserved populations.	Evaluate a culturally appropriate family-based intervention to prevent and reduce underage drinking among an	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2022 Target	FY 2023 Target	FY 2023 Target +/-FY 2022 Target
and their consequences in underage populations. (Outcome)	information to the public about evidence-based interventions for underage populations. (Target Met)		underserved population.	
SRO-5.16 By 2021, conduct research to support pharmaceutical labeling changes for five drugs, to reflect safe and appropriate dosing and use specifically in children. (Outcome)	FY 2021: NIH-supported research led to pharmaceutical labeling changes for eight drugs or devices, to reflect safe and appropriate dosing and use specifically in children. Target: Assess pharmacokinetics, pharmacodynamics, and safety of five drugs in pediatric populations. (Target Exceeded)	N/A	N/A	N/A
SRO-5.17 By 2022, develop and test the effectiveness of three strategies to enhance end-of-life and palliative care. (Outcome)	FY 2021: Studies found that an advanced care planning intervention showed sustained agreement on end-of-life decisions over time between individuals living with HIV and their family surrogate decision-makers. Target: Develop and test at least one effective intervention for improving quality of life for patients at the end of life through enhanced shared decision-making and support of informal caregivers. (Target Met)	Develop and test at least three effective interventions to enhance end-of-life and palliative care by: improving quality of life for patients; providing support for family members and informal caregivers; and/or facilitating shared decision-making.	N/A	N/A
SRO-5.18 By 2026, enhance understanding of how five health information technologies can be applied effectively to improve minority	FY 2021: NIH investigators developed a new smoking cessation mobile application, QuitJourney, based on QuitGuide (not QuitSTART which is for adolescents) and conducted acceptability and	Determine if a mobile phone app is effective in promoting physical activity or reducing weight among racial	Investigate the utility of a natural language processing (NLP) algorithm to identify patients from health	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2022 Target	FY 2023 Target	FY 2023 Target +/-FY 2022 Target
health or to reduce health disparities. (Output)	usability testing with 48 young adults. Target: Develop an adaptive smoking cessation intervention targeting adolescents of health disparity populations using the quitStart mobile application. (Target Met)	and ethnic minority populations.	disparity populations who are experiencing social isolation or other social stressors using clinical narratives in electronic health record (EHR) systems.	
SRO-5.19 By 2026, establish a formalized funding pathway for the development, validation, and regulatory review of diagnostic technologies to enhance surveillance and pandemic preparedness. (Outcome and Efficiency)	Note: SRO-5.19 will begin reporting in December 2022.	Receive FDA authorization for marketability for three home, point-of-care, or lab-based diagnostics.	Receive FDA authorization for marketability for two home, point-of-care, or lab-based diagnostics.	N/A
SRO-5.20 By 2026, advance the preclinical or clinical development of 10 antivirals for current or future infectious disease threats. (Outcome)	Note: SRO-5.20 will begin reporting in December 2022.	Advance preclinical or clinical development of one antiviral therapeutic.	Advance preclinical or clinical development of two antiviral therapeutics.	N/A
SRO-6.1 By 2023, perform comparative effectiveness studies to test five therapies for prevention or treatment of type 2 diabetes. (Outcome)	FY 2021: GRADE (Glycemia Reduction Approaches in Diabetes: A Comparative Effectiveness Study) completed participant visits in April 2021. Target: Complete all final participant visits in the Glycemia Reduction Approaches in Diabetes: A Comparative Effectiveness (GRADE) Study, according to the study protocol. (Target Met)	Analyze the primary outcome results from Glycemia Reduction Approaches in Diabetes: A Comparative Effectiveness (GRADE) Study.	Determine the long-term durability of diabetes remission following bariatric surgery compared with medical/lifestyle intervention.	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2022 Target	FY 2023 Target	FY 2023 Target +/-FY 2022 Target
SRO-6.2 By 2025, advance 1-2 new or repurposed compounds that act on neurobiological targets that may have the potential for treating alcohol or other substance use disorders. (Outcome)	FY 2021: NIH supported multiple preclinical studies to examine compounds that act on neurobiological targets involved in alcohol use disorder and relapse, such as inhibiting a signaling pathway thought to play a role in stress-induced alcohol seeking behavior in animal models. Target: Conduct a preclinical evaluation of a novel or repurposed compound that acts on neurobiological targets implicated in alcohol use disorder. (Target Met)	Evaluate the efficacy of a candidate compound used in combination with a behavioral therapy for the treatment of alcohol use disorder.	Evaluate a candidate compound for the treatment of alcohol use disorder in a preclinical and/or clinical study.	N/A
CTR-7 By 2022, engage a national community in the development, dissemination, and implementation of a comprehensive national strategy to address the burden of Chronic Obstructive Pulmonary Disease (COPD) in the US. (Output)	FY 2021: NIH launched the COPD National Action Plan Community Action Tool in February 2021, with a webinar to introduce the tool to the *Learn More Breathe Better*® program's *Breathe Better Network* partners. Target: Launch COPD National Action Plan Community Action Tool for stakeholders to capture Action Plan progress and conduct webinar and other promotional activities to encourage its use. (Target Met)	Analyze Action Plan implementation activities reported by stakeholders.	N/A	N/A
CBRR-1.1 Provide research training for predoctoral trainees and fellows that promotes greater retention and long-term success in research careers. (Output)	FY 2021: Award rate to comparison group reached 10 percent Target: N ≥ 10% (Target Met)	N ≥ 10%	N ≥ 10%	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2022 Target	FY 2023 Target	FY 2023 Target +/-FY 2022 Target
CBRR-1.2 Provide research training for postdoctoral fellows that promotes greater retention and long-term success in research careers. (Output)	FY 2021: Award rate to comparison group reached 17 percent and exceeded target by 7 percent Target: N≥10% (Target Exceeded)	N≥10%	N≥10%	N/A
CBRR-2 Promote data sharing and provide information in real time through the NIH Business System (NBS) by developing, integrating, deploying and maintaining business modules. (Output)	FY 2021: NBS continues to conduct priority deployment activities for the NIH Corrective Action Plan Remediation efforts. Target: (Development) Continue to conduct priority deployment activities for the NIH Corrective Action Plan remediation efforts. (Target Extended)	(Development) Initiate development of planned business modules to build capacity and functionality of the NIH Business System.	(Development) Identify or initiate development effort for the implementation of the G-Invoicing platform.	N/A
CBRR-4 By 2021, produce and phenotype 2,500 knockout mouse strains to enhance the capacity of researchers to investigate the in vivo function of mammalian genes and identify new models of human disease. (Outcome)	FY 2021: Over 2,500 knockout mouse juvenile lines and associated resources were produced and made available to the research community. Target: Provide a cumulative total of 2,500 knockout mouse juvenile lines and associated resources to support research into gene function and human diseases. (Target Exceeded)	N/A	N/A	N/A
CBRR-18 By 2023, develop and validate a new protocol for dementia assessment for use in large nationally representative samples. (Outcome)	FY 2021: The evaluation of data from the US Harmonized Cognitive Assessment Protocol (HCAP) baseline and the international HCAP baseline data is complete. The follow-up HCAP assessments were planned but not conducted due to COVID-19 safety	Initiate a follow-up HCAP assessment to provide new data on the incidence and prevalence of dementia and ADRD in the U.S.	Develop and validate a new protocol for dementia assessment for use in large nationally representative samples.	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2022 Target	FY 2023 Target	FY 2023 Target +/-FY 2022 Target
	issues. Target: Complete follow-up assessment in the Health and Retirement Study using the refined HCAP. (Target Not Met)			
CBRR-25 Increase the total number of mentored research career development experiences for trainees from diverse backgrounds, including groups underrepresented in biomedical research, to promote individual development and to prepare them for a range of research-related careers. (Output)	FY 2021: Trainees from diverse backgrounds received a total of 3,779 career development experiences across all career stages. Target: 3,540 career experiences across all career stages. (Target Exceeded)	3,545 career experiences across all career stages.	3,550 career experiences across all career stages.	N/A
CBRR-26 Maintain the yearly number of undergraduate students with mentored research experiences through the IDeA (Institutional Development Award) Networks of Biomedical Research Excellence (INBRE) program in order to sustain a pipeline of undergraduate students who will pursue health research careers. (Output)	FY 2021: An estimated 1,450 undergraduate students participated in mentored research experiences, consistent with 2020 level. Target: Sustain the number of undergraduate mentored research experiences from 2020 level. (Target Met)	Sustain the number of undergraduate mentored research experiences from FY 2021 level.	Sustain the number of undergraduate mentored research experiences from FY 2022 level.	N/A
CBRR-28 Collect and distribute human tissue samples and molecular and genetic data from human tissues to the scientific community with the purpose of supporting research on	FY 2021: Brain tissue from 52 new donors was obtained. Samples were distributed to 28 researchers. Target: Collect brain tissue from an additional 30 new donors and distribute tissue samples or data derived from	Collect brain tissue from an additional 40 new donors and distribute tissue samples or data derived from tissue to 20 researchers studying mental or	Collect brain tissue from an additional 50 new donors and distribute tissue samples or data derived from tissue to 25 researchers studying mental or	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2022 Target	FY 2023 Target	FY 2023 Target +/-FY 2022 Target
brain and behavior. (Output)	tissue to 20 researchers studying mental or neurological disorders. (Target Exceeded)	neurological disorders.	neurological disorders.	
CBRR-30 By 2024, expand the use of program-focused versus target-focused award mechanisms by National Institute of General Medical Sciences (NIGMS) investigators. (Output)	FY 2021: Out of 4,294 investigators supported by R01 or the Maximizing Investigators' Research Award (MIRA/R35) grants, 1,741 were MIRA/R35 investigators (41 percent). This is an increase of 9 percentage points from 32 percent in FY 2020. Target: Expand NIGMS investigator participation in the Maximizing Investigators' Research Award (MIRA) program by two percentage points. (Target Exceeded)	Expand NIGMS investigator participation in the Maximizing Investigators' Research Award (MIRA) program by two percentage points.	Expand NIGMS investigator participation in the Maximizing Investigators' Research Award (MIRA) program by two percentage points.	N/A
MPO-1 Reduce the footprint of office and warehouse space in NIH's owned and leased facilities portfolio by one percent annually to comply with guidelines in the Office of Management and Budget (OMB) Memorandum M-12-12, Promoting Efficient Spending to Support Agency Operations. (Output and Efficiency)	Note: MPO-1 will begin reporting in December 2022.	Reduce: One percent of FY 2021 usable square feet	Reduce: One percent of FY 2022 usable square feet	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2022 Target	FY 2023 Target	FY 2023 Target +/-FY 2022 Target
MPO-3 Address diverse workforce recruitment needs to ascertain highly qualified staff to conduct or support biomedical research. (Ongoing) (Output)	FY 2021: Organizational leadership, in partnership with the organization's analytics unit, focused on methods to further improve and streamline the recruitment process for NIH customers. The collection and analysis of data continued to be utilized to identify opportune times and strategies for targeted recruitment to best meet customers' needs, save resources, and streamline the hiring process. Target: Assess [AS] results of implementation Assess process in place to identify the most opportune times throughout the year for NIH to recruit for varying occupations. [EX 2019/IM 2020] (Target Met)	Assess [AS] results of implementation Assess the shared recruitment approach, using data gathered in first year of full-time practice, to determine if hiring goals are being met. [EX 2020/IM 2021]	Examine (EX) key area to enhance recruitment Examine use of advanced applicant assessments to help improve the quality of applicant pools for highly skilled positions at the NIH and determine whether or not there is an impact on hiring and retention. [IM 2022/AS 2023]	N/A
MPO-4 Reallocate laboratory resources based on external reviews by Boards of Scientific Counselors (BSC). (Output)	FY 2021: 25 percent of Principal Investigators were reviewed resulting in approximately 25 percent of resources recommended to be reallocated. Target: Conduct BSC reviews annually of 25 percent of Principal Investigators to assess quality of science and prioritize resources. (Target Met)	Conduct BSC reviews annually of 25 percent of Principal Investigators to assess quality of science and prioritize resources.	Conduct BSC reviews annually of 25 percent of Principal Investigators to assess quality of science and prioritize resources.	N/A
MPO-5 Improve facility conditions in order to reach and maintain a Condition Index (CI) weighted average of 85 or above	FY 2021: The condition of the facilities portfolio reached a CIwa of 75.6. Target: CIwa = 77.63	N/A	N/A	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2022 Target	FY 2023 Target	FY 2023 Target +/-FY 2022 Target
(CIwa=85). (Output and Efficiency)	(Target Not Met)			
MPO-7 Manage all Buildings and Facilities (B&F) line-item projects so it is completed within 100 percent of the final approved project cost. (Ongoing) (Output)	FY 2021: 31 of the 36 active projects at the Facility Project Approval Agreement (FPAA) level threshold were effectively managed to ensure completion within 100 percent of the final approved cost. Target: 21 Active Projects (Target Exceeded)	28 Active Projects	24 Active Projects	N/A
MPO-8 Manage design and construction of capital facility projects funded by B&F so that no more than 10 percent of the projects may incorporate plus or minus 10 percent adjustments of the approved scope. (Ongoing) (Output)	FY 2021: NIH managed the design and construction of 32 of the 36 funded projects within a plus or minus 10 percent adjustment to the scope. Target: 21 Active Projects (Target Exceeded)	28 Active Projects	24 Active Projects	N/A
MPO-9 Utilize performance-based contracting (PBC). (ongoing) (Output)	FY 2021: Obligated 47 percent of eligible service contracting dollars to PBC. Target: Obligate the FY 2021 goal of eligible service contracting dollars to PBC. (Target Met)	Obligate the FY 2022 goal of eligible service contracting dollars to PBC.	Obligate the FY 2023 goal of eligible service contracting dollars to PBC.	N/A
MPO-11 Verify 75 percent of awarded state-of-the-art instruments are installed at NIH-supported research institutions across the nation. (Output)	FY 2021: Of the 134 grant awards, 88 instruments (66 percent) were installed within 18 months of the Notice of Award date. A large number of grantees requested no-cost extensions due to the COVID-19 pandemic and related supply chain issues. Target: Verify 75 percent of awarded state-of-the-art instruments are installed at	Verify 60 percent of awarded state-of-the-art instruments are installed at NIH-supported research institutions across the nation 24 months after award.	Verify 60 percent of awarded state-of-the-art instruments are installed at NIH-supported research institutions across the nation 24 months after award.	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2022 Target	FY 2023 Target	FY 2023 Target +/-FY 2022 Target
	NIH-supported research institutions across the nation 18 months after a ward. (Target Not Met)			

GRANT AWARDS TABLE

	FY 2021 Final[3]	FY 2022 CR[3]	FY 2023 President's Budget[a,3]
Number of Awards	50,442	50,078	52,180
Average Award (in Whole $s)	$595,893	$595,859	$606,639
Range of Awards (in Whole $s)[1,2]	$1,000 to $52,933,106	$1,000 to $38,910,110	$1,000 to $39,373,218

[1] Award range excludes minimum values of zero to under $1,000 related primarily to no-cost extensions and co-funded actions.

[2] Award maximum estimates are based on an extrapolation from the most recent historical actual while accounting for expected budget policies applicable to each future fiscal year. The actual year-to-year fluctuations are roughly eight million dollars, plus or minus.

[3] Includes 21st Century Cures Act funding.

[a] Figures do not include any awards related to the recently established ARPA-H or proposed mandatory funding for pandemic preparedness activities.

NEF NARRATIVE

Budget Summary
(Dollars in Thousands)

	FY 2021	FY 2022	FY 2023[67]
Notification[68]	$225,000	--	$63,140

Authorizing Legislation:
Authorization…….Section 223 of Division G of the Consolidated Appropriations Act, 2008
Allocation Method……..…..Direct Federal, Competitive Contract

Overview of NEF
The Nonrecurring Expenses Fund (NEF) permits HHS to transfer unobligated balances of expired discretionary funds from FY 2008 and subsequent years into the NEF account. Congress authorized use of the funds for capital acquisitions necessary for the operation of the Department, specifically information technology (IT) and facilities infrastructure acquisitions.

Please see Exhibit A for a summary of the total NEF amount NIH has received, per fiscal year.

Program Description

In FY 2023, NIH plans to use $63.1 million in NEF resources to improve the safety and electrical power reliability in the Clinical Center Complex through replacement and upgrades of aging services with safe, state-of-of the art, cost effective, contiguous, and secure electrical systems. Additionally, NEF funds will be used for the Rocky Mountain Laboratories campus to improve, centralize, consolidate, and integrate support functions.

Program Accomplishments

The Surgery, Radiology and Lab Medicine Building (SRLM) on the Bethesda campus received $437.4 million in FY 2020 and FY 2021 combined for the development of enhanced bridging documents and the design build construction of the project. This project will construct a new addition and repurpose two floors of the west laboratory wing of the Clinical Research Center (CRC). The project will include the Clinical Center's (CC) Surgical (Department of Perioperative Medicine and Interventional Radiology – DPM/IR), Radiology (Radiology and Imaging Sciences – RADIS) and the Laboratory Medicine (Department of Laboratory Medicine - DLM) departments now located in the 1982-era Ambulatory Care Research Facility's (ACRF) wings S&T and the National Cancer Institute's (NCI) research laboratories. These departments involve some of the most advanced and technology dependent cutting-edge programs supporting NIH's Translational Research initiatives. The project is focused on developing a facility that

[67] HHS has not yet notified for FY 2023.
[68] Pursuant to Section 223 of Division G of the Consolidated Appropriation Act, 2008, notification is required of planned use. Indicates the amount HHS intends to notify for in 2023; these amounts are planned estimates and subject to final approval.

supports medical research initiatives to improve the nation's health and strengthen NIH's biomedical research capacity in close proximity to the CRC. The most recent "Building Condition Index" conducted by the NIH has the ACRF in the POOR category. The new wing will be an 8-story above-grade structure, plus one floor below grade and a mechanical penthouse. A below-grade Cardiovascular Intervention Program (CIP) suite is also planned. The funds for the Enhanced Bridging Documents ($12 million) have been obligated; the funds for the D/B construction will be obligated in early FY 2022.

In FY 2020 $12.6 million was allocated for the Building Automation System (BAS) Replacement, Building 10, Bethesda. The project is to upgrade and replace the obsolete Johnson Controls, Inc. (JCI) BAS with a new state-of-the-art, cost-effective, contiguous, simple, and secure system. The upgrade includes replacement of primary network controllers, controllers serving air-moving equipment and associated sensors, controllers serving hydronic systems and associated sensors, and replacement of pneumatic actuators with electronic actuators. To a large extent, existing network and end device wiring will remain and be reused. These funds have been obligated.

In FY 2019, $63.5 million was allocated to the NIH for construction of the Utility Vault and Patient Parking Garage on the Bethesda campus. The new Utility Vault and Parking Garage will: 1) ensure the reliability and long-term sustainability of the electrical power feeds to the 4.5 million square foot hospital and biomedical research complex; 2) mitigate the security risk, personal safety risk, and liability risk associated with the existing underground parking garage; and 3) enable the new SRLM Building addition. These funds have been obligated.

In FY 2019, $19.5 million was allocated to the NIH for Phase 1 of the Electrical Power Reliability program to replace failing and unreliable electrical power systems in the CCC on the Bethesda campus. The work under the program will be executed under four phases to replace the most critical vaults first and work through critical upgrades to the rest. These funds have been obligated.

In FY 2017, $35.3 million was allocated for the replacement of Refrigerant Chillers. This project involves replacing two existing dual steam turbine/electric driven chillers. Due to the efficiency achieved in the current chilled water upgrades accomplished between 2013 and 2015 and the additional efficiency and capacity of the four new chillers the remaining four chillers will not have to be replaced. The refrigerant removed from the demolished chillers will be used as backup for the four remaining chillers if needed. These funds have been obligated.

In FY 2017, $16.5 million was allocated for Emergency Generators to support the Centralized Utility Plant (CUP). This project will direct the new emergency power generator or generators toward the startup of the plant should a loss of power occur from the local utility. To protect the critical mission of the NIH from disruption if the electric utility service for any reason suffers a severe voltage reduction or loss of the electrical system, the COGEN system and campus electric distribution system would automatically shut down and restart through the new emergency generation system. This system will guarantee uninterrupted cooling and steam service to the most critical facilities on campus. These funds have been obligated.

In FY 2016, $162.1 million was allocated for the Renovation of the E-Wing in the NIH Clinical Center (Building 10). The renovation is the conversion of 217,285 gross square feet of former patient care and laboratory areas on Floors 2 through 13 to build out laboratory, laboratory support space and offices for 520 personnel in the clinical research programs of the National Institute of Allergy and Infectious Disease (NIAID), National Cancer Institute (NCI), National Heart, Lung, and Blood Institute (NHLBI), National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), National Institute of Mental Health (NIMH), National Institute of Neurological Disorders and Stroke (NINDS), National Eye Institute (NEI), National Human Genome Research Institute, National Institute of Dental and Craniofacial Research (NIDCR) and the National Center for Complementary and Integrative Health (NCCIH). These funds have been obligated.

Exhibit A: NEF Amounts Received by NIH for FY 2016-2021

(In millions of dollars)

Project	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021
E-Wing Renovation, Building 10, Bethesda, MD	$ 162.10					
R22 Refrigerant Chillers Replacement, Bethesda, MD		$ 35.27				
Emergency Power Generators to Assure Chilled Water, Bethesda		$ 16.48				
Surgery, Radiology and Lab Medicine Building (SRLM), Bethesda, MD		$ -			$ 212.40	$ 225.00
Electrical Power Reliability, Building 10, Bethesda. MD			$ -	$ 19.50		
Building Automation System (BAS) Replacement, Bldg 10, Bethesda, MD				$ -	$ 12.60	
Utility Vault and Patient Parking Garage, Bethesda, MD			$ -	$ 63.54		
Totals:	$ 162.10	$ 51.75	$ -	$ 83.04	$ 225.00	$ 225.00

BUDGET REQUEST BY IC (SUMMARY TABLE)

(Dollars in Thousands)[1]	FY 2021 Final[5,6]	FY 2022 CR[6]	FY 2023 President's Budget[6]
NCI	$6,539,696	$6,559,852	$6,713,851
NHLBI	$3,653,700	$3,664,811	$3,822,961
NIDCR	$483,387	$484,867	$513,191
NIDDK[2]	$2,275,530	$2,273,425	$2,347,530
NINDS	$2,503,517	$2,513,393	$2,768,043
NIAID	$6,048,849	$6,069,619	$6,268,313
NIGMS[3]	$2,986,253	$2,991,417	$3,097,557
NICHD	$1,588,197	$1,590,337	$1,674,941
NEI	$833,012	$835,714	$853,355
NIEHS[4]	$893,722	$896,175	$1,015,091
NIA	$3,888,220	$3,899,227	$4,011,413
NIAMS	$632,382	$634,292	$676,254
NIDCD	$496,578	$498,076	$508,704
NIMH	$2,099,736	$2,103,708	$2,210,828
NIDA	$1,475,867	$1,479,660	$1,843,326
NIAAA	$553,216	$554,923	$566,725
NINR	$174,411	$174,957	$198,670
NHGRI	$614,163	$615,780	$629,154
NIBIB	$409,493	$410,728	$419,493
NIMHD	$390,413	$390,865	$659,817
NCCIH	$153,616	$154,162	$183,368
NCATS	$852,853	$855,421	$873,654
FIC	$83,761	$84,044	$95,801
NLM	$460,746	$463,787	$471,998
OD	$2,521,605	$2,519,401	$2,728,665
ARPA-H	---	---	$5,000,000
Pandemic preparedness	---	---	$12,050,000
B&F	$199,400	$200,000	$300,000
Total, NIH Program Level	**$42,812,323**	**$42,918,641**	**$62,502,703**
Special Type 1 Diabetes Research (mandatory)	-$150,000	-$141,450	-$141,450
Pandemic preparedness (mandatory)	---	---	-$12,050,000
PHS Program Evaluation	-$1,271,505	-$1,271,505	-$1,271,505
Interior Appropriation (Superfund Research)	-$81,500	-$81,500	-$83,035
Total, NIH Labor/HHS Budget Authority	**$41,309,318**	**$41,424,186**	**$48,956,713**

[1] Includes funding derived by transfer from the NIH Innovation Account under the 21st Century Cures Act.

[2] Includes Type 1 Diabetes mandatory funding as shown later in the table.

[3] Includes Program Evaluation financing as shown later in the table.

[4] Includes Interior Appropriation for Superfund Research activities as shown later in the table.

[5] Amounts for FY 2021 reflect HIV/AIDS transfers across ICs under the authority of the Office of AIDS Research.

[6] Reflects directive transfer of $5.0 million from OD to the HHS Office of Inspector General.

APPROPRIATIONS ADJUSTMENT TABLE FOR FY 2021

(Dollars in Thousands)	FY 2021 Enacted	Permissive Transfer (NIH Innovation Account)[3]	OIG Transfer[4]	Secretary's Transfer	HIV/AIDS Transfer[5]	FY 2021 Final
NCI	$6,364,852	$195,000		-$19,109	-$1,047	$6,539,696
NHLBI	$3,664,811			-$11,003	-$108	$3,653,700
NIDCR	$484,867			-$1,456	-$24	$483,387
NIDDK[1]	$2,281,975			-$6,401	-$44	$2,275,530
NINDS	$2,463,393	$50,000		-$7,396	-$2,480	$2,503,517
NIAID	$6,069,619			-$18,222	-$2,548	$6,048,849
NIGMS	$2,991,417			-$5,164		$2,986,253
NICHD	$1,590,337			-$4,775	$2,635	$1,588,197
NEI	$835,714			-$2,509	-$193	$833,012
NIEHS[2]	$896,175			-$2,446	-$7	$893,722
NIA	$3,899,227			-$11,706	$699	$3,888,220
NIAMS	$634,292			-$1,904	-$6	$632,382
NIDCD	$498,076			-$1,495	-$3	$496,578
NIMH	$2,053,708	$50,000		-$6,166	$2,194	$2,099,736
NIDA	$1,479,660			-$4,442	$649	$1,475,867
NIAAA	$554,923			-$1,666	-$41	$553,216
NINR	$174,957			-$525	-$21	$174,411
NHGRI	$615,780			-$1,849	$232	$614,163
NIBIB	$410,728			-$1,233	-$2	$409,493
NIMHD	$390,865			-$1,173	$721	$390,413
NCCIH	$154,162			-$463	-$83	$153,616
NCATS	$855,421			-$2,568		$852,853
FIC	$84,044			-$252	-$31	$83,761
NLM	$463,787			-$1,392	-$1,649	$460,746
OD	$2,827,710	-$295,000	-$5,000	-$7,262	$1,157	$2,521,605
B&F	$200,000			-$600		$199,400
Total, NIH Program Level	**$42,940,500**	**$0**	**-$5,000**	**-$123,177**	**$0**	**$42,812,323**
Less funds allocated from different sources:						
Mandatory Type 1 Diabetes Research	-$150,000					-$150,000
PHS Program Evaluation	-$1,271,505					-$1,271,505
Total, NIH Discretionary Budget Authority	**$41,518,995**	**$0**	**-$5,000**	**-$123,177**	**$0**	**$41,390,818**
Interior Budget Authority	-$81,500					-$81,500
Total, NIH Labor/HHS Budget Authority	**$41,437,495**	**$0**	**-$5,000**	**-$123,177**	**$0**	**$41,309,318**

[1]Includes Type 1 Diabetes.

[2]Includes Superfund Research activity.

[3]Reflects redistribution of NIH Innovation account for the 21st Century Cures Act.

[4]Reflects directive transfer of $5.0 million from OD to the HHS Office of Inspector General.

[5]Reflects HIV/AIDS transfers across ICs under the authority of the Office of AIDS Research.

APPROPRIATIONS ADJUSTMENT TABLE FOR FY 2022

(Dollars in Thousands)	FY 2022 Continuing Resolution (CR)[3]	Type 1 Diabetes Sequestration	Gabriella Miller Fund Limitation[4]	Permissive Transfer (NIH Innovation Account)[5]	OIG Transfer[6]	HIV/AIDS Transfer	FY 2022 CR Operating Level
NCI	$6,364,852			$195,000			$6,559,852
NHLBI	$3,664,811						$3,664,811
NIDCR	$484,867						$484,867
NIDDK[1]	$2,281,975	-$8,550					$2,273,425
NINDS	$2,463,393			$50,000			$2,513,393
NIAID	$6,069,619						$6,069,619
NIGMS	$2,991,417						$2,991,417
NICHD	$1,590,337						$1,590,337
NEI	$835,714						$835,714
NIEHS[2]	$896,175						$896,175
NIA	$3,899,227						$3,899,227
NIAMS	$634,292						$634,292
NIDCD	$498,076						$498,076
NIMH	$2,053,708			$50,000			$2,103,708
NIDA	$1,479,660						$1,479,660
NIAAA	$554,923						$554,923
NINR	$174,957						$174,957
NHGRI	$615,780						$615,780
NIBIB	$410,728						$410,728
NIMHD	$390,865						$390,865
NCCIH	$154,162						$154,162
NCATS	$855,421						$855,421
FIC	$84,044						$84,044
NLM	$463,787						$463,787
OD	$2,827,710		-$8,309	-$295,000	-$5,000		$2,519,401
B&F	$200,000						$200,000
Total, NIH Program Level	**$42,940,500**	**-$8,550**	**-$8,309**	**$0**	**-$5,000**	**$0**	**$42,918,641**
Less funds allocated from different sources:							
Mandatory Type 1 Diabetes Research	-$150,000	$8,550					-$141,450
PHS Program Evaluation	-$1,271,505						-$1,271,505
Total, NIH Discretionary Budget Authority	**$41,518,995**	**$0**	**-$8,309**	**$0**	**-$5,000**	**$0**	**$41,505,686**
Interior Budget Authority	-$81,500						-$81,500
Total, NIH Labor/HHS Budget Authority	**$41,437,495**	**$0**	**-$8,309**	**$0**	**-$5,000**	**$0**	**$41,424,186**

[1]Includes Type 1 Diabetes.

[2]Includes Superfund Research activity.

[3]Reflects annualized level from the FY 2022 CR.

[4]Reflects reduction in appropriation from the 10-Year Pediatric Research Initiative Fund as limited by fund balances.

[5]Reflects redistribution of NIH Innovation account for the 21st Century Cures Act.

[6]Reflects directive transfer of $5.0 million from OD to the HHS Office of Inspector General.

BUDGET MECHANISM TABLE

Budget Mechanism - Total[1,2,3]

(Dollars in Thousands)[1,2,3]	FY 2021 Final[8,9]		FY 2022 Continuing Resolution (CR)[9,10]		FY 2023 President's Budget[9]		FY 2023 +/- FY 2022 CR	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount
Research Projects:								
Noncompeting	28,492	$15,937,228	29,502	$17,090,998	29,301	$17,543,339	-201	$452,341
Administrative Supplements[3]	*(2,912)*	483,523	*(2,326)*	331,645	*(2,285)*	356,660	*(-41)*	25,015
Competing	11,258	$6,748,930	9,806	$5,603,786	11,878	$6,804,460	2,072	$1,200,674
Subtotal, RPGs	39,750	$23,169,681	39,308	$23,026,429	41,179	$24,704,459	1,871	$1,678,030
SBIR/STTR	1,863	1,176,827	1,837	1,158,777	1,950	1,228,333	113	69,556
Research Project Grants	41,613	$24,346,508	41,145	$24,185,206	43,129	$25,932,792	1,984	$1,747,585
Research Centers:								
Specialized/Comprehensive	1,024	$2,034,952	1,047	$2,047,849	1,122	$2,173,695	75	$125,846
Clinical Research	71	421,204	68	418,049	53	313,820	-15	-104,230
Biotechnology	61	92,492	59	89,489	60	92,791	1	3,302
Comparative Medicine	48	143,583	48	140,554	47	138,903	-1	-1,651
Research Centers in Minority Institutions	21	78,151	21	78,241	25	86,489	4	8,248
Research Centers	1,225	$2,770,381	1,243	$2,774,182	1,307	$2,805,697	64	$31,515
Other Research:								
Research Careers	4,684	$880,798	4,736	$903,266	4,851	$923,027	115	$19,762
Cancer Education	68	17,633	25	17,650	30	21,439	5	3,789
Cooperative Clinical Research	249	487,472	244	447,241	279	483,142	35	35,901
Biomedical Research Support	138	103,688	113	88,872	118	91,872	5	3,000
Minority Biomedical Research Support	282	95,012	263	82,094	137	50,957	-126	-31,137
Other	2,183	1,356,525	2,309	1,340,933	2,329	1,345,505	20	4,572
Other Research	7,604	$2,941,127	7,690	$2,880,055	7,744	$2,915,942	54	$35,887
Total Research Grants	50,442	$30,058,017	50,078	$29,839,444	52,180	$31,654,431	2,102	$1,814,987
Ruth L Kirchstein Training Awards:	FTTPs		FTTPs		FTTPs		FTTPs	
Individual Awards	4,196	$200,745	4,238	$207,387	4,264	$212,933	26	$5,546
Institutional Awards	12,792	725,697	13,570	776,198	13,845	819,746	275	43,548
Total Research Training	16,988	$926,442	17,808	$983,585	18,109	$1,032,679	301	$49,094
Research & Develop. Contracts	2,427	$3,355,475	2,450	$3,420,727	2,576	$3,568,852	126	$148,125
(SBIR/STTR) (non-add)[3]	*(103)*	*(60,525)*	*(102)*	*(58,412)*	*(101)*	*(62,482)*	*(-1)*	*(4,070)*
Intramural Research		$4,538,642		$4,638,391		$4,763,453		$125,062
Res. Management & Support		2,049,666		2,145,807		2,255,892		110,084
Res. Management & Support (SBIR Admin) (non-add)[3]		*(7,493)*		*(10,362)*		*(10,467)*		*(105)*
Office of the Director - Appropriation[3,4]		*(2,521,605)*		*(2,519,401)*		*(2,728,665)*		*(209,264)*
Office of the Director - Other		1,573,180		1,579,186		1,764,361		185,174
ORIP (non-add)[3,4]		*(299,885)*		*(299,985)*		*(305,765)*		*(5,781)*
Common Fund (non-add)[3,4]		*(648,539)*		*(640,230)*		*(658,539)*		*(18,309)*
ARPA-H		0		0		5,000,000		5,000,000
Buildings and Facilities[5]		229,400		230,000		330,000		100,000
Appropriation[3]		*(199,400)*		*(200,000)*		*(300,000)*		*(100,000)*
Type 1 Diabetes[6,7]		-150,000		-141,450		-141,450		0
Program Evaluation Financing[6]		-1,271,505		-1,271,505		-1,271,505		0
Subtotal, Labor/HHS Budget Authority		**$41,309,318**		**$41,424,186**		**$48,956,713**		**$7,532,527**
Interior Appropriation for Superfund Research		81,500		81,500		83,035		1,535
Total, NIH Discretionary Budget Authority		**$41,390,818**		**$41,505,686**		**$49,039,748**		**$7,534,062**
Type 1 Diabetes[7]		150,000		141,450		141,450		0
Pandemic preparedness		0		0		12,050,000		12,050,000
Total, NIH Budget Authority		**$41,540,818**		**$41,647,136**		**$61,231,198**		**$19,584,062**
Program Evaluation Financing		1,271,505		1,271,505		1,271,505		0
Total, Program Level		**$42,812,323**		**$42,918,641**		**$62,502,703**		**$19,584,062**

1 All Subtotal and Total numbers may not add due to rounding.
2 Includes 21st Century Cures Act funding and excludes supplemental financing.
3 All numbers in italics and brackets are non-add.
4 Number of grants and dollars for the Common Fund and ORIP components of OD are distributed by mechanism and are noted here as non-adds. Office of the Director - Appropriation is the non-add total of these amounts and the funds accounted for under OD - Other.
5 Includes B&F appropriation and monies allocated pursuant to appropriations acts provisions such that funding may be used for facilities repairs and improvements at the NCI Federally Funded Research and Development Center in Frederick, Maryland.
6 Number of grants and dollars for mandatory Type 1 Diabetes (T1D) and NIGMS Program Evaluation financing are distributed by mechanism above; therefore, T1D and Program Evaluation financing amounts are deducted to provide subtotals for Labor/HHS Budget Authority.
7 Amounts in FY 2022 and FY 2023 reflect a reduction of $8.550 million for Budget Control Act sequestration.
8 Reduced by a Secretary's Transfer of $123.177 million.
9 Reduced by a transfer of $5.0 million from OD to the HHS Office of Inspector General.
10 Reflects the annualized amounts provided in the continuing resolution ending 3/11/2022.

BUDGET AUTHORITY BY OBJECT CLASS

NATIONAL INSTITUTES OF HEALTH

FY 2023 Budget Authority by Object Class

Including Mandatory Type I Diabetes & Pandemic Preparedness Funds[1]

(Dollars in Thousands)[1]

Object Classes	FY 2022 Continuing Resolution (CR)	FY 2023 President's Budget	FY 2023 +/- FY 2022 CR
Personnel Compensation			
Full-Time Permanent (11.1)	$1,220,114	$1,313,177	$93,063
Other Than Full-Time Permanent (11.3)	611,161	646,377	35,216
Other Personnel Compensation (11.5)	74,326	78,166	3,840
Military Personnel (11.7)	14,381	15,372	991
Special Personnel Services Payments (11.8)	223,579	234,601	11,022
Subtotal Personnel Compensation (11.9)	**$2,143,561**	**$2,287,693**	**$144,132**
Civilian Personnel Benefits (12.1)	723,687	770,837	47,150
Military Personnel Benefits (12.2)	11,861	12,724	864
Benefits to Former Personnel (13.0)	0	0	0
Total Pay Costs	**$2,879,108**	**$3,071,254**	**$192,146**
Travel & Transportation of Persons (21.0)	9,545	11,163	1,618
Transportation of Things (22.0)	7,696	7,704	7
Rental Payments to GSA (23.1)	31,613	30,181	-1,432
Rental Payments to Others (23.2)	256	258	1
Communications, Utilities & Misc. Charges (23.3)	12,092	12,095	3
Printing & Reproduction (24.0)	183	183	1
Consultant Services (25.1)	1,383,781	1,425,969	42,188
Other Services (25.2)	1,500,775	1,562,081	61,306
Purchase of goods and services from government accounts (25.3)	3,046,422	3,146,345	99,923
Operation & Maintenance of Facilities (25.4)	46,026	46,193	167
R&D Contracts (25.5)	1,553,027	13,706,894	12,153,868
Medical Care (25.6)	38,966	40,080	1,113
Operation & Maintenance of Equipment (25.7)	174,116	179,755	5,639
Subsistence & Support of Persons (25.8)	8	8	0
Subtotal Other Contractual Services (25.0)	**$7,743,122**	**$20,107,326**	**$12,364,204**
Supplies & Materials (26.0)	247,524	252,029	4,505
Equipment (31.0)	224,396	232,140	7,744
Land and Structures (32.0)	120,484	217,725	97,241
Investments & Loans (33.0)	0	0	0
Grants, Subsidies & Contributions (41.0)	30,289,579	37,206,068	6,916,489
Insurance Claims & Indemnities (42.0)	0	0	0
Interest & Dividends (43.0)	38	38	0
Refunds (44.0)	0	0	0
Subtotal Non-Pay Costs	**$38,686,527**	**$58,076,909**	**$19,390,382**
Total Budget Authority	**$41,565,636**	**$61,148,163**	**$19,582,527**

[1] Excludes the Superfund Research account under the jurisdiction of the Interior & Related Agencies Appropriations Subcommittee, Program Evaluation financing, and supplemental appropriations.

BUDGET AUTHORITY BY OBJECT CLASS INCLUDING SSF AND MF

NATIONAL INSTITUTES OF HEALTH

FY 2023 Budget Authority by Object Class Including Service and Supply Fund and Management Fund[1]

(Dollars in Thousands)[1]

Object Classes	FY 2022 Continuing Resolution (CR)	FY 2023 President's Budget	FY 2023 +/- FY 2022 CR
Personnel Compensation			
Full-Time Permanent (11.1)	$1,676,397	$1,786,534	$110,137
Other Than Full-Time Permanent (11.3)	662,355	699,486	37,131
Other Personnel Compensation (11.5)	118,535	124,030	5,494
Military Personnel (11.7)	24,633	26,008	1,375
Special Personnel Services Payments (11.8)	231,497	242,815	11,319
Subtotal Personnel Compensation (11.9)	**$2,713,417**	**$2,878,873**	**$165,456**
Civilian Personnel Benefits (12.1)	922,703	976,665	53,962
Military Personnel Benefits (12.2)	18,537	19,650	1,114
Benefits to Former Personnel (13.0)	1,624	1,624	0
Total Pay Costs	**$3,656,280**	**$3,876,813**	**$220,533**
Travel & Transportation of Persons (21.0)	12,234	13,886	1,652
Transportation of Things (22.0)	9,181	9,203	22
Rental Payments to GSA (23.1)	100,094	99,826	-268
Rental Payments to Others (23.2)	64,372	65,462	1,090
Communications, Utilities & Misc. Charges (23.3)	108,954	110,572	1,618
Printing & Reproduction (24.0)	194	192	-1
Consultant Services (25.1)	679,152	706,354	27,202
Other Services (25.2)	2,892,181	2,977,430	85,249
Purchase of goods and services from government accounts (25.3)	673,263	723,966	50,702
Operation & Maintenance of Facilities (25.4)	166,419	168,393	1,974
R&D Contracts (25.5)	1,563,254	13,717,288	12,154,034
Medical Care (25.6)	57,041	58,196	1,155
Operation & Maintenance of Equipment (25.7)	409,913	419,131	9,219
Subsistence & Support of Persons (25.8)	11	11	0
Subtotal Other Contractual Services (25.0)	**$6,441,234**	**$18,770,771**	**$12,329,536**
Supplies & Materials (26.0)	444,565	450,218	5,653
Equipment (31.0)	288,014	296,494	8,480
Land and Structures (32.0)	150,824	248,546	97,722
Investments & Loans (33.0)	0	0	0
Grants, Subsidies & Contributions (41.0)	30,289,584	37,206,074	6,916,489
Insurance Claims & Indemnities (42.0)	3	3	0
Interest & Dividends (43.0)	102	103	1
Refunds (44.0)	0	0	0
Subtotal Non-Pay Costs	**$37,909,355**	**$57,271,350**	**$19,361,995**
Total Budget Authority	**$41,565,636**	**$61,148,163**	**$19,582,527**

[1] Excludes the Superfund Research account under the jurisdiction of the Interior & Related Agencies Appropriations Subcommittee, Program Evaluation financing, and supplemental appropriations.

SALARIES AND EXPENSES

FY 2023 Budget Authority by Object Class Including Type I Diabetes Funds[1]
Salaries and Expenses / Administrative Expenses

(Dollars in Thousands)[1]

Object Classes	FY 2022 Continuing Resolution (CR)	FY 2023 President's Budget	FY 2023 +/- FY 2022 CR
Personnel Compensation			
Full-Time Permanent (11.1)	$1,220,114	$1,313,177	$93,063
Other Than Full-Time Permanent (11.3)	611,161	646,377	35,216
Other Personnel Compensation (11.5)	74,326	78,166	3,840
Military Personnel (11.7)	14,381	15,372	991
Special Personnel Services Payments (11.8)	223,579	234,601	11,022
Subtotal Personnel Compensation (11.9)	**$2,143,561**	**$2,287,693**	**$144,132**
Civilian Personnel Benefits (12.1)	723,687	770,837	47,150
Military Personnel Benefits (12.2)	11,861	12,724	864
Benefits to Former Personnel (13.0)	0	0	0
Total Pay Costs	**$2,879,108**	**$3,071,254**	**$192,146**
Travel & Transportation of Persons (21.0)	9,545	11,163	1,618
Transportation of Things (22.0)	7,696	7,704	7
Rental Payments to Others (23.2)	256	258	1
Communications, Utilities & Misc. Charges (23.3)	12,092	12,095	3
Printing & Reproduction (24.0)	183	183	1
Other Contractual Services:			
Consultant Services (25.1)[2]	1,256,983	1,279,698	22,715
Other Services (25.2)	1,500,775	1,562,081	61,306
Purchase of goods and services from government accounts (25.3)[2]	2,017,372	2,076,374	59,002
Operation & Maintenance of Facilities (25.4)[2]	46,026	46,193	167
Operation & Maintenance of Equipment (25.7)	174,116	179,755	5,639
Subsistence & Support of Persons (25.8)	8	8	0
Subtotal Other Contractual Services	**$4,995,281**	**$5,144,110**	**$148,829**
Supplies & Materials (26.0)	247,524	252,029	4,505
Subtotal Non-Pay Costs	**$5,242,577**	**$5,397,541**	**$154,964**
Total Salaries and Expense / Administrative Costs	**$8,121,686**	**$8,452,795**	**$331,110**

[1] Excludes the Superfund Research account under the jurisdiction of the Interior & Related Agencies Appropriations Subcommittee, Program Evaluation financing, and supplemental appropriations.

[2] Excludes obligations from accounts (OC 25.1, 25.3 and 25.4) supporting Program Evaluations and Inter-agency Agreements related to the Research and Development Contracts mechanism.

DETAIL OF FULL-TIME EQUIVALENT (FTE) EMPLOYMENT

Institutes and Centers	FY 2021 Actual	FY 2022 Estimate	FY 2023 Estimate
NCI	3,097	3,245	3,320
NHLBI	863	966	966
NIDCR	241	252	252
NIDDK	666	691	706
NINDS	554	607	632
NIAID	2,078	2,180	2,180
NIGMS	180	184	209
NICHD	535	591	602
NEI	285	290	290
NIEHS	642	672	685
NIA	483	520	600
NIAMS	229	238	242
NIDCD	134	140	140
NIMH	567	589	589
NIDA	389	398	398
NIAAA	215	238	238
NINR	83	111	111
NHGRI	347	375	385
NIBIB	97	124	129
FIC	58	61	61
NIMHD	68	140	210
NCCIH	78	90	100
NCATS	237	277	298
NLM	659	741	741
OD	968	1,087	1,162
ARPA-H	---	---	75
Central Services:			
OD - CS	823	851	870
CC	1,949	2,035	2,035
CSR	422	450	464
CIT	227	247	247
ORS	507	537	539
ORF	731	752	830
Subtotal Central Services[1]	**4,659**	**4,872**	**4,985**
PHS Trust Fund (non-add)[2]	*4*	*4*	*4*
CRADA (non-add)[3]	*8*	*8*	*8*
Total	**18,412**	**19,679**	**20,306**

[1] Reflects FTE associated with Central Services positions whose payroll costs are financed from the NIH Management Fund and the NIH Service and Supply Fund.

[2] PHS Trust Fund positions are incorporated within the IC's Direct-funded civilian FTE category and are treated as non-add values.

[3] CRADA positions are distributed across multiple ICs and are treated as non-add values.

PROGRAMS PROPOSED FOR ELIMINATION

The FY 2023 request for the National Institutes of Health does not propose any programs for elimination.

PHYSICIAN'S COMPARABILITY ALLOWANCE WORKSHEET

		FY 2020 Actual	FY 2021 Actual	FY 2022 Estimate[1]	FY 2023 Estimate
1) Number of Physicians Receiving PCAs		100	107	107	107
2) Number of Physicians with One-Year PCA		7	6	6	6
3) Number of Physicians with Multi-Year PCA		93	101	101	101
4) Average Annual Physician Pay (without PCA payment)		$164,720	$169,099	$168,154	$175,090
5) Average Annual PCA Payment		$23,225	$21,292	$22,126	$23,039
6) Number of Physicians Receiving PCAs by Category (non-add)	Category I Clinical Position				
	Category II Research Position	100	106	106	106
	Category III Occupational Health				
	Category IV-A Disability Evaluation				
	Category IV-B Health and Medical Admin.	0	1	1	1

7) If applicable, list and explain the necessity of any additional physician categories designated by your agency (for categories other than I through IV-B). Provide the number of PCA agreements per additional category for the PY, CY and BY.

N/A

8) Provide the maximum annual PCA amount paid to each category of physician in your agency and explain the reasoning for these amounts by category.

Maximum annual PCA amount for category II and IV-B vary based on grade level, amount of federal service and length of the PCA agreement. The monetary range is between $4,000 and $30,000. These flexible amounts are necessary to recruit and retain the caliber of physician needed to carry out the NIH mission which directly impacts the health of the nation.

9) Explain the recruitment and retention problem(s) for each category of physician in your agency (this should demonstrate that a current need continues to persist).(Please include any staffing data to support your explanation, such as number and duration of unfilled positions and number of accessions and separations per fiscal year.)

NIH strives to make progress recruiting and retaining qualified physicians to the Federal service. However, due to competition and more lucrative compensation in the private sector it continues to be challenging. NIH consistently has had a high turnover rate for physicians. NIH physicians require unique and specialized qualifications that make it difficult to fill vacancies.

10) Explain the degree to which recruitment and retention problems were alleviated in your agency through the use of PCAs in the prior fiscal year. (Please include any staffing data to support your explanation, such as number and duration of unfilled positions and number of accessions and separations per fiscal year.)

In FY 2021, there were a total of 107 PCA recipients across NIH. In FY 2021 and beyond, as indicated by the minimal increase in recipients to-date relative to the prior year, the critical need continues to exist for highly qualified, specialized physicians to support the NIH mission. NIH still requires compensation flexibilities such as PCA to attract and retain qualified physicians.

11) Provide any additional information that may be useful in planning PCA staffing levels and amounts in your agency.

N/A

[1] FY 2022 data will be approved during the FY 2023 Budget cycle.

HISTORY OF OBLIGATIONS BY IC

(Dollars in Thousands)	FY 2013	FY 2014	FY 2015[1]	FY 2016[1]	FY 2017[1,6]	FY 2018[1,6,7]	FY 2019[1,6,8]	FY 2020[1,6,9]	FY 2021[1,6,10]	FY 2022[1,6,11] CR	FY 2023[1,6,12,13] President's Budget
NCI	$4,789,014	$4,932,368	$4,944,593	$5,206,169	$5,636,393	$5,948,569	$5,993,599	$6,418,988	$6,558,695	$6,744,958	$6,713,851
NHLBI	$2,903,768	$2,988,415	$2,995,546	$3,109,062	$3,209,843	$3,374,154	$3,482,237	$3,624,863	$3,653,569	$3,664,811	$3,822,961
NIDCR	$387,309	$397,833	$397,672	$412,788	$424,782	$446,656	$460,613	$477,644	$483,360	$484,867	$513,191
NIDDK[2]	$1,837,027	$1,884,377	$1,899,088	$1,963,738	$2,009,448	$1,989,700	$2,099,265	$2,220,977	$2,229,148	$2,564,781	$2,347,530
NINDS	$1,533,793	$1,588,899	$1,604,581	$1,692,830	$1,778,684	$1,949,067	$2,413,897	$2,443,099	$2,490,566	$2,534,496	$2,768,043
NIAID	$4,235,094	$4,401,185	$4,417,529	$4,749,884	$4,905,708	$5,262,398	$5,567,138	$5,880,084	$6,049,416	$6,069,619	$6,268,313
NIGMS[3]	$2,293,044	$2,366,429	$2,372,199	$2,508,868	$2,646,059	$2,780,954	$2,821,806	$2,937,142	$2,986,188	$2,991,417	$3,097,557
NICHD	$1,246,140	$1,283,314	$1,286,797	$1,338,280	$1,376,541	$1,449,613	$1,508,603	$1,556,841	$1,588,125	$1,590,337	$1,674,941
NEI	$657,055	$675,551	$676,726	$707,002	$731,203	$770,483	$793,767	$823,310	$832,967	$835,714	$853,355
NIEHS[4]	$721,331	$743,002	$745,533	$769,730	$789,860	$826,646	$850,793	$883,808	$893,521	$896,175	$1,015,091
NIA	$1,040,565	$1,171,656	$1,197,459	$1,596,005	$2,048,792	$2,571,438	$3,080,043	$3,545,814	$3,888,190	$3,899,227	$4,011,413
NIAMS	$505,206	$520,314	$521,480	$540,874	$556,568	$585,240	$602,907	$624,832	$632,353	$634,292	$676,254
NIDCD	$392,540	$404,237	$405,168	$422,311	$435,877	$458,876	$472,988	$490,687	$496,574	$498,076	$508,704
NIMH	$1,396,006	$1,419,632	$1,433,603	$1,516,325	$1,604,624	$1,754,423	$1,869,653	$2,044,852	$2,100,178	$2,106,046	$2,210,828
NIDA	$993,404	$1,017,957	$1,015,695	$1,048,971	$1,070,813	$1,161,149	$1,621,334	$1,457,683	$1,475,805	$1,479,660	$1,843,326
NIAAA	$433,247	$446,282	$447,152	$466,713	$482,449	$508,398	$525,282	$546,691	$553,201	$554,923	$566,725
NINR	$136,516	$140,553	$140,837	$145,701	$149,930	$157,633	$163,165	$172,342	$174,407	$174,957	$198,670
NHGRI	$483,650	$498,076	$498,648	$512,486	$528,316	$556,741	$575,361	$604,083	$614,131	$615,780	$629,154
NIBIB	$319,062	$326,989	$327,223	$342,997	$356,971	$376,700	$388,079	$404,616	$409,461	$410,728	$419,493
NIMHD	$260,671	$268,439	$270,480	$280,264	$287,640	$304,372	$313,195	$335,799	$389,453	$390,865	$659,817
NCCIH	$120,767	$124,368	$124,046	$129,760	$134,373	$141,667	$145,933	$151,871	$153,601	$154,162	$183,368
NCATS	$542,598	$633,571	$632,629	$684,366	$704,248	$754,080	$847,430	$832,856	$852,792	$855,421	$873,654
FIC	$65,627	$67,575	$67,576	$69,996	$71,813	$75,534	$77,894	$80,811	$83,752	$84,044	$95,801
NLM[5]	$325,088	$334,383	$336,653	$393,074	$406,250	$424,789	$441,645	$456,584	$460,083	$463,787	$471,998
ORIP	$290,042	$294,486	$294,662	$295,783	$279,130	$289,205	$288,096	$293,970	$299,884	$299,985	$305,765
Common Fund	$513,461	$531,146	$545,607	$675,628	$695,430	$600,707	$619,166	$639,111	$648,538	$640,230	$658,539
OD - Other	$608,584	$477,293	$573,328	$599,263	$714,058	$1,016,632	$1,185,155	$1,467,130	$1,560,407	$1,655,130	$1,764,361
B&F	$106,676	$88,880	$123,464	$79,883	$113,415	$106,434	$211,107	$108,709	$179,715	$200,000	$300,000
Pandemic Preparedness	---	---	---	---	---	---	---	---	---	---	$12,050,000
ARPA-H	---	---	---	---	---	---	---	---	---	---	$5,000,000
Total, NIH Program Level	**$29,137,284**	**$30,027,205**	**$30,295,974**	**$32,258,751**	**$34,149,217**	**$36,642,258**	**$39,420,151**	**$41,525,195**	**$42,738,079**	**$43,494,488**	**$62,502,703**
Less funds allocated from different sources:											
Mandatory - Special type 1 Diabetes Research	-$142,350	-$139,200	-$150,000	-$150,000	-$139,650	-$26,292	-$73,923	-$105,893	-$103,778	-$432,806	-$141,450
Mandatory - Pandemic Preparedness	---	---	---	---	---	---	---	---	---	---	-$12,050,000
PHS Program Evaluation	-$8,200	-$8,200	-$715,000	-$780,000	-$824,443	-$922,871	-$1,146,821	-$1,230,821	-$1,271,505	-$1,271,505	-$1,271,505
Total, NIH Discretionary Budget Authority	**$28,986,734**	**$29,879,805**	**$29,430,974**	**$31,328,751**	**$33,185,124**	**$35,693,095**	**$38,199,407**	**$40,188,481**	**$41,362,796**	**$41,790,177**	**$49,039,748**
Interior Budget Authority	-$74,864	-$77,345	-$77,349	-$77,252	-$77,337	-$77,342	-$78,988	-$80,993	-$81,488	-$81,500	-$83,035
Total, NIH Labor/HHS Budget Authority	**$28,911,870**	**$29,802,460**	**$29,353,625**	**$31,251,499**	**$33,107,787**	**$33,021,788**	**$38,120,419**	**$40,107,488**	**$41,281,308**	**$41,708,677**	**$48,956,713**

[1] Excludes Ebola, Zika and other supplemental funding or transfers.

[2] Includes Special type 1 Diabetes Research mandatory account funding. Obligations for FY 2021 and prior years can include amounts from carryover.

[3] Includes Program Evaluation Financing resources of $715,000,000 in FY 2015, $780,000,000 in FY 2016, $824,443,000 in FY 2017, $922,871,000 in FY 2018, $1,146,821,000 in FY 2019, $1,230,821,000 in FY 2020, and $1,271,505,000 in each year for FY 2021 through FY 2023.

[4] Includes Interior Appropriation allocation for Superfund Research activities.

[5] Includes PHS Program Evaluation financing of $8,200,000 for years before FY 2015.

[6] Includes funds under the 21st Century Cures Act.

[7] Includes obligations of $60,647,563 of 21st Century Cures carryover from FY 2017.

[8] Includes obligations of $429,883,740 of FY 2018 Opioids carryover in various ICs and $42,852,637 of 21st Century Cures carryover from FY 2017 and FY 2018 in various ICs and $415,197 of T1D carryover.

[9] Includes CURES carryover obligations of $230,278,992

[10] Includes obligations of $167,738,493 of 21st Century Cures Act funding which was appropriated in FY 2017 through FY 2020, but carried over into FY 2021. Similarly, includes obligations of $83,955,593 for Special Type 1 Diabetes research program using available funding from FY 2018 through FY 2020, but carried over into FY 2021. Obligations of carryover funding are distributed by mechanism.

[11] Includes obligations of $284,492,124 of 21st Century Cures Act funding which was appropriated in FY 2017 through FY 2021, but carried over into FY 2022. Similarly, includes obligations of $291,355,777 for Special Type 1 Diabetes research program using available funding from FY 2018 through FY 2021, but carried over into FY 2022.

[12] Amounts represent estimated or requested budget authority as opposed to obligations displayed in historical years.

[13] The FY 2023 Budget proposes funding for the recently established Advanced Research Projects Agency for Health (ARPA-H) as well as new mandatory funding for pandemic preparedness activities.

HISTORY OF OBLIGATIONS BY TOTAL MECHANISM

(Dollars in Thousands)[1]	FY 2013 Actual	FY 2014 Actual	FY 2015 Actual [4]	FY 2016 Actual [4]	FY 2017 Actual [4]	FY 2018 Actual [4, 5]	FY 2019 Actual [4, 6]	FY 2020 Actual [4, 7]	FY 2021 Actual [4, 8]	FY 2022 CR [4, 9]	FY 2023 President's Budget [4, 10, 11]
Research Project Grants	$15,445,463	$16,168,246	$16,441,843	$17,839,691	$19,105,304	$20,756,893	$22,493,313	$23,744,187	$24,308,561	$24,566,872	$25,932,792
Research Centers	$2,708,744	$2,723,203	$2,663,064	$2,573,774	$2,536,308	$2,581,750	$2,680,161	$2,713,731	$2,761,258	$2,796,585	$2,805,697
Other Research	$1,783,481	$1,846,841	$1,802,719	$2,019,736	$2,181,261	$2,371,164	$2,698,036	$2,753,289	$2,894,236	$2,993,161	$2,915,942
Subtotal, Research Grants	**$19,937,688**	**$20,738,290**	**$20,907,625**	**$22,433,201**	**$23,822,873**	**$25,709,807**	**$27,871,510**	**$29,211,207**	**$29,964,055**	**$30,356,618**	**$31,654,431**
Research Training	$733,524	$738,429	$758,017	$803,869	$827,397	$855,844	$865,305	$907,010	$926,485	$983,585	$1,032,679
R & D Contracts	$2,927,077	$2,990,037	$2,826,971	$2,913,224	$3,046,759	$3,072,406	$3,124,750	$3,283,765	$3,363,105	$3,472,564	$3,568,852
Intramural Research	$3,247,193	$3,373,601	$3,409,362	$3,682,831	$3,780,181	$3,972,054	$4,179,250	$4,462,022	$4,583,901	$4,645,140	$4,763,453
Res. Mgt. & Support	$1,485,575	$1,527,131	$1,619,784	$1,653,230	$1,747,406	$1,813,738	$1,886,087	$1,974,360	$2,048,924	$2,145,895	$2,255,892
Office of the Director[2]	$608,584	$477,293	$573,328	$599,263	$701,864	$1,016,633	$1,185,155	$1,467,130	$1,560,407	$1,579,186	$1,764,361
Subtotal	**$28,939,641**	**$29,844,781**	**$30,095,088**	**$32,085,618**	**$33,928,465**	**$36,440,482**	**$39,112,057**	**$41,305,493**	**$42,446,877**	**$43,182,988**	**$45,039,668**
Buildings & Facilities[3]	$114,580	$96,880	$123,464	$95,883	$143,415	$124,434	$229,107	$138,709	$209,715	$230,000	$330,000
Interior- Superfund	$74,864	$77,345	$77,332	$77,252	$77,337	$77,342	$78,988	$80,993	$81,488	$81,500	$83,035
ARPA-H	---	---	---	---	---	---	---	---	---	---	$5,000,000
Pandemic Preparedness	---	---	---	---	---	---	---	---	---	---	$12,050,000
Total	**$29,129,085**	**$30,019,005**	**$30,295,884**	**$32,258,753**	**$34,149,217**	**$36,642,258**	**$39,420,151**	**$41,525,195**	**$42,738,079**	**$43,494,488**	**$62,502,703**

[1] Obligations for actual years exclude lapse. Amounts for all years include Special Type 1 Diabetes. All Subtotal and Total numbers may not add due to rounding. FY 2017 through FY 2021 includes 21st Century Cures Act funding. All years exclude Ebola-related and supplemental funding.

[2] Excludes obligations for the Common Fund and the Office of Research Infrastructure Programs, which are distributed by mechanism.

[3] Includes B&F appropriation and monies allocated ($18,000,000 in FY 2018, $18,000,000 in FY 2019, $30,000,000 in FY 2020, and $30,000,000 in each of FY 2021 through FY2023) pursuant to appropriations acts provisions that funding may be used for facilities repairs and improvements at the NCI Federally funded Research and Development Center in Frederick, Maryland.

[4] Includes Program Evaluation Financing resources of $715,000,000 in FY 2015, $780,000,000 in FY 2016, $824,443,000 in FY 2017, $922,871,000 in FY 2018, $1,146,821,000 in FY 2019, $1,230,821,000 in FY 2020, and $1,271,505,000 in each year for FY 2021 through FY 2023.

[5] Includes obligations of $60,647,563 of 21st Century Cures Act funding which was appropriated in FY 2017, but carried over into FY 2018.

[6] Includes obligations of $42,852,637 of 21st Century Cures Act funding which was appropriated in FY 2017 and FY 2018, but carried over into FY 2019. Similarly, includes $429,883,740 of Opioids funding and $415,917 of Type 1 Diabetes funding carried over from FY 2018. Obligations of carryover funding are distributed by mechanism.

[7] Includes obligations of $230,278,992 of 21st Century Cures Act funding which was appropriated in FY 2017 through FY 2019, but carried over into FY 2020. Similarly, includes $200,200,850 of Type 1 Diabetes funding carried over from FY 2018 and FY 2019. Obligations of carryover funding are distributed by mechanism.

[8] Includes obligations of $167,738,493 of 21st Century Cures Act funding which was appropriated in FY 2017 through FY 2020, but carried over into FY 2021. Similarly, includes obligations of $83,955,593 for Special Type 1 Diabetes research program using available funding from FY 2018 through FY 2020, but carried over into FY 2021. Obligations of carryover funding are distributed by mechanism.

[9] Includes obligations of $284,492,124 of 21st Century Cures Act funding which was appropriated in FY 2017 through FY 2021, but carried over into FY 2022. Similarly, includes obligations of $291,355,777 for Special Type 1 Diabetes research program using available funding from FY 2018 through FY 2021, but carried over into FY 2022. Obligations of carryover funding are distributed by mechanism.

[10] The FY 2023 Budget proposes funding for the recently established Advanced Research Projects Agency for Health (ARPA-H) as well as new mandatory funding for pandemic preparedness activities.

[11] FY 2023 figures are based on requested budget authority.

STATISTICAL DATA: DIRECT AND INDIRECT COSTS AWARDED

(Dollars in Thousands)	Direct Cost Awarded	Indirect Cost Awarded	Percent of Total		Percent Change	
			Direct Cost Awarded	Indirect Cost Awarded	Direct Cost Awarded	Indirect Cost Awarded
FY 2011	$15,849,082	$6,173,769	72.0%	28.0%	-1.2%	-0.3%
FY 2012	$15,978,032	$6,182,900	72.1%	27.9%	0.8%	0.2%
FY 2013	$14,915,599	$5,755,617	72.2%	27.8%	-6.7%	-6.9%
FY 2014	$15,568,553	$5,908,275	72.5%	27.5%	4.4%	2.7%
FY 2015	$15,645,282	$6,020,843	72.2%	27.8%	0.5%	1.9%
FY 2016	$16,791,158	$6,445,133	72.3%	27.7%	7.3%	7.1%
FY 2017[1]	$17,799,515	$6,838,801	72.2%	27.8%	6.0%	6.1%
FY 2018[1,2]	$19,599,758	$7,481,452	72.4%	27.6%	10.1%	9.4%
FY 2019[1,3]	$20,544,931	$7,953,747	72.1%	27.9%	4.8%	6.3%
FY 2020[1,*]	$21,765,222	$8,406,459	72.1%	27.9%	5.9%	5.7%
FY 2021 Final[1]	$22,363,606	$8,620,853	72.2%	27.8%	2.8%	2.6%
FY 2022 CR[1]	$22,259,130	$8,563,898	72.2%	27.8%	-0.5%	-0.7%
FY 2023 President's Budget[1,a]	$23,578,114	$9,108,996	72.1%	27.9%	5.9%	6.4%

Note: Data for fiscal years 2022 and later represent estimates and will change as actual data are received.

[1] Includes 21st Century Cures Act funding.

[2] Figures reflect BA carried over into later years.

[3] Figures include estimates of BA carried over into later years.

* Restated with grant awards for the ECHO & INCLUDE programs in the OD - Other mechanism. These awards were assigned to NICHD in the FY 2022 Congressional Justification.

[a] Figures do not include any awards related to the recently established ARPA-H or proposed mandatory funding for pandemic preparedness activities.

RPGS – TOTAL NUMBER OF AWARDS AND FUNDING

(Dollars in Thousands)	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017 Final[1]	FY 2018 Final[1,2]	FY 2019 Final[1,3]	FY 2020 Final[1,*]	FY 2021 Final[1]	FY 2022 CR[1]	FY 2023 President's Budget[1,a]
No. of Awards:											
Competing	8,234	9,168	9,540	10,364	10,123	11,116	11,020	11,373	11,258	9,806	11,878
Noncompeting	25,140	23,504	23,261	23,528	24,638	25,780	27,624	28,366	28,492	29,502	29,301
Subtotal	33,374	32,672	32,801	33,892	34,761	36,896	38,644	39,739	39,750	39,308	41,179
SBIR/STTR	1,466	1,660	1,578	1,689	1,807	2,034	2,023	1,832	1,863	1,837	1,950
Total	**34,840**	**34,332**	**34,379**	**35,581**	**36,568**	**38,930**	**40,667**	**41,571**	**41,613**	**41,145**	**43,129**
Average Annual Cost:											
Competing RPGs	$418	$489	$452	$484	$522	$527	$573	$559	$599	$571	$573
Total RPGs[X]	444	474	479	502	523	546	552	571	583	586	600
Percent Change in Average Cost from Prior Year[Y]											
Competing RPGs	-0.8%	17.0%	-7.5%	7.2%	7.8%	1.0%	8.7%	-2.4%	7.2%	-4.7%	0.2%
Total RPGs[X]	-3.3%	6.7%	1.2%	4.8%	4.0%	4.4%	1.1%	3.5%	2.1%	0.5%	2.4%
Average Length of Award in Years	**3.5**	**3.5**	**3.5**	**3.6**	**3.6**	**3.6**	**3.6**	**3.6**	**3.6**	**3.6**	**3.6**

NOTE: Includes awards supported by the Common Fund program (for all years) and the Type 1 Diabetes mandatory account.

[X] Includes Noncompeting RPGs and Administrative Supplements. Excludes SBIR/STTR awards.

[Y] Based on average costs in whole dollars.

[1] Includes 21st Century Cures Act funding.

[2] Figures reflect BA carried over into later years.

[3] Figures include estimates of BA carried over into later years.

* Restated with grant awards for the ECHO & INCLUDE programs in the OD - Other mechanism. These awards were assigned to NICHD in the FY 2022 Congressional Justification.

[a] Figures do not include any awards related to the recently established ARPA-H or proposed mandatory funding for pandemic preparedness activities.

RPGS – SUCCESS RATES

INSTITUTES & CENTERS[+,1,2]	FY 2014	FY 2015	FY 2016	FY 2017 Final[6]	FY 2018 Final[6,7]	FY 2019 Final[6,8]	FY 2020 Final[6,*]	FY 2021 Final[6]	FY 2022 CR[6]	FY 2023 President's Budget[6,a]
NCI	14.1%	13.0%	12.0%	11.7%	11.3%	11.9%	12.9%	13.8%	13.8%	14.2%
NHLBI	18.2%	21.9%	24.2%	23.5%	25.1%	22.3%	22.2%	20.5%	19.3%	21.4%
NIDCR	21.5%	22.0%	19.9%	17.8%	22.2%	23.8%	21.7%	21.8%	19.4%	24.4%
NIDDK	22.9%	20.3%	20.1%	17.8%	21.6%	20.3%	24.4%	22.7%	22.4%	20.8%
NINDS	18.7%	20.5%	19.8%	17.7%	22.4%	20.4%	23.7%	20.2%	16.2%	19.4%
NIAID	22.0%	21.5%	23.8%	19.1%	22.9%	22.1%	23.9%	17.5%	17.4%	19.4%
NIGMS	24.8%	29.6%	29.6%	30.6%	29.2%	32.6%	32.3%	33.4%	26.5%	27.1%
NICHD*	12.5%	11.5%	13.2%	16.1%	18.4%	19.5%	18.0%	18.4%	16.7%	19.4%
NEI	26.7%	21.4%	25.7%	24.9%	26.7%	28.4%	29.6%	24.8%	22.7%	23.7%
NIEHS	15.0%	14.7%	14.2%	15.0%	17.1%	14.8%	14.2%	14.4%	12.0%	36.7%
NIA	15.9%	17.7%	22.8%	26.6%	28.9%	29.2%	25.8%	24.2%	18.2%	16.9%
NIAMS	18.1%	16.7%	16.0%	17.0%	16.7%	17.1%	18.0%	17.6%	12.2%	18.9%
NIDCD	25.8%	24.9%	26.7%	24.4%	27.1%	25.2%	24.2%	24.0%	23.2%	23.2%
NIMH	19.4%	20.4%	22.9%	20.9%	22.2%	24.8%	22.5%	22.1%	20.7%	21.6%
NIDA	18.0%	19.6%	15.4%	19.7%	19.4%	17.5%	16.9%	14.7%	10.4%	25.9%
NIAAA	19.2%	16.4%	18.8%	22.0%	26.7%	20.9%	21.4%	17.1%	17.3%	19.9%
NINR	11.6%	8.0%	9.0%	8.9%	10.3%	9.3%	10.8%	12.6%	7.9%	16.9%
NHGRI	17.7%	18.8%	25.6%	23.9%	28.0%	19.2%	21.8%	24.7%	17.5%	12.0%
NIBIB	13.1%	12.0%	14.6%	13.0%	16.8%	18.3%	19.8%	17.2%	15.7%	16.8%
NIMHD	11.9%	13.7%	19.3%	21.5%	10.7%	7.5%	7.9%	11.2%	10.0%	39.5%
NCCIH[3]	8.7%	10.8%	13.9%	16.7%	20.3%	12.5%	11.6%	11.1%	6.4%	14.3%
NCATS[4]	16.7%	66.7%	27.7%	21.8%	36.4%	20.7%	25.2%	14.7%	17.3%	20.6%
FIC	9.1%	9.7%	29.5%	10.8%	19.5%	20.6%	19.7%	13.8%	21.2%	23.4%
NLM	19.4%	19.8%	13.0%	14.9%	17.7%	18.4%	13.4%	11.9%	14.1%	9.8%
ORIP & SEPA[5]	19.6%	21.5%	18.8%	16.5%	17.8%	34.2%	29.6%	25.9%	39.1%	40.9%
Common Fund	10.0%	12.1%	12.6%	11.8%	10.9%	11.0%	9.5%	8.8%	6.2%	7.9%
NIH	**18.0%**	**18.3%**	**19.1%**	**18.7%**	**20.3%**	**20.1%**	**20.7%**	**19.1%**	**16.9%**	**19.8%**

[+] Success Rates identified in FY 2021 and beyond are estimates, and will change as applications are received and selected for funding.

[1] Application success rates represent the percentage of applications that are awarded during the fiscal year.

[2] Includes Special type 1 Diabetes Research program administered by NIDDK. Excludes NIEHS Superfund Research and OD Other awards.

[3] The National Center for Complementary and Alternative Medicine (NCCAM) was renamed in December 2014 to the National Center for Complementary and Integrative Health (NCCIH).

[4] The National Center for Advancing Translational Sciences (NCATS) was established concurrent with the dissolution of National Center for Research Resources (NCRR) effective FY 2012.

[5] The SEPA program transitioned to NIGMS in FY 2017 from the NIH Office of Research Infrastructure Program (ORIP).

[6] Includes 21st Century Cures Act funding.

[7] Figures reflect BA carried over into later years.

[8] Figures include estimates of BA carried over into later years.

* Restated with grant awards for the ECHO & INCLUDE programs in the OD - Other mechanism. These awards were assigned to NICHD in the FY 2022 Congressional Justification.

[a] Figures do not include any awards related to the recently established ARPA-H or proposed mandatory funding for pandemic preparedness activities.

TOTAL R01 EQUIVALENT DATA FOR FIRST TIME AND ESTABLISHED INVESTIGATORS

R01 Equivalent Grants[1,2,3,4]	FY 2021 Final[5]	FY 2022 CR[5]	FY 2023 President's Budget[5,a]
Applications			
Received	37,987	39,213	41,540
Funded	**7,647**	**6,949**	**8,583**
Total Investigators			
Received	33,856	34,953	37,101
Funded	**9,503**	**8,682**	**10,838**
Established Investigators			
Received	20,777	21,201	22,371
Funded	**6,715**	**6,091**	**7,571**
First-time Investigators			
Received	13,079	13,752	14,730
Funded	**2,788**	**2,591**	**3,267**

1 R01 Equivalent Grants form a subset of all RPG awards. In FY 2021 they comprised roughly 68% of Funded Applications, 72% of Funded Total Investigators, 78% of Funded Established Investigators and 60% of Funded First-time Applicants.

[2] The ratio of total and funded applicants to applications and the proportion of total and funded first-time applicants are based on linear extrapolation of five years of the latest actual data.

[3] Excludes applications and awards associated with reimbursable agreements and Superfund Research account.

[4] Estimates for received applications reflect consolidations of Institute/Center validated refinements to linear extrapolation of five years of latest actual data. Funded application figures reflect the annual estimate identified in the New/Competing RPG line of mechanism budget table.

[5] Includes 21st Century Cures Act funding.

[a] Figures do not include any awards related to the recently established ARPA-H or proposed mandatory funding for pandemic preparedness activities.

COMPETING RPGS BY LENGTH OF AWARD

(Dollars in Thousands)	FY 2021 Final[1]		FY 2022 CR[1]		FY 2023 President's Budget[1,a]	
	No.	Amount	No.	Amount	No.	Amount
Competing RPGs:[x]						
One-Year Awards	1,415	$1,524,326	1,175	$1,219,523	1,424	$1,480,820
Two-Year Awards	2,400	$505,879	2,161	$480,776	2,617	$583,788
Three-Year Awards	443	$237,305	419	$235,296	507	$285,711
Four-Year Awards	1,732	$977,995	1,699	$937,407	2,058	$1,138,258
Five or More Year Awards	5,268	$3,503,425	4,352	$2,730,784	5,272	$3,315,883
Total Competing RPGs	11,258	$6,748,930	9,806	$5,603,786	11,878	$6,804,460

[x] The distribution of awards with durations of 1, 2, 3, 4 and 5+ years is based on historical data.

[1] Includes 21st Century Cures Act funding.

[a] Figures do not include any awards related to the recently established ARPA-H or proposed mandatory funding for pandemic preparedness activities.

NON-COMPETING COMMITMENTS

(Dollars in Thousands)	FY 2021 Final[4]	FY 2022 CR[4]	FY 2023 President's Budget[4,a]
Research Project Grants (RPGs)			
Noncompeting:			
Number	28,492	29,502	29,301
Amount	$15,937,228	$17,090,998	$17,543,339
Administrative Supp	$483,523	$331,645	$356,660
Competing:			
Number	11,258	9,806	11,878
Amount	$6,748,930	$5,603,786	$6,804,460
SBIR/STTR:			
Number	1,863	1,837	1,950
Noncompeting	948	994	821
Amount[1]	$1,176,827	$1,158,777	$1,228,333
Noncompeting	$598,561	$627,228	$517,363
Subtotal, RPGs:			
Number	41,613	41,145	43,129
Amount	$24,346,508	$24,185,206	$25,932,792
Research Centers:			
Number	1,225	1,243	1,307
Noncompeting	978	977	1,057
Amount	$2,770,381	$2,774,182	$2,805,697
Noncompeting	$2,212,624	$2,179,676	$2,269,898
Other Research:			
Number	7,604	7,690	7,744
Noncompeting	5,863	5,981	6,202
Amount	$2,941,127	$2,880,055	$2,915,942
Noncompeting	$2,267,717	$2,239,951	$2,335,445
Training:			
FTTPs	16,988	17,808	18,109
Noncompeting	12,855	13,317	13,542
Amount	$926,442	$983,585	$1,032,679
Noncompeting	$701,075	$735,561	$772,263
Total Extramural Research[2]	**$30,984,459**	**$30,823,028**	**$32,687,110**
Noncompeting Number/FTTPs	49,136	50,771	50,923
Competing Number/FTTPs	18,294	17,115	19,366
Noncompeting Amount	$22,200,728	$23,205,059	$23,794,968
Competing Amount	$8,783,731	$7,617,969	$8,892,142
Total Percent Change	**2.7%**	**-0.5%**	**6.0%**
Total Discretionary Budget Authority[3,a]	**$42,662,323**	**$42,777,191**	**$45,311,253**
Percent Change	**2.7%**	**0.3%**	**5.9%**

[1] The 3.65% combined SBIR/STTR program threshold is achieved in FY 2021 and sustained in subsequent

[2] Includes both grants and FTTPs for Noncompeting and Competing figures.

[3] Includes Labor/HHS appropriations, the Interior Superfund Research account, 21st Century Cures Act funding, as well as Program Evaluation financing resources. Excludes mandatory accounts such as Type 1 Diabetes.

[4] Includes 21st Century Cures Act funding.

[a] Figures do not include any awards related to the recently established ARPA-H or proposed mandatory funding for pandemic preparedness activities.

MF GENERAL STATEMENT

The NIH Management Fund (MF) was established on June 29, 1957, by Public Law 85-67. The MF was created to finance a variety of centralized support services and administrative activities that are required for the efficient and effective operation of all NIH programs and facilities. The services provided by the MF include a research hospital and outpatient clinic; receipt, review and referral of research and training grant applications, and general administrative support services. The MF is financed through offsetting collections from the NIH Institutes and Centers representing charges for services provided. Funds credited to the NIH Management Fund remain available for one fiscal year after the fiscal year in which they are deposited.

MF BUDGET AUTHORITY BY ACTIVITY

NATIONAL INSTITUTES OF HEALTH
Management Fund

Budget Authority by Activity
(Dollars in Thousands)

	FY 2021 Final		FY 2022 CR		FY 2023 President's Budget		FY 2023 +/- FY 2022 CR	
Extramural Research	**FTE**	**Amount**	**FTE**	**Amount**	**FTE**	**Amount**	**FTE**	**Amount**
Detail								
Clinical Center	1,949	$652,751	2,035	$669,069	2,035	$682,451	0	$13,381
Center for Scientific Review	422	125,456	450	128,593	464	131,165	14	2,572
Office of Research Services, Development & Operations and Administrative services[1]	253	82,745	0	0	0	0	0	0
TOTAL	**2,624**	**$860,952**	**2,485**	**$797,662**	**2,499**	**$813,616**	**14**	**$15,953**

[1] Effective in FY 2022, ORS is financed entirely through the Service and Supply Fund, rather than financing certain portions through the Management Fund.

MF BUDGET AUTHORITY BY OBJECT CLASS

NATIONAL INSTITUTES OF HEALTH
Management Fund

Budget Authority by Object Class[1]
(Dollars in Thousands)

		FY 2022 CR	FY 2023 President's Budget	FY 2023 +/- FY 2022 CR
Total compensable workyears:				
	Full-time equivalent	2,485	2,499	14
	Full-time equivalent of overtime and holiday hours	0	0	0
	Average ES salary	$205	$212	$8
	Average GM/GS grade	11.5	11.5	0.0
	Average GM/GS salary	$117	$120	$4
	Average salary, Commissioned Corps (42 U.S.C. 207)	$109	$113	$4
	Average salary of ungraded positions	$168	$174	$6
	OBJECT CLASSES	**FY 2022 CR**	**FY 2023 President's Budget**	**FY 2023 +/- FY 2022 CR**
	Personnel Compensation			
11.1	Full-Time Permanent	216,563	224,667	8,104
11.3	Other Than Full-Time Permanent	38,669	40,116	1,447
11.5	Other Personnel Compensation	27,666	28,702	1,035
11.7	Military Personnel	5,407	5,610	202
11.8	Special Personnel Services Payments	7,160	7,428	268
11.9	**Subtotal Personnel Compensation**	**$295,466**	**$306,522**	**$11,056**
12.1	Civilian Personnel Benefits	99,165	102,560	3,394
12.2	Military Personnel Benefits	3,795	3,937	142
13.0	Benefits to Former Personnel	0	0	0
	Subtotal Pay Costs	**$398,426**	**$413,019**	**$14,593**
21.0	Travel & Transportation of Persons	769	771	2
22.0	Transportation of Things	664	665	1
23.1	Rental Payments to GSA	8	8	0
23.2	Rental Payments to Others	107	108	1
23.3	Communications, Utilities & Misc. Charges	3,886	3,920	34
24.0	Printing & Reproduction	7	7	0
25.1	Consulting Services	38,461	38,500	39
25.2	Other Services	99,340	100,195	855
25.3	Purchase of Goods and Services from Government Accounts	48,385	48,701	316
25.4	Operation & Maintenance of Facilities	16,804	16,850	46
25.5	R&D Contracts	422	422	0
25.6	Medical Care	16,534	16,550	16
25.7	Operation & Maintenance of Equipment	25,271	25,272	1
25.8	Subsistence & Support of Persons	3	3	0
25.0	**Subtotal Other Contractual Services**	**$245,221**	**$246,494**	**$1,273**
26.0	Supplies & Materials	125,954	126,000	46
31.0	Equipment	20,342	20,342	0
32.0	Land and Structures	2,266	2,270	4
33.0	Investments & Loans	0	0	0
41.0	Grants, Subsidies & Contributions	0	0	0
42.0	Insurance Claims & Indemnities	3	3	0
43.0	Interest & Dividends	10	10	0
44.0	Refunds	0	0	0
	Subtotal Non-Pay Costs	**$399,236**	**$400,597**	**$1,360**
	Total Budget Authority by Object Class	**$797,662**	**$813,616**	**$15,953**

[1] Includes FTEs whose payroll obligations are supported by the NIH Common Fund.

MF DETAIL OF POSITIONS

GRADE	FY 2021 Final	FY 2022 CR	FY 2023 President's Budget
Total, ES Positions	4	2	2
Total, ES Salary	$797,200	$409,362	$424,771
GM/GS-15	123	121	121
GM/GS-14	337	331	339
GM/GS-13	376	371	373
GS-12	533	522	522
GS-11	465	470	472
GS-10	34	33	33
GS-9	109	89	90
GS-8	97	64	68
GS-7	223	172	174
GS-6	46	47	47
GS-5	20	18	18
GS-4	7	5	5
GS-3	7	7	7
GS-2	3	3	3
GS-1	1	0	0
Subtotal	2,381	2,253	2,272
Commissioned Corps (42 U.S.C. 207)			
Assistant Surgeon General	0	0	0
Director Grade	14	14	14
Senior Grade	15	15	15
Full Grade	11	11	11
Senior Assistant Grade	14	14	14
Assistant Grade	0	0	0
Subtotal	54	54	54
Ungraded	242	242	242
Total permanent positions	2,410	2,282	2,301
Total positions, end of year	2,681	2,551	2,570
Total full-time equivalent (FTE) employment, end of year	2,624	2,485	2,499
Average ES salary	199,300	204,681	212,386
Average GM/GS grade	11.4	11.5	11.5
Average GM/GS salary	103,878	116,805	120,495

SSF GENERAL STATEMENT

The NIH Service and Supply Fund (SSF) was established on July 3, 1945, under 42 U.S.C. 231. The SSF was created to finance a variety of centralized research support services and administrative activities that are required for the efficient and effective operation of all NIH programs and facilities. The SSF provides a single means for consolidating the financing and accounting of business-type operations, including the sales of services and commodities to customers. The services provided through the SSF include mainframe computing, cybersecurity, enterprise IT software planning and development, facilities engineering, planning and design, facility use and maintenance including leased buildings, printing, telecommunications, procurement, shipping and receiving, motor pool, research animals, fabrication and maintenance of scientific equipment, utilities and plant maintenance, finance and accounting operations, government-wide contracting for IT, biomedical engineering, security, consolidated human resources, collaborative computer science research, police, fire, and other administrative support services. The SSF is financed through offsetting collections from the NIH Institutes and Centers representing charges for goods and services provided.

SSF BUDGET AUTHORITY BY ACTIVITY

NATIONAL INSTITUTES OF HEALTH
Service and Supply Fund

Budget Authority by Activity
(Dollars in Thousands)

	FY 2021 Final		FY 2022 CR		FY 2023 President's Budget		FY 2023 +/- FY 2022 CR	
Extramural Research	**FTE**	**Amount**	**FTE**	**Amount**	**FTE**	**Amount**	**FTE**	**Amount**
Detail								
Research Support and Administrative (OD & includes CIF, ORS)[1]	823	$1,669,290	851	$1,795,836	870	$1,831,753	19	$35,917
Office of Research Facilities Development & Operations (ORF)	985	512,154	1,289	524,958	1,369	535,457	80	10,499
Center for Information Technology	227	457,860	247	469,306	247	578,692	0	109,386
TOTAL	**2,035**	**$2,639,304**	**2,387**	**$2,790,101**	**2,486**	**$2,945,903**	**99**	**$155,802**

[1] Effective in FY 2022, ORS is financed entirely through the Service and Supply Fund, rather than financing certain portions through the Management Fund.

SSF BUDGET AUTHORITY BY OBJECT CLASS

NATIONAL INSTITUTES OF HEALTH
Service Supply Fund

Budget Authority by Object Class[1]

(Dollars in Thousands)

		FY 2022 CR	FY 2023 President's Budget	FY 2023 +/- FY 2022 CR
Total compensable workyears:				
	Full-time equivalent	2,387	2,486	99
	Full-time equivalent of overtime and holiday hours	0	0	0
	Average ES salary	$200	$204	$4
	Average GM/GS grade	12.0	12.0	0.0
	Average GM/GS salary	$115	$119	$3
	Average salary, Commissioned Corps (42 U.S.C. 207)	$108	$112	$4
	Average salary of ungraded positions	$149	$154	$5
	OBJECT CLASSES	**FY 2022 Enacted**	**FY 2023 President's Budget**	**FY 2023 +/- FY 2022**
	Personnel Compensation			
11.1	Full-Time Permanent	239,720	248,691	8,970
11.3	Other Than Full-Time Permanent	12,524	12,993	469
11.5	Other Personnel Compensation	16,543	17,162	619
11.7	Military Personnel	4,845	5,026	181
11.8	Special Personnel Services Payments	758	786	28
11.9	**Subtotal Personnel Compensation**	**$274,390**	**$284,658**	**$10,268**
12.1	Civilian Personnel Benefits	99,851	103,268	3,418
12.2	Military Personnel Benefits	2,882	2,989	108
13.0	Benefits to Former Personnel	1,624	1,624	0
	Subtotal Pay Costs	**$378,746**	**$392,540**	**$13,794**
21.0	Travel & Transportation of Persons	1,920	1,952	33
22.0	Transportation of Things	820	834	14
23.1	Rental Payments to GSA	68,474	69,638	1,164
23.2	Rental Payments to Others	64,008	65,096	1,088
23.3	Communications, Utilities & Misc. Charges	92,977	94,557	1,581
24.0	Printing & Reproduction	4	2	-2
25.1	Consulting Services	54,573	55,501	928
25.2	Other Services	1,292,065	1,315,153	23,089
25.3	Purchase of Goods and Services from Government Accounts	368,557	474,822	106,265
25.4	Operation & Maintenance of Facilities	103,589	105,350	1,761
25.5	R&D Contracts	9,805	9,972	167
25.6	Medical Care	1,540	1,567	26
25.7	Operation & Maintenance of Equipment	210,525	214,104	3,579
25.8	Subsistence & Support of Persons	0	0	0
25.0	**Subtotal Other Contractual Services**	**$2,040,655**	**$2,176,469**	**$135,815**
26.0	Supplies & Materials	71,087	72,189	1,102
31.0	Equipment	43,277	44,012	736
32.0	Land and Structures	28,074	28,551	477
33.0	Investments & Loans	0	0	0
41.0	Grants, Subsidies & Contributions	5	5	0
42.0	Insurance Claims & Indemnities	0	0	0
43.0	Interest & Dividends	55	55	1
44.0	Refunds	0	0	0
	Subtotal Non-Pay Costs	**$2,411,355**	**$2,553,363**	**$142,008**
	Total Budget Authority by Object Class	**$2,790,101**	**$2,945,903**	**$155,802**

[1] Includes FTEs whose payroll obligations are supported by the NIH Common Fund.

SSF DETAIL OF POSITIONS

GRADE	FY 2021 Final	FY 2022 CR	FY 2023 President's Budget
Total, ES Positions	8	11	12
Total, ES Salary	$1,585,275	$2,201,357	$2,449,702
GM/GS-15	110	119	129
GM/GS-14	328	376	401
GM/GS-13	674	736	769
GS-12	298	341	363
GS-11	114	142	148
GS-10	5	9	9
GS-9	87	116	121
GS-8	18	59	59
GS-7	45	102	102
GS-6	5	9	9
GS-5	14	18	18
GS-4	12	19	19
GS-3	11	13	13
GS-2	8	2	2
GS-1	12	11	11
Subtotal	1,741	2,072	2,173
Commissioned Corps (42 U.S.C. 207)			
Assistant Surgeon General	0	0	0
Director Grade	7	7	7
Senior Grade	4	6	6
Full Grade	12	12	12
Senior Assistant Grade	4	5	5
Assistant Grade	1	0	0
Subtotal	28	30	30
Ungraded	314	318	375
Total permanent positions	2,013	2,316	2,412
Total positions, end of year	2,091	2,431	2,590
Total full-time equivalent (FTE) employment, end of year	2,035	2,387	2,486
Average ES salary	198,159	200,123	204,142
Average GM/GS grade	12.3	12.0	12.0
Average GM/GS salary	115,983	115,342	118,841

IDEA DIGITAL MODERNIZATION

Modernization of the Public-Facing Digital Services – 21st Century Integrated Digital Experience Act

The 21st Century Integrated Digital Experience Act (IDEA) was signed into law on Dec. 20, 2018. It requires data-driven, user-centric website and digital services modernization, website consolidation, and website design consistency in all Executive Agencies. Departments across the federal landscape are working to implement innovative digital communications approaches to increase efficiency and create more effective relationships with their intended audiences. The American public expects instant and impactful communications – desired, trusted content available when they want it, where they want it, and in the format they want it. If the consumer is not satisfied they move on and the opportunity for impact is lost.

Modernization Efforts

In FY 2019, HHS engaged Department leadership and developed a Digital Communications Strategy that aligns with the requirements of IDEA. In FY 2020, HHS Digital Communications Leaders began implementation of the Strategy in alignment with IDEA, beginning to align budgets to modernization requirements.

As the result of a comprehensive review of costs associated with website development, maintenance, and their measures of effectiveness, HHS will prioritize:

- modernization needs of websites, including providing unique digital communications services, and
- continuing to developing estimated costs and impact measures for achieving IDEA.

Over the next four years HHS will continue to implement IDEA by focusing extensively on a user-centric, Digital First approach to both external and internal communications and developing performance standards. HHS will focus on training, hiring, and tools that drive the communication culture change necessary to successfully implement IDEA.

Over the next year, HHS Agencies and Offices will work together to continue to implement IDEA and the HHS Digital Communications Strategy across all communications products and platforms.

CROSS-CUTTING INITIATIVES

DEPARTMENT OF HEALTH AND HUMAN SERVICES

NATIONAL INSTITUTES OF HEALTH

Cross-Cutting Initiatives

FY 2023 Budget Table of Contents — Page No.

INTRODUCTION

The National Institutes of Health (NIH), the Nation's premiere biomedical research agency, is tasked with guiding U.S. scientific research and development in an ever-changing world. The pace of research and development is moving faster than it ever has before, and the coming years are certain to offer both new scientific opportunities and pose continued serious challenges for human health. The NIH constantly strives to not only meet the current and evolving biomedical needs, but to set the standard for high caliber research and ethical conduct of science.

NIH's mission is to seek fundamental knowledge about the nature and behavior of living systems and apply that knowledge to enhance health, lengthen life, and reduce illness and disability. To achieve its mission, the NIH supports research on the causes, prevention, and treatment of human diseases and disorders; processes in healthy development and aging; and methods for collecting and disseminating data and health information. In addition, the NIH Institutes, Centers, and Offices (ICOs) leverage existing strengths and resources by collaborating in innovative, creative and multidisciplinary ways to answer complex and crucial questions about human health and disease.

To tackle some of the biggest questions facing biomedical science today, the NIH relies on crosscutting, multi-ICO initiatives and research programs which bring together diverse experts and leaders from across the agency. For example, 10 NIH Institutes and Centers (ICs) collaborate on the Brain Research through Advancing Innovative Neurotechnologies® (BRAIN) Initiative, a public-private partnership (PPP), focused on innovative technologies which allow researchers to gain a new understanding of the brain to ultimately lead to discoveries in treatments, cures, and preventions for brain disorders. The NIH Common Fund brings together over 20 ICOs to support high-risk, innovative endeavors with the potential for extraordinary impact. This includes programs such as the Single Cell Analysis efforts, which developed novel tools to overcome major technological hurdles and developed a catalogue of phenotypic and transcriptomic data. These initiatives and others like them are designed to tackle multifaceted questions about human health and disease that are best served by inter-Institute, interdisciplinary collaborative efforts that fully capture the complexities of the research need.

The coronavirus disease 2019 (COVID-19) pandemic required more engaged and creative collaborations across NIH than ever before. The NIH ICOs came together to address emerging scientific and clinical questions and are now building on those partnerships to lead rapid innovations in research practices. For example, the Researching COVID to Enhance Recovery (RECOVER) Initiative, led by the National Heart, Lung, and Blood Institute (NHLBI), seeks to understand, prevent, and treat post-acute sequelae of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, including Long COVID, to mitigate the long-term public health effects of the COVID-19 pandemic. RECOVER utilizes coordinating centers, digital health platforms, and master protocols to enhance our basic knowledge of viral infections in general and is likely to improve understanding of other chronic post-viral syndromes and autoimmune diseases in the future.

Building strong research collaborations and partnerships requires both a diverse scientific workforce and the recruitment of diverse research participants to ensure thoughtful methodology

can capture the wide variety of human health needs. NIH-wide efforts will continue to focus on developing and testing interventions to reduce health disparities, identifying key gaps in science related to health disparities, and promoting targeted research on appropriately tailored public health, clinical, and community preventive services in diverse settings and contexts. The NIH UNITE Initiative, comprised of representatives from across all 27 NIH ICs, was launched with the goal of identifying and addressing structural racism within the NIH community and the greater biomedical research community. The NIH Data Science Initiative also works to address goals relevant to diversity in health. For example, NIH's Artificial Intelligence/Machine Learning Consortium to Advance Health Equity and Researcher Diversity (AIM-AHEAD) program, a key facet of the NIH Data Science Initiative, will broaden the benefits of AI across demographic groups and improve health equity. In considering diverse research participation, the *All of Us* Research Program has been designed to reflect the diversity of the United States, with a special focus on including participants from groups that have previously been underrepresented in health research. Efforts in Tribal health research coordination, led by the Tribal Health Research Office (THRO), support the development of culturally relevant health research vital to improving the health of American Indian and Alaska Native communities.

During FY 2023, NIH will continue to facilitate partnerships across ICOs to leverage infrastructure and scientific expertise to effectively turn scientific discovery into improved human health. Building partnerships and leveraging existing relationships are critical to supporting and facilitating scientific and clinical research to prevent illness and disease. The NIH will learn from advances made during the COVID-19 pandemic to build on these collaborations going forward. By responding to urgent and evolving health needs, addressing health disparities, and building on previous discoveries, NIH will remain a leader in biomedical research and development into the future.

BRAIN RESEARCH THROUGH ADVANCING INNOVATIVE NEUROTECHNOLOGIES® (BRAIN) INITIATIVE

Program Overview

The NIH *Brain Research Through Advancing Innovative Neurotechnologies*® (BRAIN) Initiative is an ambitious program to develop and apply new technologies to answer fundamental questions about the brain and ultimately to inspire new treatments for brain diseases. Launched in 2014, The BRAIN® Initiative leverages a timely convergence of public health needs and scientific opportunity. The need: similar to electrical networks, the brain operates through circuits of cells to perform complex functions. Dysfunction of brain circuits underlies neurologic, psychiatric, and substance use disorders that impose an immense public health burden, yet the complexity and inaccessibility of the brain exceed the limits of research tools currently available to answer fundamental questions about brain function in health and disease. The opportunity: research advances in science and engineering now offer the potential for researchers to overcome these limitations, enabling them to monitor the activity of thousands of brain cells in real time, map connections between cells, and precisely modulate brain circuits. Solutions for those suffering with Alzheimer's and Parkinson's disease, for example, will come from seeing how malfunctions of brain circuits drive disease, and learning how to rewire errant circuits into healthy function. The work of the BRAIN Initiative will help lay the groundwork for understanding the mechanisms underlying a variety of conditions and diseases that impact brain function, including the neurological symptoms of COVID-19.

Collaboration Within and Beyond NIH

The BRAIN Initiative is highly collaborative within NIH, across Federal agencies, and with private organizations and the international scientific community. Under the leadership of the BRAIN Initiative Director, fully integrated teams from 10 NIH Institutes and Centers (ICs) manage the program. The BRAIN Multi-Council Working Group (MCWG) provides critical input to the IC Advisory Councils and to NIH leadership on how best to achieve the BRAIN Initiative goals. NIH also works in close collaboration with scientists and engineers from other government agencies, including the Food and Drug Administration (FDA), National Science Foundation (NSF), Defense Advanced Research Projects Agency (DARPA), Intelligence Advanced Research Projects Activity (IARPA), and Department of Energy (DoE), and representatives from FDA, NSF, DARPA, and IARPA regularly contribute their expertise through *ex officio* memberships on the MCWG. The BRAIN Initiative Alliance,[69] comprising federal, non-profit, industry, and academic members of the BRAIN Initiative, coordinates and facilitates communications to the public and the scientific community about BRAIN Initiative successes and opportunities for further discovery. This extensive collaboration has allowed the NIH to engage talent from across a broad spectrum of science and engineering experts at institutions and companies throughout the United States and internationally.

Exciting Research Findings

The BRAIN Initiative has enabled scientific advances that provide opportunities to understand the structure and function of the brain at an unprecedented level of detail. Researchers throughout neuroscience are rapidly adopting these advances, and the BRAIN Initiative is both

[69] www.braininitiative.org

dramatically enhancing existing methods and developing entirely new technologies to study and manipulate brain circuits.

BRAIN Initiative Cell Census Network (BICCN)[70]
The human brain, with its nearly 100 billion neurons, a roughly equal number of non-neuronal cells, and nearly 100 trillion connections, is arguably the most complex biological machine known to humankind. A critical step toward unraveling this complexity is to catalogue how many and what types of cells make up the brain. The BICCN is a collaboration of over 250 NIH-supported scientists at nearly 50 institutions across 3 continents, focused on exactly this challenge. Recently the BICCN published a landmark series of articles that describe a comprehensive atlas of the cell types comprising the motor cortex of mice, monkeys, and humans. The data collected through this effort are available to all scientists through the BICCN Data Inventory. Already, these results are enabling significant advances in our understanding of the locations and functions of these cell types, the differences and similarities in cell types between species, and the accuracy of the technologies used to acquire the data. The single cell analysis techniques used by the BICCN reveal the unique genetic fingerprints of different cell types, offering a powerful new tool for studying brain disorders. For example, researchers have used these approaches to define specific human brain cell types that are particularly vulnerable in Alzheimer's disease. Together these studies herald a comprehensive cell atlas of the entire mouse brain and set the stage for extending these efforts to the human brain.

Progress in human brain diseases and beyond
From its inception, the BRAIN Initiative had as its goal to understand the human brain by developing and testing new technologies in animal models, with the expectation that this will, in due course, provide tools and knowledge applicable to the human brain and brain diseases. Ultimately, the Initiative aims to inspire new approaches to reduce the enormous burden of neurological diseases, psychiatric disorders, and disabilities resulting from developmental disorders and brain and spinal cord injuries. The extent to which the Initiative is already opening new avenues for progress is encouraging. Among the advances showing promise are, for example, methods to identify the brain cell types affected by specific diseases, which is revolutionizing the field of investigative neuropathology; visual neuroprostheses for vision restoration in those with blindness; Brain Computer Interfaces (BCI) that decode intelligible speech and written text directly from brain activity for those unable to speak due to paralysis; and technologies for self-adjusting or "closed-loop" Deep Brain Stimulation (DBS) therapies for persons with Parkinson's disease and essential tremor. The latter not only minimize unwanted effects but also allow continuous and direct feedback while people with movement disorders are going about their daily lives in their natural environments. While information obtained from such technology has immense benefits for the patient and society at large, data and patient privacy are safeguarded by rigorous ethical considerations. Beyond medical science, private sector investments inspired by the BRAIN Initiative are also already underway in artificial intelligence, human computer interfaces, and "neuromorphic" computer hardware engineered to mimic the architecture of the nervous system.

[70] braininitiative.nih.gov/brain-programs/cell-census-network-biccn

Setting Priorities and Assessing Progress

From the Initiative's launch, the report BRAIN 2025: A Scientific Vision[71] has provided an overarching vision and plan for this multi-faceted program. An independent group of interdisciplinary scientists developed the BRAIN 2025 plan through extensive deliberation with the scientific community. BRAIN 2025 recommended that the BRAIN Initiative focus on technology development in the first five years followed by a shift in future years to integrating and disseminating these technologies for broad, effective use by the wider scientific community. Because of the fast pace and unpredictable path of science and technology development, in 2019, a new external scientific working group reviewed progress towards the BRAIN 2025 goals. In the report, The BRAIN Initiative 2.0: From Cells to Circuits, Towards Cures,[72] they concluded the Initiative was advancing on all major priorities with new opportunities emerging and that given the remarkable progress to date, the BRAIN Initiative should invest in larger scale, transformative projects that could propel neuroscience far into the future.

Neuroethics as an integral part of BRAIN Initiative research

The BRAIN Initiative has committed at the outset to consider in a serious and sustained manner the ethical implications of emerging neuroscience research technologies. The BRAIN 2025 report recognized that neuroethics is an essential partner to neuroscience that can play a key role in guiding neuroscience research and the application of its findings toward addressing human health. Similarly, the BRAIN 2.0 report The BRAIN Initiative and Neuroethics: Enabling and Enhancing Neuroscience Advances for Society[73] anticipated ethical considerations in the context of rapidly evolving science. The external Neuroethics Working Group (NEWG), alongside the MCWG, provides expert input on neuroethics to the BRAIN Initiative. The BRAIN Initiative funds neuroethics research projects, facilitates collaborations to integrate neuroethics into neuroscience research, scans the BRAIN Initiative research portfolio to identify ethical questions, organizes workshops on neuroethics topics that are important for the BRAIN Initiative, and disseminates NEWG findings through high profile publications.

Promoting a Shift in Research Culture in Neuroscience

Given the ambitious goals of the BRAIN Initiative, success will require the engaged participation of a diverse collection of individuals from a variety of disciplines as well as widespread availability and use of research data and tools. The BRAIN Initiative is working to build a more inclusive and diverse research community and foster productive collaboration across research teams and disciplines, including through new requirements to the research it will support.

Building a more diverse research community

NIH recognizes that diverse teams working together to capitalize on innovative ideas and distinct perspectives outperform homogeneous teams. Accordingly, the BRAIN Initiative now requires that most applicants include a Plan for Enhancing Diverse Perspectives (PEDP) as part of the application. The PEDP will outline the strategies that applicants will use to advance the scientific and technical merit of the proposed project through the inclusion of diverse

[71] braininitiative.nih.gov/strategic-planning/brain-2025-report

[72] braininitiative.nih.gov/strategic-planning/acd-working-groups/brain-initiative%C2%AE-20-cells-circuits-toward-cures

[73] braininitiative.nih.gov/strategic-planning/acd-working-groups/brain-initiative%C2%AE-and-neuroethics-enabling-and-enhancing

perspectives. Examples of potential strategies investigators can use to compose teams richly diverse in perspectives, backgrounds, and academic disciplines can include inclusion and mentoring of personnel from groups historically underrepresented in the research workforce and inclusion of community advisory boards to inform research project design and/or dissemination of results. In addition to this new effort towards inclusivity, the Initiative also funds grant supplements that allow investigators to support a new trainee or early career researcher from an underrepresented group and further their career development. Further, the Blueprint/BRAIN Diversity Specialized Predoctoral to Postdoctoral Advancement (DSPAN) and BRAIN Initiative Transition to Independence Award programs support talented researchers from diverse backgrounds as they transition to the postdoctoral and the independent investigator career stages, respectively.

Recognizing the value of data sharing

The BRAIN Initiative projects are generating vast amounts of data. It is essential that these data are widely available to the research community for further analyses and to take into account any potential ethical considerations when neuroscience data are used to investigate human brain function. The BRAIN Initiative places a high priority on ensuring that the increasingly valuable data that it generates are FAIR (Findable, Accessible, Interoperable, and Reusable). To that end, and in line with NIH-wide efforts,[74] in 2019 the Initiative established a robust data sharing policy[75] which requires current awardees and new grantees to submit data from BRAIN supported research to one of the BRAIN data archives. This policy is supported by the authorities in the 21st Century Cures Act. The BRAIN Initiative has also substantially increased support for the development of data standards, archives, and analysis tools, and has funded multiple projects focused explicitly on the dissemination of research tools and results. These efforts to ensure that BRAIN Initiative data are FAIR will maximize their utility and promote a cultural shift towards data sharing and collaboration across different sub-fields of neuroscience research.

Next Steps: New Transformative Projects at the Frontiers of Science and Technology

Building on the success of the BICCN and following recommendations from the BRAIN 2.0 reports, the BRAIN Initiative is investing in three new projects that will accelerate the development of tools and techniques that will transform neuroscience research and our ability to treat human brain disorders. Two of these projects, the Human Brain Cell Atlas and the Armamentarium for Brain Cell Access, were jump-started by FY 2021 Congressionally directed funds and are already underway, while the third on Next Generation Technologies for Brain Micro-Connectivity Analysis is currently under development, with funding opportunity announcements (FOAs) potentially planned for FY 2022 and first awards to be issued in FY 2023, pending the availability of appropriations. Together these projects mark an unprecedented new phase for neuroscience research and the BRAIN Initiative, with an eye toward understanding the highly complex human brain.

The Human Brain Cell Atlas

Building on the successes of the BICCN, the Human Brain Cell Atlas project will provide a critically-needed inventory of all cell classes in the human brain, including detailed analyses of

[74] grants.nih.gov/grants/guide/notice-files/NOT-OD-21-013.html
[75] braininitiative.nih.gov/brain-programs/informatics

their genetic fingerprints. Representing an acceleration and expansion of the goals of the BICCN, The Human Brain Cell Atlas project will build directly on the remarkable technical progress and research infrastructure that is now in place to generate comprehensive brain cell atlases in humans and other species and establish annotated digital repositories for brain cell types available to the neuroscience research community. The tools, discoveries and resources that emerge from this project have the potential to transform our understanding of the human brain in health and disease in much the same way sequencing the human genome heralded the revolution in gene-based precision medicine.

Armamentarium for Brain Cell Access

In parallel with the Human Brain Cell Atlas, the Armamentarium for Brain Cell Access will support the development of technologies that can precisely target specific cells and circuits in the brain to probe their functions and roles in disease. An expanded toolkit for accurately targeting brain cells will enable precision treatments for human disorders. Research in the Human Brain Cell Atlas in conjunction with the Armamentarium for Brain Cell Access will accelerate the translation of discoveries toward exquisite precision for molecular and genetic human brain circuit therapies.

Next Generation Technologies for Brain Micro-Connectivity Analysis

The third transformative project will aim to usher in a new era of brain research and therapies where detailed wiring diagrams or "connectomes" of the brain will provide new vistas of how cells in the brain talk to each other and how brain circuits work. The first goal of this project will be to complete a nanometer-level wiring diagram of an entire mouse brain, which represents an orders of magnitude leap from the connectomes of significantly smaller brains of worms and flies. This project will also support research to map the long-distance projections or "projectomes" in humans and non-human primates. Projectomes are akin to mapping the major highways in the brain as opposed to the "street-level" connectome view that will be mapped in the mouse brain. These initiatives will also generate data at an unprecedented scale—a whole mouse brain connectome would take up 1 exabyte (1,000 petabytes) of data, whereas a whole human brain connectome would comprise 1 zettabyte, which is roughly equivalent to the world's annual internet traffic. Managing and processing data at this scale will require collaborations across biology, engineering, computer science, physics, and chemistry. In spring 2021, NIH partnered with the DOE Office of Science to host a series of workshops to foster these collaborations and consider challenges and opportunities presented by state-of-the-art technologies for mapping brain circuits.

Conclusion

The BRAIN Initiative funds cross-cutting research and facilitate fundamental discoveries in neuroscience that will inspire new therapies to alleviate the burden of diseases of the brain. The BRAIN Initiative has also taken major steps in shifting the research culture within neuroscience through its emphasis on neuroethics, diversity and inclusion in the research community, and FAIR data sharing practices to enable and enhance the scientific and technological advances from the BRAIN Initiative. The new BRAIN transformative projects represent an ambitious new era in neuroscience. The discoveries on the horizon promise to reshape our understanding of the brain as well as the approaches to improving human health and treating the many neurologic and neuropsychiatric diseases afflicting humankind.

COMMON FUND SINGLE CELL ANALYSIS RESEARCH

Program Overview

The adult human body contains an estimated 37 trillion cells, carefully organized in tissues to carry out the daily processes to keep us alive and healthy. Many biomedical research studies are performed using groups of cells, which can obscure important differences between individual cells within the same population. In these studies, rare cell types and differences in cellular states may go undetected, normal variation between cells is often not appreciated, and the function and context of individual cells as part of the whole can be impossible to identify. Understanding the organization, specialization, and cooperation of different cells within tissues may lead to a paradigm shift in our understanding of development, health, aging, and disease. However, despite recent technological advances, novel tools and approaches to study cellular heterogeneity in complex environments are still greatly needed and understanding high-resolution features of cells within tissues remains a major challenge in biomedical research.

Single cell research is of relevance to many National Institutes of Health (NIH) Institutes, Centers, and Offices (ICOs), and is supported through a variety of ICO-specific activities across the agency. In addition, the NIH Common Fund (CF),[76] a dedicated source of support for cross-cutting NIH priorities, has been advancing single cell research in partnership with ICOs for approximately 10 years through a series of complementary programs. Launched in 2012, the CF's Single Cell Analysis[77] program aimed to examine signatures of individual human cells to measure, analyze, and manipulate cellular heterogeneity and to define specific cell types or states in a population. This program also developed innovative tools and technologies to enable single cell analysis and examine biological processes at the single cell level. Led in partnership with the National Institute of Mental Health (NIMH) and the National Institute of Biomedical Imaging and Bioengineering (NIBIB), 19 ICOs across NIH participated in scientific oversight and management for the Single Cell Analysis program.

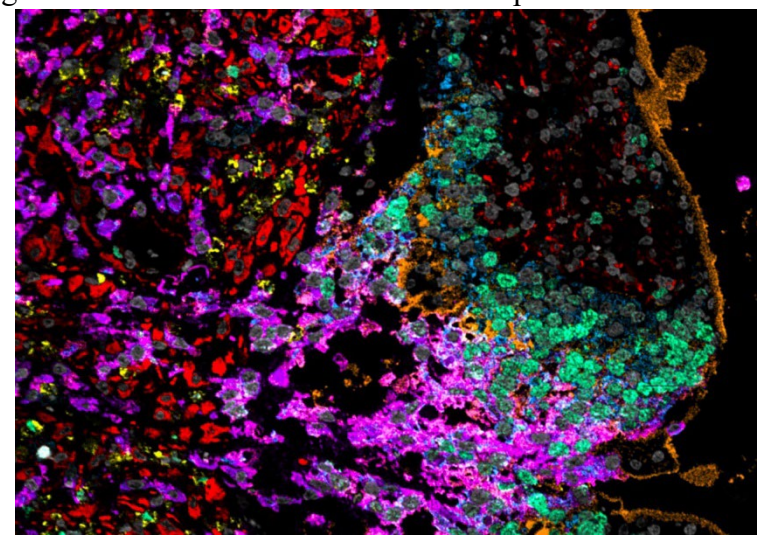
By the end of the Single Cell Analysis program in 2017, the program had developed a publicly available portal containing phenotypic and transcriptomic data from over 600 cells across over 50 subjects. It also developed novel tools that overcame major technological hurdles in single cell analysis research, including new tools that enabled high-throughput detection of gene transcripts in single cells, improvements in imaging techniques to enhance spatial resolution, and barcoding techniques to detect cell-type-specific gene expression. Harnessing the creative energy of the research community, the Single Cell Analysis program supported a "Follow that Cell" Grand Challenge to develop new approaches for analyzing dynamic states of individual cells that could serve as the basis for predicting cell behavior and function over time. This Challenge yielded multiple innovative solutions, with the winning project demonstrating a novel nanopipette technology to monitor the properties of single cells over time, allowing repeated measurements without destroying cells. Evaluation of the Single Cell Analysis program demonstrated that it had an important impact on advancing single cell research, with over 200 highly cited papers published before the program's end. Additionally, there was a substantial increase in NIH-funded projects in single cell analysis during this time, as well as an increase in

[76] commonfund.nih.gov/
[77] commonfund.nih.gov/singlecell

publications in this area, suggesting that the Single Cell Analysis program contributed to a rapid growth in this research field.[78]

Thanks in part to the success of the Single Cell Analysis program and other related technological advances, it is now within the realm of possibility to map the entire human body at single cell resolution. However, given the enormity of this task, this remains a significant challenge. To address this challenge, CF launched the Human BioMolecular Atlas Program (HuBMAP)[79] in 2018. Co-led by the National Heart, Lung, and Blood Institute (NHLBI), NIBIB, and the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), along with an additional 12 participating NIH ICOs, HuBMAP is developing an open, global framework for mapping the human body at single cell resolution. These efforts will lay the groundwork for researchers across the world to contribute to mapping efforts using a standardized, coordinated approach, sharing data and tools with the entire biomedical research community.

HuBMAP is composed of several integrated initiatives. These include development of novel transformative technologies to map the human body, rapid integration of promising technologies into the HuBMAP research consortium so that HuBMAP funded researchers have access to the most cutting-edge approaches, tissue mapping centers to produce 3D tissue maps from various organs at high-resolution, and demonstration projects to showcase how HuBMAP data, in combination with other data sets as needed, can be used to build improved tools and models of cellular organization and communication in tissues. Additionally, HuBMAP also supports the HuBMAP Integration, Visualization, and Engagement (HIVE) Collaboratory, charged with managing data; coordinating across the HuBMAP consortium; developing tools for visualizing, searching, and modeling data; and building an atlas of tissue maps. To ensure that HuBMAP's efforts complement and do not duplicate other ongoing single cell atlas programs, HuBMAP is coordinating with related NIH programs, such as The Brain Research Through Advancing Innovative Neurotechnologies® (BRAIN) initiative, the National Cancer Institute's (NCI) Human Tumor Atlas Network, the NIDDK Precision Medicine Program and GenitoUrinary Development Molecular Anatomy Project (GUDMAP), and NHLBI's LungMAP. HuBMAP is also coordinating with international



Cell atlas of the maternal-fetal interface in the uterus during early pregnancy. Image produced by HuBMAP researcher Dr. Mike Angelo, Stanford University.

[78] Roy et al. *Accelerating a paradigm shift: The Common Fund Single Cell Analysis Program.* science.org/doi/10.1126/sciadv.aat8573

[79] commonfund.nih.gov/HuBMAP

mapping efforts, such as the Human Cell Atlas and the Human Protein Atlas, to make data interoperable across different programs and initiatives.

HuBMAP has begun releasing foundational data sets that can be used by the entire biomedical research community. The HuBMAP data portal[80] provides access to almost 600 data sets, consisting of over 500 samples from over 60 donors. These data sets include single cell information from human kidney, spleen, lymph node, large and small intestine, thymus, lung, heart, liver, and pancreas. HuBMAP has also developed a number of innovative tools and resources to facilitate single cell analysis research, including technologies to map proteins to distinct cell types within tissue samples, processes for "anchoring" different types of data to link multiple data sets across the same type of cell, molecular profiles of proteins specific to different types of cells that can be used to predict where cells are in relation to each other in healthy and diseased tissues, and a web application that allows researchers to map their own data onto reference maps of eight organs.

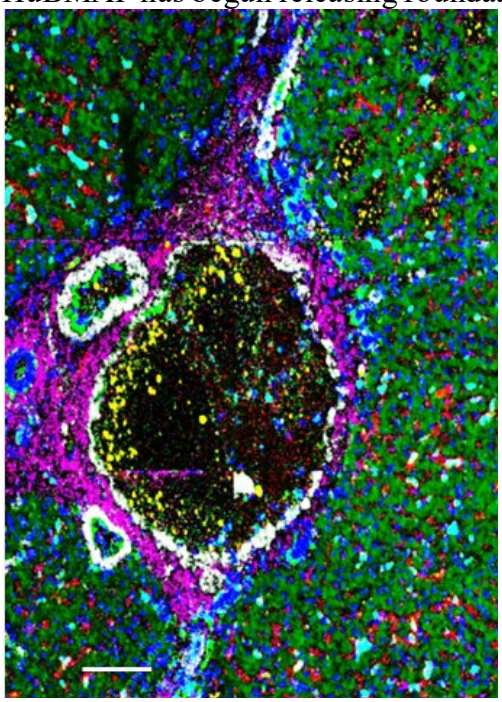


Image of portal triad in the human kidney, where three blood vessels meet to carry blood and nutrients to the liver. Image from HuBMAP researchers Drs. Hua Tian (Pennsylvania State University) and Brent Stockwell (Columbia).

In 2021, the CF launched an exciting new chapter in single cell research, the Cellular Senescence Network (SenNet).[81] Co-led by the National Institute on Aging (NIA) and NCI, with participation from an additional 19 NIH ICOs, SenNet is leveraging single cell approaches to comprehensively identify and characterize the differences in rare senescent cells across different tissues, various stages of human health, and the lifespan. Senescent cells are specialized cells within the body that no longer divide. Under certain circumstances, such as aging, senescent cells accumulate and release a collection of molecules that can cause damage to nearby tissue. Under other conditions, such as cancer or wound healing, senescent cells can protect health by preventing tumor growth or releasing molecules that promote the growth of new tissue. Biomedical researchers still have many unanswered questions about how, when, why, and where senescent cells form, but their rarity and diversity make them difficult to identify and characterize in the body. Despite this, senescence is an attractive target for new therapeutics, with some already in development. A deeper understanding of cellular senescence will help researchers to develop therapies that encourage beneficial effects of senescent cells while suppressing their tissue-damaging effects.

[80] portal.hubmapconsortium.org/
[81] commonfund.nih.gov/senescence

SenNet will provide publicly accessible atlases of senescent cells, the differences among them, and the molecules they secrete, using data collected from multiple human and model organism tissues. To identify and characterize these rare cells, SenNet will develop innovative tools and technologies that build upon previous advances in single cell analysis, such as those from the Single Cell Analysis program and HuBMAP. Lastly, SenNet aims to unite cellular senescence researchers by developing common terms and classifications for senescent cells.

Next Steps

HuBMAP and SenNet are ongoing, with HuBMAP and the first stage of SenNet both continuing through 2025. At that time, it is anticipated that these programs will have achieved the ambitious goals defined at the beginning of each program, propelling single cell research forward in different ways. At the end of the first stage of SenNet, CF will consider whether there are additional, high-impact goals that may best be achieved through support of a second stage of the program. Additionally, the Common Fund Data Ecosystem (CFDE),[82] a trans-CF effort to enable researchers to query across multiple disparate data sets, is working closely with HuBMAP and SenNet to ensure the single cell data from both programs is interoperable for maximum utility for the biomedical research community.

[82] commonfund.nih.gov/dataecosystem

RESEARCHING COVID TO ENHANCE RECOVERY (RECOVER) INITIATIVE

Program Overview

In the summer of 2020, as the National Institutes of Health (NIH) and its industry partners worked rapidly to complete critical safety and efficacy trials of COVID-19 vaccines and therapeutics, reports began to emerge that some people who had already struggled with COVID-19 were still fraught with symptoms months later. By December 2020, SARS-CoV-2 had spread to more than 20 million Americans, and researchers had published the first case studies of people who experienced long-term effects.[83] That same month, NIH brought together researchers, clinicians, and patients for a workshop to summarize emerging knowledge about post-acute sequelae of SARS-CoV-2 infection (PASC, or Long-COVID) and to identify key scientific questions that would drive future studies.[84] That workshop helped set the stage for NIH's Researching COVID to Enhance Recovery (RECOVER) Initiative, which is working to improve our understanding of Long-COVID, and ultimately to inform how to prevent and treat it.[85]

An evolving body of research shows that recovery from infection with SARS-CoV-2 varies from person to person. Most patients seem to recover quickly and completely, while for other individuals there are significant post-acute sequelae. Reported symptoms among people who have been infected with SARS-CoV-2 range from mild to incapacitating, may persist after recovery from acute disease, may involve multiple organs and systems, and can adversely affect overall quality of life. Persistent symptoms sometimes called Long COVID, have been reported to include fatigue, shortness of breath, "brain fog," sleep disorders, fevers, gastrointestinal symptoms, anxiety, and depression. However, in some cases, new symptoms arise after acute infection or evolve over time, even among people who initially had no symptoms.

Recognizing the importance of this public health challenge, in December 2020, Congress appropriated $1.15 billion in NIH funding, available for obligation over four years, to support research into the long-term effects of SARS-CoV-2. Buoyed by this funding, NIH launched RECOVER in February 2021.

Among the questions that RECOVER hopes to answer are:

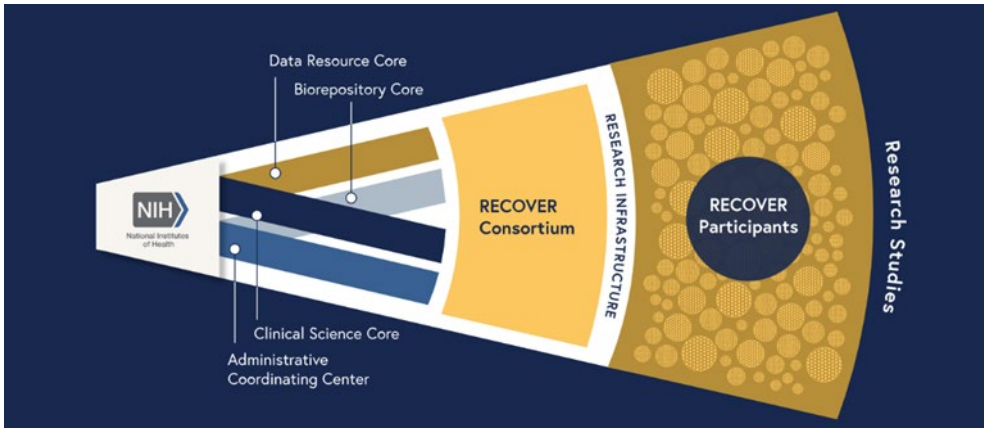
- What is the clinical spectrum of Long-COVID and how can we help physicians diagnose it?
- What fraction of people develop Long-COVID after acute SARS-CoV-2 infection?
- What is the biology underlying Long-COVID and recovery from SARS-CoV-2 infection over time?
- Does SARS-CoV-2 infection trigger changes in the body that increase the risk of other conditions, such as chronic heart or brain disorders?
- Does Long-COVID share mechanisms with or offer insights into other post-viral syndromes, such as myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS)?

At the heart of RECOVER is a longitudinal cohort study of children and adults, including pregnant women, at various stages of recovery from SARS-CoV-2 infection. The study will also

[83] pubmed.ncbi.nlm.nih.gov/32644129/
[84] pubmed.ncbi.nlm.nih.gov/33780290/
[85] recovercovid.org/

enroll participants without SARS-CoV-2 infection to serve as a comparison group. NIH envisioned that to quickly assemble a nationally representative cohort, RECOVER would include participants enrolled from Long COVID clinics as well as from existing NIH-funded studies of population health. Many of these existing studies include high representation of people from minority and underserved groups that have been disproportionately affected by COVID-19, including African Americans, Hispanic Americans, American Indian/Alaska Natives, and people in rural communities. A Clinical Science Core (CSC) would coordinate the study and establish a collaborative network for investigators, with additional cores to facilitate appropriate analysis and sharing of data and biospecimens.

In June 2021, an award was made to New York University Langone Health to serve as the CSC. The CSC convened researchers, people affected by Long COVID, and representatives from advocacy organizations to develop a harmonized set of master study protocols—agreed-upon methods, measures, and terminology that will be used to monitor people recovering from Long COVID and generate data that will underpin critical studies of Long COVID. With those master protocols now in hand, researchers from different sites across the country will all be speaking the same language and using the same tools as they collect, analyze, share, and compare data on Long COVID.



In September 2021, the NIH announced a nearly $470 million award to the CSC, which will disseminate funds to more than 30 institutions. Those institutions will partner with hundreds of sites across the country to enroll tens of thousands of volunteers and follow their health over the next several years.

In addition to clinical exams and laboratory tests, RECOVER will collect data through electronic health records and mobile health technologies, such as smartphone apps and wearable devices; this will help reduce the burden on participants and enable the analysis of real-world data from participants in their daily life. An autopsy component will analyze multiple organs and tissues, including the brain, to identify tissue injury due to SARS-CoV-2 infection and/or its sequelae.

In summary, the comprehensive and inclusive composition of the Recovery Cohort, the harmonized master protocols—developed with input from patients—and the broad array of expertise represented in the investigator consortium will support a robust multi-disciplinary assessment of Long COVID that will help determine what causes it and find much needed answers to prevent and treat this often-debilitating condition.

NIH Collaboration

Given the clear involvement of cardiovascular-pulmonary, neurologic, and immune systems in Long COVID, the National Heart, Lung, and Blood Institute (NHLBI), the National Institute of Allergy and Infectious Diseases (NIAID), and the National Institute of Neurological Disorders and Stroke (NINDS) are co-leading RECOVER. Critical expertise is also provided by the National Cancer Institute (NCI), National Center for Advancing Translational Sciences (NCATS), National Center for Complementary and Integrative Health (NCCIH), National Institute on Aging (NIA), *Eunice Kennedy Shriver* National Institute for Child Health and Human Development (NICHD), National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), National Institute for Mental Health (NIMH), and National Library of Medicine (NLM), as well as the *All of Us* Research Program and the Office of Data Science Strategy within the NIH Office of the Director.

Next Steps/Goals

The RECOVER infrastructure is in place to support more than 30 funded cohorts in enrolling racially and ethnically diverse children and adults, including pregnant women, across the country. The participants may be followed for up to four years. This will increase understanding about the biological basis of Long COVID and help inform researchers and clinicians investigating potential therapies. Additional efforts related to RECOVER may include developing approaches and technologies to help identify individuals susceptible to developing Long COVID.[86] RECOVER also has the potential to enhance our basic knowledge of how humans recover from viral infections in general and is likely to improve understanding of other chronic post-viral syndromes and autoimmune diseases. Such knowledge could help inform future pandemic response preparedness.

[86] grants.nih.gov/grants/guide/notice-files/NOT-HL-21-018.html

UNITE INITIATIVE

Program Overview:
The National Institutes of Health (NIH) launched the UNITE Initiative[87] at a special meeting of the Advisory Committee to the Director[88] on February 26, 2021, with the goal of identifying and advancing racial and ethnic equity at the NIH and within the greater biomedical ecosystem. UNITE is comprised of five workstreams with separate but coordinated objectives to tackle the problem of racism and discrimination in science while developing methods to promote diversity and inclusion across the biomedical enterprise. These workstreams include:

- U - Understanding stakeholder experiences through listening and learning
- N - New research on health disparities, minority health, and health equity (HD/MH/HE)
- I - Improving the NIH culture and structure for equity, inclusion, and excellence
- T - Transparency, communication, and accountability with NIH's internal and external stakeholders
- E - Extramural research ecosystem: changing policy, culture, and structure to promote workforce diversity

UNITE is an idea generator that establishes proposals for review and consideration by the NIH Steering Committee. Through this NIH-wide, collaborative effort, UNITE will work to address challenging issues stemming from structural racism. These challenges specifically include but are not limited to:

- Attracting and Retaining Scientists from Underrepresented Groups
- Addressing Disparities in the Success Rates for Grants Supporting Black Scientists
- Improving Transparency of Race-Based Demographic Data
- Increasing Funding of Research for Minority Health, Health Disparities, and Health Equity[89]

Attracting and Retaining Scientists from Underrepresented Groups: The NIH is instituting several efforts to attract and retain scientists from underrepresented groups and is implementing UNITE recommendations that enhance end expand those efforts. For example, NIH is expanding the Distinguished Scholars Program,[90] a cohort model for enhancing diversity and inclusion of Principal Investigators in the NIH Intramural Research Program, to Senior Investigators hired with tenure and enhancing recruitment of researchers from underrepresented groups as candidates for open tenure-track investigator positions. This program is led through a collaboration between the Chief Officer for Scientific Workforce Diversity (COSWD) Office and the Intramural Research Program (IRP).

NIH is working to expand the NIH Science Education Partnership Award (SEPA) program.[91] SEPA funds innovative pre-kindergarten to grade 12 science, technology, engineering and

[87] www.nih.gov/ending-structural-racism/unite
[88] acd.od.nih.gov/meetings.html
[89] www.cell.com/cell/fulltext/S0092-8674(21)00631-0
[90] diversity.nih.gov/programs-partnerships/dsp
[91] nihsepa.org/

Addressing Disparities in the Success Rates for Grants Supporting Black Scientists: In 2011, Ginther et al. reported a significant racial gap apparent in NIH Research Project Grants (R01) funding.[92] The funding rate for R01 applications from African American/Black (AA/B) scientists was 10 percentage points lower than for all other groups. This spurred NIH and the biomedical community to look closely at individual and systemwide potential contributors and solutions, codified in 13 recommendations by the NIH Advisory Committee to the Director (ACD).[93] Today, there are still far too few Black applicants and applicants from other groups underrepresented in the biomedical workforce (Figure 1). While success rates for receipt of R01 equivalent grants from Black applicants have increased slightly,[94] further work remains to eliminate the well-documented funding gap.

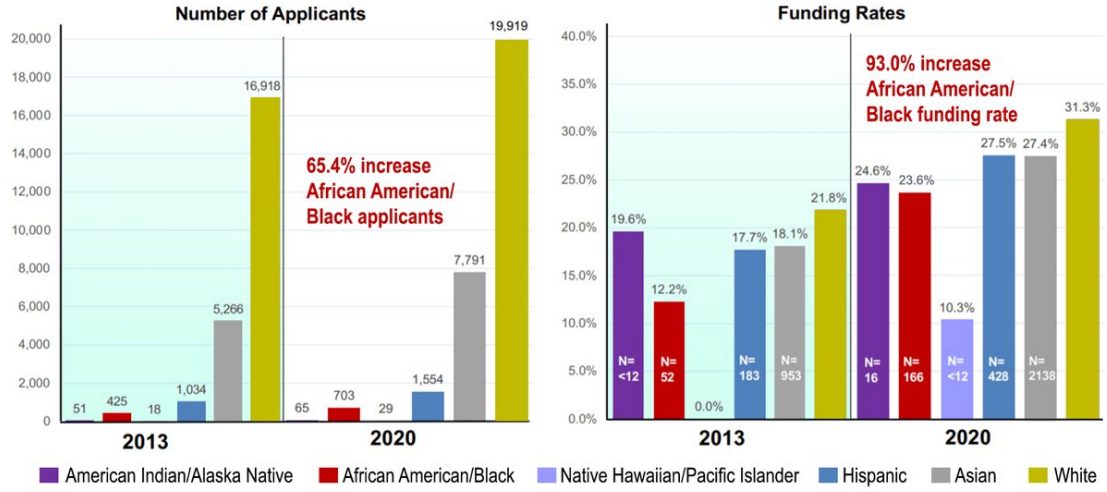


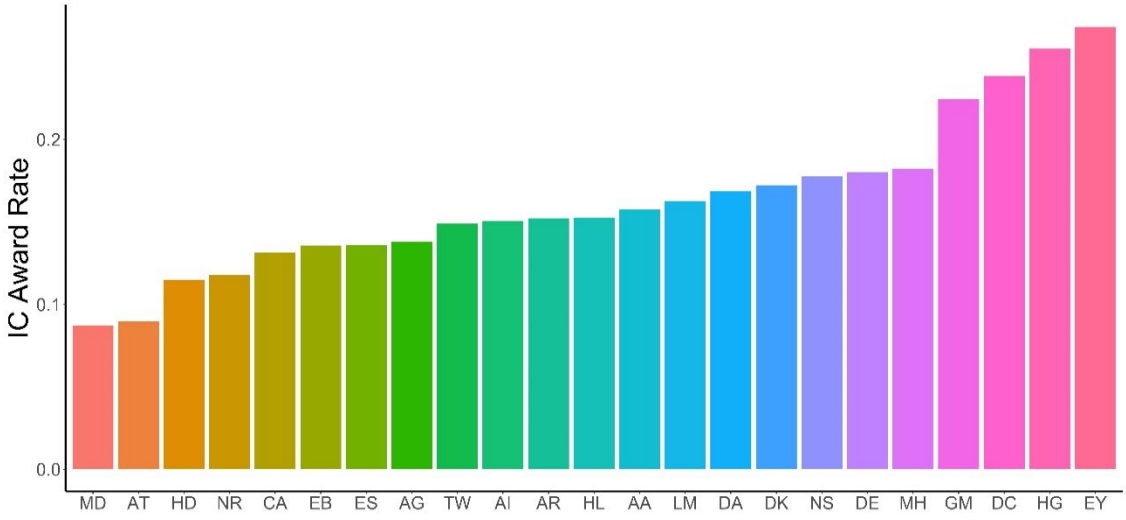
Fig. 1. Disparities in NIH R01 Grant Application and Funding Rates. Disparities in number of applicants and funding rates between NIH R01 grants that support non-white investigators and NIH R01 grants that support white investigators. From 2013 to 2020, both application and funding rates for grants that support African American/Black investigators increased, but differences with white investigators still remained.

To better understand funding differences, NIH analyzed data from 2011-2015 (Figure 2) and found that 10 percent of 148 topics account for 50 percent of applications submitted by AA/B Principal Investigators (PIs). Applications on "AA/B Preferred" topics were funded at lower

[92] www.ncbi.nlm.nih.gov/pmc/articles/PMC3412416/
[93] acd.od.nih.gov/documents/reports/DiversityBiomedicalResearchWorkforceReport.pdf
[94] diversity.nih.gov/sites/coswd/files/images/docs/SWD_Progress_2021_Infographic.pdf

rates despite peer review outcomes being similar. The lower rate of funding was primarily due to their assignment to ICs with lower award rates.[95,96]

In summary, differential award rates were critical drivers of differences, with ICs that had lower award rates receiving a greater proportion of applications in topics to which AA/B PIs disproportionately apply. These data present a new potential target for intervention that the NIH will be exploring. The President's FY 2023 budget proposal may help address this gap, as it proposes increased funding for the National Institute on Minority Health and Health Disparities (NIMHD), the National Institute of Nursing Research (NINR), the National Heart Lung and Blood Institute (NHLBI), and the Fogarty International Center (FIC) -- ICs that have disproportionate numbers of institutional applications whose scientists are from underrepresented groups, but lower than average R01 success rates.



MD, Minority Health and Health Disparities; AT, Center for Complementary and Integrative Health; HD, Child Health and Human Development; NR, Nursing Research; CA, Cancer; EB, Biomedical Imaging and Bioengineering; ES, Environmental Health Sciences; AG, Aging; TW, Fogarty Center; AI, Allergy and Infectious Diseases; AR, Arthritis and Musculoskeletal and Skin Diseases; HL, Heart Lung and Blood; AA, Alcohol Abuse; LM, Library of Medicine; DA, Drug Abuse; DK, Diabetes and Digestive and Kidney Diseases; NS, Neurological Disorders and Stroke; DE, Dental; MH, Mental Health; GM, General Medical Sciences; DC, Deafness and Communication; HG, Human Genome Research; EY, Eye.

Fig. 2. Institute and Center Award Rates for 157,405 R01 Applications 2011-2015. ICs have widely varying award rates (the ratio of funded applications to all applications). These marked variations (from 9.1% to 26.9%) may explain funding differences for different topics.[97]

UNITE is listening to and learning from internal and external stakeholders through many mechanisms and engaging all of the NIH for change and then noting examples of bidirectional communication which impacts institutional and cultural transformation. One example of this process can be seen in NIH's Brain Research Through Advancing Innovative Neurotechnologies® (BRAIN) Initiative funding opportunity announcement (FOA), which was posted April 8, 2021. The NIH BRAIN FOA is the first to use a Plan to Enhance Diverse Perspectives (PEDP) as consideration for scoring.[98] The term diverse perspectives is broadly defined (e.g., diversity of discipline, geography, etc.), including consideration of diversity as

[95] pubmed.ncbi.nlm.nih.gov/31633016/
[96] elifesciences.org/articles/67173
[97] doi.org/10.1016/j.neuron.2021.10.021
[98] grants.nih.gov/grants/guide/notice-files/NOT-MH-21-310.html

defined in NIH's notice of interest in diversity.[99] This innovative approach is expected to foster the UNITE goal of racial and ethnic equity.

Improving Transparency of Race-Based Demographic Data: Another critical aspect of the UNITE Initiative is to develop a sustainable process to systematically gather and make public the demographics of NIH's internal and external workforce. The NIH has made several efforts to ensure transparency of these data:

- Published NIH internal federal workforce data[100] that describe the demographic composition of the NIH workforce. Data will be used to investigate potential disparities which may present barriers to equity in the scientific workforce.

- Published NIH's Intramural Research Program data dashboard[101] to capture 2019/2020 data on employee demographics and allow cross-tabulations of sex, race/ethnicity, and career stage.

- Enhanced reporting of NIH grantee demographics in the NIH Databook,[102] which provides basic summary statistics on extramural grants and contract awards, grant applications, the organizations that NIH supports, the trainees and fellows supported through NIH programs, and the national biomedical workforce.

To facilitate public access of these data and more, UNITE has developed a data dashboard on the NIH Ending Structural Racism Webpage. This one-stop shop for high-level NIH data related to Diversity, Equity, Inclusion, and Accessibility links to more granular data across the NIH website and will be regularly updated towards UNITE's mission of transparency and accountability.[103]

Increasing Funding of Research for MH/HD/HE: As COVID-19 has made painfully clear, health disparities and inequities continue to contribute to morbidity and mortality in our nation, making it essential to redress the fundamental causes of these disparities/inequities and identify research programs that could identify effective interventions. All NIH ICs, led by the NIMHD, will seek to expand and enhance research on health disparities and health equity. NIH has implemented several strategies that seek to expand and enhance research on health disparities and health equity:

- The NIH Common Fund, led by the Division of Program Coordination, Planning, and Strategic Initiatives (DPCPSI), has published two FOAs, RFA-RM-21-021[104] and RFA-RM-21-022,[105] to support innovative investigator-initiated projects aimed at reducing health disparities and inequalities and advance health equity, totaling $58 million over five years. Emphasis was placed on projects aimed at developing effective interventions,

[99] grants.nih.gov/grants/guide/notice-files/NOT-OD-20-031.html
[100] www.edi.nih.gov/data/demographics
[101] oir.nih.gov/sourcebook/personnel/irp-demographics
[102] report.nih.gov/nihdatabook/
[103] www.nih.gov/ending-structural-racism/data-dashboard
[104] grants.nih.gov/grants/guide/rfa-files/RFA-RM-21-021.html
[105] grants.nih.gov/grants/guide/rfa-files/RFA-RM-21-022.html

and institutions that serve minority populations. Eleven awards were issued, with five focused on supporting researchers at MSIs.

- The NIH published the RFA-MD-21-004[106] that supports observational research to understand the role of structural racism and discrimination (SRD) in causing and sustaining health disparities, and intervention research that addresses SRD in order to improve minority health or reduce health disparities; and up to $30.8 million committed from 25 NIH Institutes, Centers, and Offices (ICOs).

- Republishing RFA-RM-21-022: Transformative Research to Address Health Disparities and Advance Health Equity at Minority Serving Institutions (U01 Clinical Trial Allowed)[107] in FY 2022.

Addressing Racism in the NIH Workplace: The NIH has identified accounts of racism in the workplace reported by people of color throughout the biomedical research enterprise both through personal accounts and through Notification and Federal Employee Antidiscrimination and Retaliation (NoFEAR) Act data collected and shared by the Office of Equity, Diversity, and Inclusion (EDI).[108] To address racism in the NIH workplace, NIH will publicly identify and correct any NIH policies or practices that may have helped to perpetuate structural racism and discrimination. Efforts NIH has made to date to identify and correct any disparities include:

- Developing FY 2022 performance plan element for IC Directors to be held accountable for diversity, equity, inclusion, and accessibility.

- Updating internal NIH policy[109] to acknowledge the full range of protected categories for reporting harassment and discrimination.

- Developing Racial and Ethnic Equity Plans that set expectations for each IC as a component of the FY 2022 performance plan element.

- Updating eRA Commons to include racial discrimination as a specific concern that NIH grantee institutions can report to the NIH.[110]

NIH-wide Collaboration: UNITE is spearheaded by the Immediate Office of the Director and co-chaired by the Chief Officer for Scientific Workforce Diversity, the Deputy Director for Management, and the Principal Deputy Director. The five interrelated, but distinct, workstreams of UNITE have nearly 80 members from across the NIH workforce with representation from each of NIH's 27 ICs as well as the Office of the Director. Members of UNITE were nominated by NIH ICO Leadership. UNITE works in collaboration with several NIH key stakeholders including EDI, COSWD, the Office of Human Resources (OHR), OHR/Civil Program, the Office of Communications and Public Liaison, DPCPSI, and others. The UNITE Initiative

[106] grants.nih.gov/grants/guide/rfa-files/RFA-MD-21-004.html
[107] grants.nih.gov/grants/guide/rfa-files/RFA-RM-21-022.html
[108] www.edi.nih.gov/no-fear-act
[109] policymanual.nih.gov/1311
[110] public.era.nih.gov/shape/public/notificationForm.era

reports to the NIH Steering Committee and to the NIH ACD. The infrastructure described here allows UNITE to receive input from across NIH and external stakeholders at all levels and encourages the community to general proposals and concepts that includes an NIH-wide support system.

Next Steps/Goals: While NIH understands that ending structural racism and achieving racial and ethnic equity in the biomedical research enterprise will take time, NIH believes doing so will propel our work in biomedical research and discovery. Recommendations put forward by UNITE for next steps include:

- Continue to listen and learn from a wide variety of stakeholders, both internal and external, including those who are not frequently engaged
- Develop actionable data dashboards that track and provide visualizations of the intramural workforce and NIH HD/MH/HE research investments with key performance indicators and metrics
- Encourage additional FOAs that focus on IC-specific disease/topic areas related to HD/MH/HE
- Develop programs to spur institutional culture change in support of inclusivity and equity
- Examine NIH staff (e.g., program officer, scientific review officer) interactions with applicants (e.g., underrepresented group applicants) to address bias or inequities that may impact funding opportunities
- Develop programs to expand NIH interactions with and support of HBCUs, TCUs, and other MSIs
- Change the physical and virtual representations at NIH to more accurately reflect the diversity of our society

DATA SCIENCE AT NIH

Overview

Immense amounts of data are generated throughout the biomedical research enterprise and in health care settings, from fundamental experiments using cells and research organisms to clinical studies and community-level epidemiological research. These data have value to the original studies in which they are generated as well as benefit for future investigations. Thus, careful acquisition, management, storage, and analysis of these data quickly and accurately are priority interests for the NIH. Investing in data science is critical to draw meaning from these data. In addition, NIH must support the wide range of research and advanced data analysis needs, both those arising in response to the NIH COVID-19 response as well as future challenges and opportunities. Guided by its Strategic Plan for Data Science,[111] NIH supports efforts to build the infrastructure and capabilities needed to discover, access, analyze, and combine data in innovative ways that respect the conditions under which the original data were collected. In addition, NIH must develop a diverse and talented data science workforce that will address critical priorities in research, clinical care, and human health.

The Office of Data Science Strategy (ODSS) within the NIH Office of the Director (OD) Division of Program Coordination, Planning, and Strategic Initiatives supports catalytic efforts to advance data science as well as efforts to integrate NIH resources into a modern data ecosystem built on principles of Findability, Accessibility, Interoperability and Reusability (FAIR). ODSS leads the implementation of the NIH Strategic Plan for Data Science through partnerships and collaborations with NIH Institutes, Centers, and Offices (ICOs), other federal government agencies, and the private sector.

Progress

The importance of data science to the NIH mission continues to increase, partly driven by the volume, velocity, and complexity of health and life science data, as well as the potential for these rich data to inform our understanding of human health and disease. Supporting innovative workflows that integrate disparate data resources continues to be a grand challenge for the research community and an NIH focus. In response, several NIH-wide programs include efforts to enhance data interoperability and cross-data workflows, including the NIH Helping to End Addiction Long-term (HEAL) Initiative,[112] the Common Fund Data Ecosystem,[113] and the *All of Us* Research Program.[114] In addition, other NIH-wide programs aim to advance data science more broadly including the new Harnessing Data Science for Health Discovery and Innovation in Africa program.[115]

1. Data Infrastructure & Interoperability

As a first step to connecting the data across NIH, ODSS has partnered with the Center for Information Technology (CIT) in an NIH-wide effort to develop a Research Authentication Service (RAS). RAS will streamline access to NIH's controlled access data by creating common

[111] datascience.nih.gov/nih-strategic-plan-data-science
[112] heal.nih.gov/
[113] commonfund.nih.gov/dataecosystem
[114] www.researchallofus.org/
[115] commonfund.nih.gov/AfricaData

authentication and authorization protocols for identity and access management across NIH systems. Reducing researcher burden for data access through RAS is a foundational component of NIH's data ecosystem. Eight NIH platforms are participating in RAS: National Cancer Institute's (NCI) Cancer Research Data Commons;[116] Common Fund's (CF) Common Fund Data Ecosystem;[117] National Human Genome Research Institute's (NHGRI) Genomic Data Science Analysis, Visualization, and Informatics Lab-space (AnVIL);[118] National Heart, Lung, and Blood Institute's (NHLBI) BioData Catalyst;[119] National Institute of Mental Health's (NIMH) NIMH Data Archive;[120] NIH *All of Us* Research Program's Research Hub;[121] National Library of Medicine's (NLM) National Center for Biotechnology Information's (NCBI) database of Genotypes and Phenotypes (dbGaP);[122] and CF/*Eunice Kennedy Shriver* National Institute of Child Health and Human Development's (NICHD) Kids First Data Resource Center.[123] An important milestone was reached in FY 2021, with researchers now able to use RAS to seamlessly log in once across participating platforms steps to access relevant data.

A second effort to support data interoperability across NIH is the NIH Cloud Platform Interoperability (NCPI) program, which is a partnership between ODSS and five NIH Institutes and their platforms: NCI's Cancer Research Data Commons, CF's Kids First Data Resource Center, NHGRI's AnVIL, NHLBI's BioData Catalyst, and NLM/NCBI's dbGaP. NCPI uses a federated model to simplify research access to genomic data and serves as a test ground for new interoperability approaches to large scale data analysis. As of FY 2021, researchers can access and analyze genomic data across these five important NCPI platforms.

Finally, commercial cloud companies provide a foundational computational infrastructure for interoperability. Cloud services are ideally suited to geographically distributed collaborations and big data analysis. The NIH Science and Technology Research Infrastructure for Discovery, Experimentation, and Sustainability (STRIDES) Initiative is a collaboration between ODSS and CIT promoting commercial cloud access. With ODSS funding support, STRIDES is harnessing the power of the cloud to help advance biomedical research by providing cost-effective access to industry-leading partners. These partnerships enable researchers' access to rich datasets and advanced computational infrastructure, tools, and services. In FY 2021, NIH added Microsoft Azure as an industry partner joining Google and Amazon Web Services to advance the STRIDES Initiative's aim to accelerate biomedical research in the cloud.

2. Modernized Data Ecosystem

To modernize its data-resources ecosystem, NIH supports efforts to store and share datasets and to leverage ongoing initiatives to better integrate clinical and observational data into data science. Accessible, well-organized, secure, and efficiently operated data resources are critical to modern scientific inquiry.

[116] datascience.cancer.gov/data-commons
[117] commonfund.nih.gov/dataecosystem
[118] www.genome.gov/Funded-Programs-Projects/Computational-Genomics-and-Data-Science-Program/Genomic-Analysis-Visualization-Informatics-Lab-space-AnVIL
[119] biodatacatalyst.nhlbi.nih.gov/
[120] nda.nih.gov/
[121] www.researchallofus.org/
[122] www.ncbi.nlm.nih.gov/gap/
[123] kidsfirstdrc.org/

To support a seamless repository ecosystem, ODSS has collaborated across the NIH ICOs to support existing data repositories of all sizes and all stages in their life cycle and to increase their FAIR-ness and Transparency, Responsibility, User focus, Sustainability and Technology (TRUST)-worthiness. These efforts improve NIH-supported data repositories' usage, utility, and impact. ODSS also supports new collaborations to make data from NIH-funded research efforts FAIR and artificial intelligence and machine learning (AI/ML)-ready. In FY 2021, ODSS supported 14 repositories and 36 collaborative projects in these efforts, and 1 ICO supported an additional 5 projects.

Challenges remain in utilizing the advances in data science to address questions of health disparities in underrepresented populations. For example, American Indian and Alaska Native (AI/AN) communities across the Nation have been among the hardest hit by the COVID-19 pandemic. In response to the May 20, 2020 Tribal Consultation for COVID-19 Research,[124] NIH solicited Tribal input for the design of the data management efforts under the Rapid Acceleration of Diagnostics Underserved Populations (RADx-UP) initiative.

Recognizing and respecting Tribal sovereignty, ODSS and the National Institute on Minority Health and Health Disparities (NIMHD) conducted a Tribal Consultation to establish a RADx Tribal Data Repository (TDR).[125] Designed to be an independent, Tribally managed and governed research data repository resource, the TDR will house data collected from RADx projects conducted in AI/AN communities. Specifically, the TDR will facilitate, manage, and oversee responsible data access and sharing of de-identified AI/AN RADx research data.

In addition, for more than a decade, NIH has encouraged the use and development of common data elements (CDEs), which are standardized, precisely defined questions paired with a set of specific allowable responses representing important research concept that must be captured in a systematic manner across different sites, studies, or clinical trials. Given the urgent need to develop new vaccines and therapeutics, design tools for rapid diagnosis, and understand the health impacts of COVID-19, CDEs are an important tool for collecting data in consistent ways to facilitate their use and reuse. NIH convened a COVID-19 CDE Coordinating Committee to help ensure consistent use of CDEs across the thousands of COVID-19 studies.

These projects together are intended to provide for the changing research landscape and develop an ecosystem comprising of both domain-specific and generalists repositories better suited to allow researchers to efficiently comply with the data management and sharing expectations per NIH's new Policy for Data Management and Sharing[126] (effective January 25, 2023), and most importantly, to prepare the research community to better maximize the value of data generated through NIH-funded efforts and accelerate the pace of biomedical discoveries and medical breakthroughs for better health outcomes.

[124] dpcpsi.nih.gov/thro/tribal-consultations/covid-19
[125] dpcpsi.nih.gov/thro/tribal-consultations
[126] grants.nih.gov/grants/guide/notice-files/NOT-OD-21-013.html

3. Data Management, Analytics, and Tools

For the development and dissemination of advanced data management, analytics, and visualization tools, NIH supports the creation and dissemination of useful, generalizable, and accessible tools and workflows, to broaden the utility, usability, and accessibility of specialized tools, and to improve discovery and cataloging resources.

One important program is the Smart and Connected Health interagency program, which supports innovative, high-risk/high-reward research with the promise of disruptive transformations in biomedical research. This initiative is a partnership among the National Science Foundation (NSF), ODSS, and 22 NIH ICOs and was recently expanded to focus on the use of AI/ML and advanced data science in biomedical research.

Additionally, new partnerships with the U.S. Department of Energy (DOE) to advance petabyte-scale genomic search will bring new computational techniques to address critical challenges in large-scale biomedical data science.

Finally, in FY 2021, NIH continued its efforts to advance the use of the Health Level Seven International® (HL7®) Fast Healthcare Interoperability Resources (FHIR®) standard for transmitting research data. The FHIR application programming interface, already widely used to exchange clinical care data, is critical to enabling standardized timely extraction of COVID-19 patient data from electronic health record systems for research on the epidemiology, disease pathology, and immune response to the virus. Furthermore, NIH is supporting the use of FHIR for biomedical research through multiple other initiatives. ODSS has developed a training program for NIH staff on FHIR broadly and analyzing data with personal identifiable information and ways to protect the confidentiality of such information specifically.

4. Supporting Workforce and Diversity in Data Science

NIH is leading efforts to increase and diversify the data science workforce through code-a-thons, data science training, and fellowship and scholar programs. ODSS supported enhancing the data science capacity in minority-serving institutions, in collaboration with NIMHD; Institutional Development Award (IDeA) state institutions, in collaboration with National Institute of General Medical Sciences (NIGMS); and Tribal Colleges and Universities (TCU) by funding the devolpment of data science curriculum and hands-on training programs. These programs aim to develop data scientists who are not only proficient in the computational arena but also in applying such skills to address research on health equity.

The Data and Technology Advancement (DATA) National Service Scholar Program, coordinated by ODSS, offers one- to two-year positions to skilled data scientists to directly work with NIH leadership on high-profile projects that leverage large datasets to impact biomedical research and policy across fields of study.[127] Currently, 13 data scholars are working across the NIH to address important areas of science including childhood cancer, rare diseases, environmental and public health, and cardiovascular research.

[127] datascience.nih.gov/data-and-technology-advancement-data-national-service-scholar-program-data-scientists-advancing

The Promise of Artificial Intelligence and Machine Learning

In addition to the coordinated NIH efforts to build an ecosystem of FAIR data, FY 2021 appropriations provided funds to accelerate progress in AI/ML with a focus on preparing NIH data and enhancing understanding of ethics transparency in the use of AI/ML. AI/ML are a collection of data-driven analytical technologies with the potential to significantly advance biomedical research. With this support, NIH has launched two new flagship AI initiatives: The Artificial Intelligence/Machine Learning Consortium to Advance Health Equity and Researcher Diversity (AIM-AHEAD) Program[128] which is also focused on health equity; and the CF's Bridge to Artificial Intelligence (Bridge2AI) program,[129] which will change the way biomedical researchers address data-driven grand challenges in biomedicine.

While NIH is committed to ensuring that its clinical research reflects the Nation's diversity, many existing biomedical studies and datasets lack diverse representation, leading to inadequate understanding of continued health disparities and inequities. Furthermore, a lack of diversity in both data and researchers contributes to a risk that AI/ML applications perpetuate harmful biases. Launched in 2021, and led by ODSS, the NIH AIM-AHEAD program will establish mutually beneficial and coordinated partnerships to increase the participation and representation of researchers and communities currently underrepresented in the development of AI/ML and enhance the capabilities of this emerging technology.

The Bridge2AI program will propel biomedical research forward by setting the stage for widespread adoption of AI that tackles complex biomedical challenges beyond human intuition. A key step in this process is generating new flagship data sets and best practices for machine learning analysis. A new partnership between the DOE and the Bridge to AI program will develop AI/ML algorithms for privacy-sensitive datasets such as biomedical or personal healthcare information.

NIH makes a wealth of biomedical data available and reusable to research communities; however, not all these data can be used efficiently and effectively by AI/ML applications. In 2021, ODSS issued a new funding opportunity to support collaborations between NIH-funded researchers and AI/ML experts to improve the AI/ML-readiness of biomedical and behavioral research data. Another new funding opportunity was issued in FY 2021 to support the development of curricula and training activities for researchers to learn the skills needed to make biomedical and behavioral research data AI/ML-ready. Competitive opportunities for supplemental funding in the areas of AI/ML-readiness of biomedical data, and workforce development for AI/ML-ready data resulted in co-funded efforts between ODSS and 15 other ICOs.

Future Directions

In the coming years, NIH will continue to invest in foundational and strategic capabilities to support a data science ecosystem, accelerate the development and use of AI/ML, enhance the availability of biomedical data for research, and continue to prioritize the development of a diverse data science workforce. Greater data science capabilities are required to build an NIH-wide FAIR data ecosystem. While the NIH RAS single-sign on service facilitates streamlined

[128] datascience.nih.gov/artificial-intelligence/aim-ahead
[129] commonfund.nih.gov/bridge2ai

data access, new NIH-wide search capabilities are needed to enable dataset findability, build cohorts for clinical studies, and to bring together knowledge and data for greater understandings. ODSS is engaging the community to identify challenges and opportunities in data discovery and will support the development of new tools and services in data discovery in FY 2023. Consistent and seamless discovery of data across NIH repositories as well as third-party, generalist repositories will better connect researchers with the relevant data that meet their specific needs and use cases. Continued support for the NCPI program will test some of these potential strategies including the use of FHIR to enhance cohort discovery.

NIH will continue to work across the federal government and industrial sector to ensure that the agency both leverages emerging advances and ensures consideration of the special nature of health phenomena in enveloping in data science, data security and analytics.

NIH expects the increasing interest in and rapid adoption of AI/ML capabilities to expand to new areas and more complex challenges. The AIM-AHEAD program will develop diverse leadership in AI/ML to address health disparities research. The Bridge2AI program will attract new AI/ML expertise to AI/ML-ready, flagship datasets. In addition, in collaboration with NIH ICOs, ODSS will increase the focus on ethics in AI/ML, will pursue external collaborations to address open research questions regarding the preservation of privacy and redressing representational biases in data and models and will explore systems approaches to embedding ethics across the AI/ML workflow. Taken together, these efforts in FAIR data sharing, interoperable data platforms, and advances in AI/ML will help meet the critical needs of the 21st Century biomedical research enterprise.

ALL OF US RESEARCH PROGRAM

Program Overview

In FY 2021, the *All of Us* Research Program continued its mission to accelerate health research and medical breakthroughs to enable individualized prevention, treatment, and care for all of us. The program expanded data and access to the Researcher Workbench, the online destination where registered users can explore the *All of Us* data, including COVID-19 related data; witnessed the first publications of peer-reviewed studies using *All of Us* data; expanded the program's trusted network of community engagement partners; released the next steps of the program's enhanced tribal engagement; and through its collaboration with the NIH ICs, launched its first ancillary study and continues to build additional partnerships.[130] *All of Us* is on its way to enrolling one million or more participants, and as of February 2022, nearly 466,000 participants have consented to join the program and more than 321,000 participants had completed all steps in the initial protocol. The program also continues to explore more enrollment options and in July 2020, began a pilot to mail saliva collection kits to participants. The pilot has collected biosamples from more than 11,130 additional participants, and anticipates rolling out the program nationwide in 2022.

The data available on the Researcher Workbench platform continues to expand and currently includes physical measurements, surveys, electronic health records (EHRs), data from wearable devices, such as Fitbits, and results from the COVID-19 Participant Experience (COPE) survey, the first repeated survey within *All of Us*. The Researcher Workbench is broadly available to any U.S.-based academic, nonprofit, or health care organization researcher. Once their institution has signed-off for any researchers and entered into the program's Data Use and Registration Agreement (DURA), users will be asked to go through a process to verify their identity and ensure they understand their responsibilities.[131] Diversity and inclusion are core principles of the *All of Us* Research Program -- a priority in both the program's researcher and participant base. As of February 2022, more than 1,480 researchers have gained access, over 1,100 research projects have been launched, and more than 293 institutions, including 29 Historically Black Colleges and Universities and Hispanic-Serving Institutions, have signed a DURA with the program.[132] The program envisions the Researcher Workbench supporting thousands of studies across different research domains with the data available, and anticipates data updates and expansion at least twice a year.

Over the last year, the program saw the publication of the first peer-reviewed study that used *All of U*s data by researchers outside of the program. The researchers used the data platform to study health care access and utilization among adult cancer survivors.[133] The results of this study indicated that a majority of cancer survivors who are participants in *All of Us* saw a doctor or a specialist in the past 12 months, but that a significant number of participants delayed care due to out-of-pocket health care expenses, such as deductibles or copayments. *All of Us* developed a strategy to engage with researchers to enhance their awareness of its resource and expand future

[130] www.researchallofus.org/data-tools/workbench/
[131] www.researchallofus.org/data-tools/data-snapshots/
[132] www.researchallofus.org/institutional-agreements/
[133] onlinelibrary.wiley.com/doi/full/10.1002/cam4.3924

use of the platform. Another publication built artificial intelligence/machine learning models to predict patients with glaucoma who would need surgery, and demonstrated that use of *All of Us* data provided a much more predictive model than use of single site data. More than 20 publications have now used *All of Us* data.

All of Us remains dedicated and committed to the program's core value of engaging participants as partners. This core value is driven by guiding principles of privacy and trust and a mission to empower participants, and intends to promote transparency, reciprocity, and involvement of communities in the governance, oversight, design, implementation, and evaluation of the program. The program is applying lessons learned and charting a new, positive path for engagement through active strategies and providing value to them. *All of Us* remains committed to community engagement as a key way of building trust and community among participants. In 2021, the program funded the next iteration of engagement work, which includes adding three additional partners to the program's robust network of engagement partners.[134] These three new community partners are the American Association on Health and Disability, National Baptist Convention USA Inc., and Baylor College of Medicine. These partners will fortify the program's existing network of trusted community organizations, provide a vital sounding board to shape program activities and direction, lend their expertise to help engage with researchers from underrepresented groups, motivate diverse communities to enroll, and advance the science of engagement.

Additionally, in March 2021, NIH and *All of Us* released the program's Tribal Consultation report, highlighting the agency's commitments to expand and strengthen the respectful engagement of American Indian and Alaska Native (AI/AN) people and support their inclusion in the program.[135] *All of Us'* consultation was one of the most extensive Tribal Consultations that NIH has held to date, encompassing multiple events across the country, a formal request for information, and comment periods for tribal leaders to weigh in on draft proposals. In response to tribal leader input gathered from a nearly two-year consultation process, *All of Us* will initiate specialized education efforts for researchers, take steps to ensure the diverse perspectives and needs of AI/AN communities are integrated into the program, and support ongoing engagement activities with Tribal Nations to pave the way for collaborations in the future. *All of Us* has an opportunity to help address underrepresentation in research and uncover factors that contribute to health disparities, but that can only be accomplished if the program goes about engagement in the right way, in partnership with communities. The program's Tribal Consultation is a critical element in fostering the ongoing dialogue needed to achieve those goals.

NIH Collaboration

COVID-19 Research

At the start of the pandemic, *All of Us* was positioned to aid researchers around the country who were interested in discovering when and where COVID-19 began to spread in the United States and its impact on individuals. The program's COVID-19 research initiatives included antibody

[134] allofus.nih.gov/news-events-and-media/announcements/all-us-research-program-awards-funding-seven-community-partners

[135] allofus.nih.gov/news-events-and-media/announcements/nih-enhance-tribal-engagement-efforts-precision-medicine-research

serology testing participant samples, the ongoing collection and expansion of EHR data available to researchers, and the results of the COPE survey in which more than 100,000 participants completed at least one survey.

All of Us antibody testing started with participant blood samples from those who enrolled in March 2020 and the program worked backwards until January 2, 2020.[136] Altogether, more than 24,000 samples from participants across all 50 states were tested.[137] The study found evidence of SARS-CoV-2 infections in five states earlier than had initially been reported. These participants were from outside the major urban hotspots of Seattle and New York City, believed to be key points of entry of the virus in the United States. The positive samples were from participants in Illinois, Massachusetts, Mississippi, Pennsylvania, and Wisconsin. The program discovered that most positive samples were collected by *All of Us* prior to the first reported cases in those states and providing evidence that the virus that causes COVID-19 was present in the United States as far back as December 2019. This study provides valuable information about the beginning of the U.S. epidemic and highlights the real-world value of longitudinal research in understanding dynamics of emerging diseases like COVID-19.

All of Us is also rapidly collecting relevant information from participants' EHR data. As of October 2021, researchers have accessed EHR data from over 214,200 participants, producing basic descriptive statistics within the Data Browser and utilizing the Researcher Workbench for in depth analysis. Through the use of EHR data, researchers can better understand patterns in symptoms and severity of COVID-19. The program continues to work diligently with health care provider organizations to make COVID-19 EHR data available to researchers in a timely manner while ensuring privacy and security safeguards are maintained. The program's initial COVID-19 data are now all available to NIH and approved researchers through the *All of Us* Researcher Workbench.

Nutrition for Precision Health, powered by the *All of Us* Research Program

Nutrition for Precision Health (NPH) is the program's first ancillary partnership with the NIH Common Fund. The study will focus on developing algorithms that predict individual responses to food and dietary patterns.[138] NPH will build on recent advances in biomedical science including artificial intelligence, microbiome research, as well as the infrastructure and large, diverse participant group of *All of Us*. During this first phase, NPH will leverage *All of Us* by recruiting a subset of 10,000 participants, which will be the largest precision nutrition study to date. Subsets of these individuals will be asked to undergo more detailed dietary regimens and analyses. The first awards to support phase one of NPH are anticipated to be made in 2022. The diverse study population in *All of Us* will illuminate important insights into diet-related health disparities. Building on phase one, a second phase of the initiative is envisioned to support studies to validate those algorithms that predict responses to diet. NPH is a great example of how NIH may leverage *All of Us* to support additional ancillary studies.

[136] allofus.nih.gov/news-events-and-media/announcements/all-us-research-program-launches-covid-19-research-initiatives

[137] academic.oup.com/cid/advance-article/doi/10.1093/cid/ciab519/6294073

[138] commonfund.nih.gov/nutritionforprecisionhealth

Promoting Biomedical Workforce Diversity

NIH recognizes the need to diversify the scientific workforce by enhancing the participation of individuals from diverse backgrounds in the biomedical, clinical, behavioral and social sciences research workforce. As a result, *All of Us* has partnered with the National Human Genome Research Institute and the National Institute of Biomedical Imaging and Bioengineering to solicit R01 grant applications that propose independent research projects intended to support Early Stage Investigators from diverse backgrounds, including those from groups underrepresented in the health-related sciences, with plans to make the first awards in FY 2022.[139] Through this initiative, *All of Us* hopes to foster diversity in the workforce and provide opportunities for researchers from diverse backgrounds, including those from groups nationally underrepresented in the genomics and bioinformatics workforce.

Mental Health

All of Us is actively collaborating with the National Institute of Mental Health (NIMH) on the Research Domain Criteria (RDoC), a research framework for investigating mental disorders.[140] RDoC integrates many levels of information, from genomics and circuits to behavior and self-reporting, to explore basic dimensions of functioning that span the full range of human behavior from normal to abnormal. This collaborative partnership will support research data collection from validated tasks from the RDoC framework. In 2022, *All of Us* will focus on the integration and pilot testing of NIMH recommended tasks for data collection among the program's diverse participant sample. By leveraging the program's diverse participants, *All of Us* aims to be a critical partner in NIMH's goal of using RDoC to provide information about the basic biological and cognitive processes that lead to mental health and illness, broadly conceived. The information gained from using RDoC through this cross-cutting NIH partnership may help inform the creation of mental health screening tools, diagnostic systems, and treatments. The FY 2023 President's Budget includes a $107.1 million increase for NIMH, including $25.0 million to increase research on the impact of the COVID-19 pandemic on mental health.

Future Direction

As a result of a strategic planning process undertaken in 2021, *All of Us* set five goals to accomplish by the end of 2026: (1) enroll one million participants that reflect the diversity of the United States, over the lifespan of the program, and have participants share all baseline physical measurements and biosamples; (2) expand the data available to include surveys, health data streams, a whole genome sequence, environmental data, and physical measures; (3) launch ancillary studies as a core and scalable capability; (4) establish a global community of researchers; and (5) incorporate return of value that includes participants receiving health related genomics and EHR.

The first and most important of these goals is *All of Us'* commitment and dedication to continue the program's progress towards enrolling at least one million participants. *All of Us* also intends to expand the cohort to include pediatric participants as the first special population priority. Expansion of the cohort to include children will be led by a dedicated pediatric team that will focus on the development of approved protocols and policies, evaluation of existing capacity for pediatric participation, and addition of pediatric expertise to *All of Us'* engagement efforts

[139] grants.nih.gov/grants/guide/notice-files/NOT-OD-20-031.html
[140] www.nimh.nih.gov/research/research-funded-by-nimh/rdoc/about-rdoc

including partners and participant ambassador boards. This dedicated team will be headed by the new Director of Special Populations, whom the program anticipates bringing onboard in 2022. The program has already made significant progress in the ability to contribute to pediatric research as a subset of 19,729 adult participants have contributed EHR data dating back to their childhoods.

The expansion of data available to researchers will improve overall health and early detection, treatment, and prevention for a broad variety of diseases. Data will be derived from surveys, digital health technologies, data linkages, clinical or other health record data (e.g., EHRs, patient portals, health information exchanges), or bioassays. In 2021, *All of Us* reached a major milestone in this effort when the program started to analyze whole genome sequences. The program anticipates making genetic data available to researchers by 2022, with strict privacy and security safeguards in place to protect participants' information.

All of Us sees ancillary studies as partnerships that expand the program's dataset by adding participants outside of the program's target audience and/or adding opportunities for participants to donate new data. Over the next five years *All of U*s plans to launch ancillary studies as a core and scalable capability that expands the cohort and delivers phenotypic, lifestyle, environmental, and biologic data. Through the use of ancillary studies, *All of Us* will deliver on the promise to accelerate health research and medical breakthroughs by helping researchers achieve their goals more efficiently than would be possible on their own, multiplying the value of the program by expanding datatype diversity and potentially boosting participant enrollment.

Over the next five years, *All of Us* aims to establish a diverse global community of 10,000 researchers that productively use the program's dataset. The program will work to achieve this goal by working to enable data interoperability with other international cohorts to increase impact and addressing existing historical barriers that are faced by traditionally underrepresented researchers. *All of Us* anticipates measuring the utility of data from the program's different classes of researchers by including proximate impacts such as number of publications. By expanding the talent of researchers contributing to the biomedical research enterprise, the program aims to advance public health and encourage broad scientific discovery.

All of Us' strategic vision aims to integrate return of value to participants, and the evaluation of its impact, into operations and expectations. The systems and process will be designed so that when a participant makes a contribution, they know when and what to expect in return. *All of Us* will continually evaluate participants' perceptions of the program; their satisfaction with the return of information; their trust and willingness to participate; and how efforts to return value affects our mission and enrollment and retention goals. At the end of 2020, the program began delivering non-health related genetic results to participants. The choices for genetic information participants can choose to receive will also expand in 2022 such that participants will have the choice to learn new information on hereditary disease risk and pharmacogenetics from their genomes. In the future, *All of Us* anticipates the return of additional health related information to participants such as EHR records.

In *All of Us'* early years, the program focused on building the systems and processes necessary to engage a diverse cohort. In the next five years, the program will focus on a return-of-value

strategy, aiming to increase enrollment and active engagement through the return of genetic health related information to participants. Therefore, these strategic goals are designed not only to build datasets that meet researchers' interests, but also to return health information that is of value to participants. *All of Us* will continually evaluate participants' and researchers' perceptions of these efforts and remain dedicated to the program's mission.

TRIBAL HEALTH RESEARCH OFFICE (THRO)

Program Overview

The National Institutes of Health (NIH) supports a broad and expanding portfolio of American Indian and Alaska Native (AI/AN) health research, training, and research-related activities. In 2015, NIH established the Tribal Health Research Office (THRO)[141] to ensure sovereign Tribal Nations have the opportunity to participate in research leading to the development of critical health interventions and to benefit from research in addressing their health priorities. Located in the Division of Program Coordination, Planning, and Strategic Initiatives (DPCPSI) in the Office of the Director (OD), THRO is NIH's point-of-contact for all federally recognized Tribal Nations. In addition to coordinating Tribal health research and activities across NIH Institutes, Centers, and Offices (ICOs), THRO ensures NIH programs, policies, and activities significantly affecting sovereign Tribes are developed with input from Tribal Nations. The first NIH ***Strategic Plan for Tribal Health Research FY 2019 – FY 2023***[142] (Strategic Plan) was developed with significant input from Tribal Nations. The Strategic Plan was implemented across all NIH ICOs to increase the impact of NIH-funded research and improve NIH's relationship with Tribal Nations by accomplishing four strategic goals: 1. enhancing communication and collaboration; 2. building research capacity; 3. expanding research; and 4. enhancing cultural competency and community engagement.

NIH's successful biomedical research partnerships with Tribal Nations are built on respect for Tribal Sovereignty. This important partnership formed the foundation for AI/AN participation in clinical trials of coronavirus disease 2019 (COVID-19) vaccine candidates and investigational therapeutics. THRO and the National Institute of Allergy and Infectious Diseases (NIAID) worked together to facilitate discussions with a vaccine sponsor and Tribal Nations that resulted in a data, material, and biological specimen use agreement. As a result, Tribes in the Pacific Northwest and in the Great Plains were significant contributors to the COVID-19 phase III vaccine clinical trial process. THRO played an important role in leading the NIH Tribal Consultation on COVID-19 Research[143] in May 2020 with the NIH Immediate Office of the Director (IMOD), and partners, including the National Institute of Environmental Health Sciences (NIEHS) and the National Institute on Minority Health and Health Disparities (NIMHD). Input from Tribal Nations provided vital information to help develop effective health research programs and initiatives focused on the response to the COVID-19 pandemic in Tribal communities. The Rapid Acceleration of Diagnostics Underserved Populations (RADx®-UP) research program was shaped by comments received from Tribal Consultation and subsequently 10 awards were made to researchers who worked in partnership with Tribal communities.

NIH continues to partner with several U.S. Department of Health and Human Services (HHS) agencies including the Indian Health Service (IHS), Centers for Disease Control and Prevention (CDC), and U.S. Food and Drug Administration (FDA) to develop culturally appropriate information on COVID-19 research, therapeutics, and vaccines. This was essential to ensure sovereign Tribal Nations receive clear, accurate and timely information to support informed decisions to protect the safety of their Tribal citizens. Due to the critical need for

[141] dpcpsi.nih.gov/thro
[142] dpcpsi.nih.gov/sites/default/files/2019_THRO_StrategicPlan_508.pdf
[143] dpcpsi.nih.gov/thro/tribal-consultations/covid-19

communication during the COVID-19 pandemic, NIH also continues to convene numerous virtual engagements with Tribal Nations across the United States.

Supporting scientific workforce development in sovereign Tribal Nations is a critical component of NIH support for Tribal health research. In 2021, THRO and the NIH Office of Data Science Strategy (ODSS) partnered with several Tribal Colleges and Universities (TCUs) to develop a data science curriculum to increase their capacity to train the next generation of AI/AN data scientists.

NIH-Wide Collaborations

The Strategic Plan includes processes and metrics for evaluating progress toward achieving the strategic goals and their supporting objectives. THRO partnered with the NIH Office of Evaluation, Performance, and Reporting to implement an NIH-wide strategic tracking process to measure NIH's progress in meeting each of the Plan's four Strategic Goals.

To ensure the opportunity for Tribal Nations to provide meaningful and timely input on NIH policies, programs, and activities with significant potential Tribal impact, NIH holds annual Tribal Consultations led by THRO. THRO also partners with NIH ICOs to hold Tribal Consultations on focused topics such as the 2021 Tribal Consultation on the Native American Research Centers for Health program evaluation with the National Institute of General Medical Sciences (NIGMS) and the 2021 Tribal Consultation on the RADx® Tribal Data Repository with NIMHD and ODSS.[144]

Next Steps/Goals

In 2021, THRO led the annual NIH Tribal Consultation focusing on the NIH Draft Tribal Consultation Policy. The NIH 2021 Tribal Consultation included engagement with Tribes in all 10 HHS Regions. This Policy is intended to complement the HHS Tribal Consultation Policy by focusing on NIH-specific issues. When the Policy is finalized in early 2022, it will replace the 2014 NIH Guidance on the Implementation of the HHS Tribal Consultation Policy. The draft Policy was developed with extensive input from the NIH Tribal Advisory Committee (TAC) and the NIH Office of Science Policy (OSP) to enhance transparency in the Tribal Consultation process and to reflect NIH's commitment to consistent engagement with Tribal Nations.

NIH will continue to provide culturally appropriate information to support the decisions of AI/AN communities to participate in COVID-19 research and clinical trials, including studies on severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) variants and post-acute sequelae of SARS-CoV-2 infection. Recognizing the unprecedented potential mental health effects of the COVID-19 pandemic in Tribal communities, THRO convened a virtual discussion between the THRO Director and the Director of the National Institute on Mental Health (NIMH) addressing this important public health topic.[145]

Culturally appropriate data sharing practices respecting Tribal Sovereignty are critical for successful biomedical research partnerships. NIH is developing guidance with input from Tribal Nations and the NIH TAC on appropriate data sharing and management practices for health

[144] dpcpsi.nih.gov/thro/tribal-consultations
[145] www.nimh.nih.gov/news/media/2021/mental-health-in-american-indian-and-alaska-native-communities

research with Tribal Nations. The 2019 NIH Tribal Consultation on the NIH Draft Policy for Data Management and Sharing was essential in receiving Tribal input that helped shape the guidance.

Increasing the AI/AN biomedical research workforce is an NIH priority. NIH supports regional training hubs in partnership with Tribal Nations and TCUs to increase Tribe Nation's capacity to conduct biomedical research. Regional training hubs introduce high school students to different fields of biomedical research with the goal of encouraging them to complete internships at the NIH and ultimately to pursue biomedical research careers.

NIH Common Fund

Congressional Justification

FY 2023

Department of Health and Human Services

National Institutes of Health

National Institutes of Health
Office of Strategic Coordination - The Common Fund

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DEPARTMENT OF HEALTH AND HUMAN SERVICES

NATIONAL INSTITUTES OF HEALTH

NIH Common Fund

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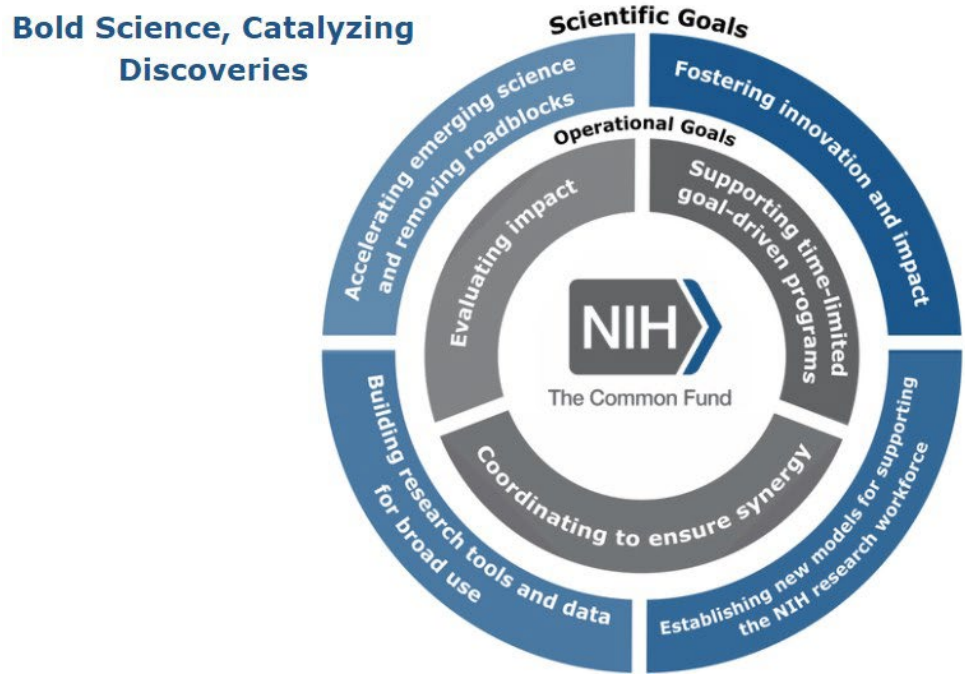
Director's Overview

The NIH Common Fund (CF) is a unique and exciting component of the NIH, specifically designed to address challenges and opportunities that are of high priority for the NIH as a whole.[146] We support research in areas of emerging scientific opportunities, public health challenges, and knowledge gaps that deserve special emphasis; that would benefit from strategic coordination and planning across NIH Institutes and Centers (ICs); and are designed to achieve specific, high-impact goals and milestones within a 5- to 10-year timeframe. These bold scientific programs often accelerate emerging science, enhance the biomedical research workforce, remove research roadblocks, or support high-risk, high-reward science. Many CF programs are designed to produce specific deliverables, such as data sets, tools, technologies, or fundamental scientific paradigms. We intend for these deliverables to spur subsequent scientific advances that would not be possible without our strategic investment.

Elizabeth Wilder, Ph.D., Director, Office of Strategic Coordination

The NIH Common Fund



[146] commonfund.nih.gov/

CF programs are broad-reaching and span the entire NIH mission. As a general framework, however, they can be grouped into four categories, with some programs relevant to more than one category: Transformational Discoveries and Tools, Catalytic Data Resources, Re-engineering Clinical and Translational Research Processes, and Innovative Approaches to Workforce Development.

Transformational Discoveries and Tools

Many CF programs have a primary objective to enable discovery, often through the development of novel and broadly useful tools, data, and methods. For example, the Molecular Transducers of Physical Activity[147] program is investigating the molecular responses to exercise and, where possible, associating individual signatures with specific physiologic outcomes, allowing for the development of more targeted exercise interventions and physical activity prescriptions. The Transformative High Resolution Cryo-Electron Microscopy[148] program is providing nationwide access to high resolution cryo-electron microscopy and tomography for biomedical researchers by creating national service centers, technological improvements, and development of an expert workforce. The High-Risk, High-Reward[149] program supports several initiatives that foster innovation and scientific discovery across all areas of the NIH mission through support of exceptionally creative scientists and projects that may carry high levels of risk, but which hold the promise of exceptional impact.

Catalytic Data Resources

Several CF programs have an overarching goal of establishing new data resources or new methods for managing data. Also included in this category are efforts to enhance the utility of CF data sets. The Human BioMolecular Atlas Program (HuBMAP)[150] is catalyzing development of an open, global data framework for comprehensively mapping the human body at cellular resolution through data generation and by interoperating with other single cell mapping efforts. Bridge to Artificial Intelligence (Bridge2AI)[151] is generating flagship data sets and best practices for the collection and preparation of data sets amenable to AI and machine learning approaches to address biomedical and behavioral grand challenges.

Re-engineering Clinical and Translational Research Processes

Several CF programs are establishing new models for translational and clinical research. The Somatic Cell Genome Editing[152] program is developing a translational pipeline for somatic cell genome editing therapies through improved, Investigational New Device (IND)–enabling technologies. The Transformative Research to Address Health Disparities and Advance Health Equity[153] initiative is supporting innovative research projects that aim to have a major impact in developing, disseminating, or implementing novel and effective interventions that prevent, reduce, or eliminate health disparities and health inequities.

[147] commonfund.nih.gov/MolecularTransducers
[148] commonfund.nih.gov/CryoEM
[149] commonfund.nih.gov/highrisk
[150] commonfund.nih.gov/HuBMAP
[151] commonfund.nih.gov/bridge2ai
[152] commonfund.nih.gov/editing
[153] commonfund.nih.gov/healthdisparitiestransformation

Innovative Approaches to Workforce Development

The most valuable resource for the biomedical research enterprise is the energy, creativity, and innovation of its workforce. Several CF programs aim to establish new models for training, workforce development, and research capacity building. The Faculty Institutional Recruitment for Sustainable Transformation (FIRST)[154] program aims to establish a more inclusive and diverse biomedical research workforce through support of cluster hiring and institutional culture change efforts. The Enhancing the Diversity of the NIH-Funded Workforce[155] program is developing, implementing, assessing, and disseminating innovative approaches to engaging, training, and mentoring students; enhancing faculty development; and strengthening institutional research and training infrastructure to enhance participation and persistence of individuals from underrepresented backgrounds in biomedical research careers.

CF programs provide a venue for NIH to respond to critical needs and scientific opportunities using a trans-agency approach, complementing IC-specific programs and activities. CF programs play an important role in addressing NIH priority areas, including emerging priorities and research opportunities that have recently arisen or come to the forefront of the Nation's attention during the past several years of rapid change.

In response to the COVID-19 pandemic, CF is supporting research to prevent, prepare for, and respond to SARS-CoV-2. With support from the Coronavirus Aid, Relief, and Economic Security (CARES) Act,[156] CF supported emergency competitive revisions to existing grants and cooperative agreements to conduct innovative research on COVID-19/coronavirus in FY 2020.[157] Research supported by these supplements includes investigation of the causes of inequities in COVID-19 severity, with the aim of developing more targeted interventions; screening thousands of well-characterized drugs for their ability to block SARS-CoV-2 infection for rapid translation into the clinic; exploring the use of a robotic lung ultrasound to standardize diagnosis, lower costs, and keep medical staff safer in resource-limited settings; and using telemedicine to make advance care decisions and improve end-of-life choices for COVID-19 patients. In FY 2021, CF issued five Transformative Research Awards to bring new, innovative perspectives to COVID-19/coronavirus research. These awards, part of the High-Risk, High-Reward program, support highly innovative research that is expected to have exceptional impact. These awards are addressing the impact of SARS-CoV-2 on multiple organ systems, using deep machine learning to predict therapeutic antibody structures for future viral pandemics, determining the disease mechanism of the virus in the brain, developing a handheld rapid sensing system to detect and monitor SARS-CoV-2 in air, and engineering therapeutic molecular antivirals that can co-adapt along with SARS-CoV-2 in infected hosts.[158]

Recent events, including health inequities highlighted by the COVID pandemic and growing attention to social justice issues, have elevated the urgent need for additional research to address

[154] commonfund.nih.gov/first
[155] commonfund.nih.gov/diversity
[156] congress.gov/116/plaws/publ136/PLAW-116publ136.pdf
[157] commonfund.nih.gov/covid19/fundedresearch
[158] commonfund.nih.gov/TRA/fundedresearch

health disparities. Through a new initiative called UNITE,[159] NIH has begun to identify short-term and long-term actions to end structural racism and racial inequities throughout the biomedical research enterprise. Part of ending racial inequities in biomedical research will be to ensure NIH-supported research benefits the health of all populations, especially those whose health is negatively impacted by racism. Launched in FY 2021, the Transformative Research to Address Health Disparities and Advance Health Equity initiative originated with the UNITE initiative and is now being implemented as a Common Fund program. This initiative is funding bold projects aiming to develop, disseminate, and/or implement innovative and effective interventions that prevent, reduce, or eliminate health disparities and health inequities. Additionally, this initiative is expected to increase the competitiveness of investigators and expand the research base dedicated to health disparities research at minority serving institutions. Projects funded in FY 2021 include community-based research collaborations that develop and test financial interventions addressing structural racism, spiritual healing and stress reduction interventions for youth from racial and ethnic minority communities to prevent chronic disease outcomes, technology-enhanced approaches to advance cancer health equity among diverse deaf, deafblind, and hard-of-hearing populations, and school-based, telehealth-driven care to prevent health disparities in underserved rural and socioeconomically disadvantaged children.[160]

The CF has undertaken a robust, community-informed planning process to develop a comprehensive, coordinated program in FY 2023 to address health disparities. The Community Partnerships to Advance Science for Society (ComPASS) program will support interventions that target the upstream structural targets contributing to health disparities, such as transportation development, housing policies, early childhood screening, education programs, and more.[161] These structural intervention targets span many sectors and require innovative approaches to advance health equity. Importantly, ComPASS will support community-driven structural interventions, ensuring that communities are engaged as partners in research, interventions address the most important issues for the community, and successful interventions are sustainable. It will support workforce development in academic and community-based organizations to establish research and community engagement expertise that will lead to sustainable health equity partnerships. Once expertise is established within partner organizations, research opportunity announcements will be issued in future years to demonstrate the capacity of these networks to engage communities in research that addresses health issues of importance to those communities and that address pervasive and harmful health disparities and health inequities.

The CF fulfills a unique role at NIH, supporting research that is often broad-reaching across scientific disciplines and provides catalytic data, tools, and resources with the potential to advance many different research areas. Planning for CF programs involves identifying areas of extraordinary opportunity and pressing need for biomedical research as a whole. Therefore, although several CF activities were rapidly launched to address critical needs highlighted by recent events, continued investment in CF programs to provide foundational support for the biomedical research enterprise remains crucially important. These activities are essential to continue even in times of major upheavals and rapid change, helping to ensure the biomedical

[159] nih.gov/ending-structural-racism
[160] commonfund.nih.gov/healthdisparitiestransformation/fundedresearch
[161] https://dpcpsi.nih.gov/sites/default/files/2.10PM-Cf-Concept-COMPASS-Zenk-Gordon-FINAL-508.pdf

research community is well-poised to respond nimbly to new and unpredictable issues that emerge in the future.

CF has accelerated the launch of several exciting initiatives. The Cellular Senescence Network,[162] originally planned to launch in FY 2022, was instead launched in FY 2021. This accelerated launch jumpstarted the development of critical resources, tools, and technologies that will help researchers investigate the role of senescent (non-dividing) cells in health and disease, across multiple tissues, and across the lifespan. Originally planned to launch in FY 2021, a second stage of the 4D Nucleome[163] program was launched in FY 2020 to develop data and tools to catalyze research on how the spatial arrangement of DNA in the cell influences health and disease over time. Additional funding also allowed support of increased numbers of promising early career researchers through the New Innovator award[164] initiative.

Since CF programs are designed with clearly defined goals and milestones, it is critically important to rigorously monitor ongoing progress to ensure programs are on track, and to adjust if needed. Additionally, as CF programs are intended to produce valuable resources and knowledge to spur subsequent research advances, it is also important to assess the impact of the program and its deliverables on the broad biomedical research landscape. We make significant efforts to evaluate CF programs during their lifetime, and outcomes are assessed as programs end. Continuous evaluation during program implementation allows flexibility to modify program management and/or budgets in response to rapidly evolving scientific landscapes, technical challenges, or other unforeseen challenges or opportunities. New challenges and opportunities will be addressed in FY 2023 from funds made available as programs end, move to other sources of support, or require decreased support as indicated by evaluative data.

[162] commonfund.nih.gov/senescence
[163] commonfund.nih.gov/4Dnucleome
[164] commonfund.nih.gov/newinnovator

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National Institutes of Health
Office of Strategic Coordination - The Common Fund

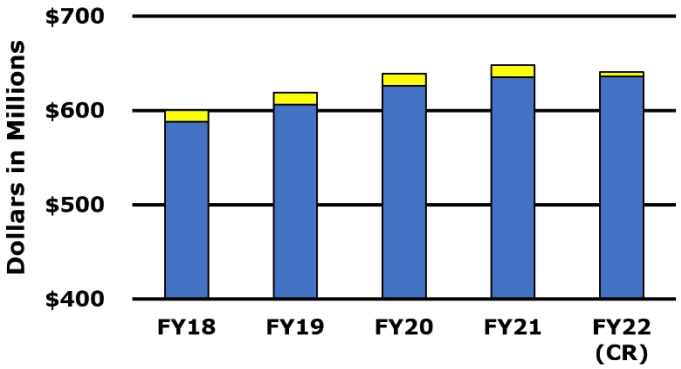
Bold Science, Catalyzing Discoveries

ABOUT THE NIH COMMON FUND

- The NIH Common Fund provides a dedicated source of support for trans-NIH scientific programs with the potential for extraordinary impact.
- Common Fund programs are time-limited, goal-driven investments that accelerate emerging science, remove research roadblocks, enhance the biomedical workforce, and/or support high-risk, high-reward science.
- These programs often involve multi-disciplinary, innovative researchers who work together to tackle a shared, ambitious goal.
- Common Fund programs span the NIH mission, addressing scientific opportunities and research challenges in some of the most cutting-edge areas of biomedical research.

Elizabeth Wilder, Ph.D., has been the Director of the Office of Strategic Coordination since 2010.

FUNDING HISTORY



The FY 2023 President's Budget request is $658.5 million.
Blue = base appropriation Yellow = Pediatric Research Initiative Fund

FACTS AND FIGURES

- 21 Scientific Programs in FY 2021
- 544 Principal Investigators (PIs)*
  - 181 High-Risk, High-Reward PIs*
  - 104 Early career High-Risk, High Reward PIs*
- 136 competing Research Project Grants*
- 24 NIH Institutes, Centers, and Offices co-leading programs in FY 2021

**Data represent yearly averages from FY 2017 – FY 2021*

COMMON FUND RESEARCH ACCOMPLISHMENTS

The **Extracellular RNA Communication** program has cataloged extracellular RNA molecules found in human biofluids like plasma, saliva, and urine from over 2,000 donors. This program has identified potential extracellular RNA biomarkers for nearly 30 diseases and conditions, including cardiovascular disease, pregnancy complications, glaucoma, diabetes, and multiple types of cancer.

The **Gabriella Miller Kids First Research** program has performed genetic sequencing on over 40 childhood cancer and structural birth defects patient cohorts, representing over 16,000 patients and 40,000 genomes. Kids First data has led to new discoveries about genetic causes of childhood neuroblastoma, congenital heart defects, disorders of sex development, Ewing sarcoma, orofacial cleft, and syndromic cranial dysinnervation.

Common Fund programs generate a wide array of broadly useful tools and technologies. These include a combination of small molecules that could enhance the therapeutic potential of induced pluripotent stem cells, an approach to comprehensively map neurons within various organs in 3D, a new method to image the arrangement of small regions of DNA in the nucleus, and a web application that allows researchers to map their own data onto reference maps of 8 organs.

National Institutes of Health
Office of Strategic Coordination - The Common Fund

Bold Science, Catalyzing Discoveries

SELECTED CURRENT ACTIVITIES

- The **Nutrition for Precision Health** program is leveraging the large, diverse participant pool in the *All of Us* Research Program to develop algorithms to predict personalized responses to food and dietary patterns.
- **Faculty Institutional Recruitment for Sustainable Transformation (FIRST)** is establishing a more inclusive and diverse biomedical research workforce through support of cluster hiring and institutional culture change efforts.
- The **Cellular Senescence Network** is comprehensively identifying and characterizing senescent (no longer dividing) cells across the body, across various states of health, and across the lifespan.

LOOKING TO THE FUTURE

- The **Somatic Mosaicism Across Human Tissues** program, launching in FY 2023, aims to expand our understanding of the causes and effects of genetically distinct cells within an individual, known as mosaicism.
- The **Somatic Cell Genome Editing** program is planning a second phase to facilitate the transfer of genome editing approaches into the clinic.
- The **Community Partnerships to Advance Science for Society (ComPASS)** program will develop and evaluate community-driven structural interventions to address health disparities.

SPOTLIGHT ON.....

COMMON FUND DATA ECOSYSTEM

Common Fund programs generate a significant number of large-scale, diverse data sets for the biomedical research community. These data sets are highly valuable on their own but hold the potential to enable entirely new kinds of discoveries if researchers can interrogate multiple disparate data sets in combination. The **Common Fund Data Ecosystem** is building infrastructure to enable researchers to query across and use multiple Common Fund data sets, provide training for users to operate on the data in a cloud environment, and ensure that Common Fund data continue to be available after individual programs are completed.

SUPPORTING THE BIOMEDICAL WORKFORCE

All biomedical research breakthroughs rely on the creativity and skill of a robust and diverse scientific workforce. The Common Fund supports several programs that aim to develop and assess novel approaches to support researchers from diverse backgrounds at different career stages. These programs include efforts to support highly creative early career researchers, researchers seeking to explore new directions or "out of the box" ideas, novel training and mentoring approaches to engage and retain researchers from diverse backgrounds, and faculty cluster hiring approaches to establish cultures of inclusive excellence at research institutions.

https://commonfund.nih.gov/

MAJOR CHANGES IN THE BUDGET REQUEST

Major changes by budget mechanism and/or budget activity detail are briefly described below. Note there may be overlap between budget mechanisms and activity detail, and these highlights will not sum to the total change for the FY 2023 President's Budget request for the Common Fund, which is $18.3 million more than the FY 2022 CR level, for a total of $658.5 million.

Research Project Grants (-$8.4 million; total $301.4 million): The Common Fund expects to support a total of 355 Research Project Grant (RPG) awards in FY 2023, down from 362 in FY 2022. Estimated awards for FY 2023 include 206 Noncompeting RPGs and 149 Competing RPGs. The decrease in RPGs reflects the planned ramping down of several programs.

Research Centers (+$23.3 million; total $153.5 million): The Common Fund expects to support a total of 121 Research Centers in FY 2023, up from 104 in FY 2022. This change reflects increased support for Specialized/Comprehensive Centers within the Faculty Institutional Recruitment for Sustainable Transformation (FIRST) program.

Other Research (+$10.3 million; total $155.6 million): The Common Fund expects to support 6 Cooperative Clinical Research awards and 89 Other Research (Other) awards. The increase in the Other Research mechanism reflects increased support for Cooperative Clinical Research activities within the Precision for Nutrition Health program.

Research Training (-$2.1 million; total $8.5 million): The Common Fund expects to support 396 full-time training positions (FTTPs) through Institutional Training Awards. This decrease reflects the planned winding down of the Building Infrastructure Leading to Diversity (BUILD) initiative within the Enhancing the Diversity of the NIH-Funded Workforce program.

Intramural Research (-$7.2 million; total $0.3 million): The decrease in support for intramural research reflects the planned completion of the Undiagnosed Diseases Network, the Common Fund program with the most substantial intramural component.

BUDGET MECHANISM TABLE
(Dollars in Thousands)

MECHANISM	FY 2021 Final		FY 2022 CR		FY 2023 President's Budget		FY 2023 +/- FY 2022 CR	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount
Research Projects:								
Noncompeting	272	$215,492	254	$205,153	206	$166,311	-48	-$38,842
Administrative Supplements	*(25)*	3,863	*(49)*	7,544	*(4)*	600	*(-45)*	-6,944
Competing:								
Renewal	0	0	0	0	0	0	0	0
New	140	126,243	108	97,117	149	134,538	41	37,421
Supplements	0	0	0	0	0	0	0	0
Subtotal, Competing	140	$126,243	108	$97,117	149	$134,538	41	$37,421
Subtotal, RPGs	412	$345,598	362	$309,814	355	$301,449	-7	-$8,365
SBIR/STTR	0	0	0	0	0	0	0	0
Research Project Grants	412	$345,598	362	$309,814	355	$301,449	-7	-$8,365
Research Centers:								
Specialized/Comprehensive	48	$57,035	89	$105,504	106	$126,481	17	$20,977
Clinical Research	10	16,244	7	10,762	8	12,477	1	1,715
Biotechnology	0	0	5	7,500	5	10,000	0	2,500
Comparative Medicine	4	7,271	3	6,344	2	4,500	-1	-1,844
Research Centers in Minority Institutions	0	0	0	0	0	0	0	0
Research Centers	62	$80,550	104	$130,110	121	$153,458	17	$23,348
Other Research:								
Research Careers	0	$0	0	$0	0	$0	0	$0
Cancer Education	0	0	0	0	0	0	0	0
Cooperative Clinical Research	0	0	6	5,761	6	14,684	0	8,923
Biomedical Research Support	0	0	0	0	0	0	0	0
Minority Biomedical Research Support	0	0	0	0	0	0	0	0
Other	117	184,290	89	139,485	89	140,908	0	1,423
Other Research	117	$184,290	95	$145,246	95	$155,592	0	$10,346
Total Research Grants	591	$610,438	561	$585,170	571	$610,499	10	$25,329
Ruth L Kirschstein Training Awards:	FTTPs		FTTPs		FTTPs		FTTPs	
Individual Awards	0	$0	0	$0	0	$0	0	$0
Institutional Awards	380	8,048	495	10,631	396	8,505	-99	-2,126
Total Research Training	380	$8,048	495	$10,631	396	$8,505	-99	-$2,126
Research & Develop. Contracts	0	$258	0	$7,974	0	$8,000	0	$26
(SBIR/STTR) (non-add)	*(0)*	*(0)*	*(0)*	*(0)*	*(0)*	*(0)*	*(0)*	*(0)*
Intramural Research	0	7,927	0	7,460	0	307	0	-7,153
Res. Management & Support	0	21,868	0	28,995	0	31,228	0	2,233
SBIR Admin. (non-add)	*(0)*	*(0)*	*(0)*	*(0)*	*(0)*	*(0)*	*(0)*	*(0)*
Construction		0		0		0		0
Buildings and Facilities		0		0		0		0
Total, Common Fund	0	$648,539	0	$640,230	0	$658,539	0	$18,309

[1] All items in italics and brackets are non-add entries.

BUDGET BY PROGRAM
(Dollars in Thousands)

National Institutes of Health
Common Fund by Program
(Dollars in Thousands)

Common Fund Program	FY 2021 Final	FY 2022 CR	FY 2023 President's Budget
4D Nucleome	28,148	28,378	28,394
Acute to Chronic Pain Signatures	16,350	6,432	125
Bridge to Artificial Intelligence (Bridge2AI)	170	32,556	32,406
Cellular Senescence Network (SenNET)	24,997	40,350	41,850
Enhancing the Diversity of the NIH-Funded Workforce	48,941	44,222	39,478
Extracellular RNA Communication	11,509	10,841	102
Faculty Institutional Recruitment for Sustainable Transformation (FIRST)	4,237	31,062	52,886
Gabriella Miller Kids First Pediatric Research	12,960	4,754	13,080
Global Health	10,063	844	85
Glycoscience	5,331	320	0
Harnessing Data Science for Health Discovery and Innovation in Africa (DSI-Africa)	12,485	12,455	16,418
Health Care Systems Research Collaboratory	1,750	225	0
High-Risk Research	202,465	171,249	177,314
NIH Director's Pioneer Award	*46,216*	*47,278*	*43,759*
NIH Director's New Innovator Award Program	*65,389*	*48,301*	*49,459*
Transformative Research Award	*44,057*	*47,323*	*42,815*
NIH Director's Early Independence Award Program	*22,962*	*23,329*	*23,894*
Transformative Health Disparities Research	*23,841*	*5,019*	*17,387*
Human BioMolecular Atlas Project (HuBMAP)	28,416	36,676	42,636
Illuminating the Druggable Genome	14,763	13,390	6,400
Knockout Mouse Phenotyping Program	423	0	0
Metabolomics	11,942	106	0
Molecular Transducers of Physical Activity	43,886	40,493	13,489
Nutrition for Precision Health	0	20,691	37,105
Somatic Cell Genome Editing	39,901	50,433	47,572
Somatic Mosaicism across Human Tissues (SMaHT)	0	0	11,453
S.P.A.R.C. - Stimulating Peripheral Activity to Relieve Conditions	42,702	30,932	35,677
Transformative High Resolution Cryo-Electron Microscopy (CryoEM)	37,478	19,890	19,508
Undiagnosed Diseases Network	22,199	16,400	0
Strategic Planning, Evaluation, and Infrastructure	27,424	27,532	28,986
Subtotal Common Fund	648,539	640,230	644,962
New Initiatives in Common Fund	0	0	13,577
Total Common Fund	648,539	640,230	658,539

JUSTIFICATION OF BUDGET REQUEST

NIH Common Fund

Authorizing Legislation: Section 301 and Title IV of the Public Health Service Act, as amended.

Budget Authority (BA)

	FY 2021 Final	FY 2022 Enacted	FY 2023 President's Budget	FY 2023 +/- FY 2022
BA	$648,539,000	$640,229,600	$658,539,000	$18,309,400
FTE	0	0	0	0

Program funds are allocated as follows: Competitive Grants/Cooperative Agreements; Contracts; Direct Federal/Intramural and Other.

Overall Budget Policy. The FY 2023 President's Budget request for the CF is $658.5 million, an increase of $18.3 million or 2.9 percent compared with the FY 2022 CR level. This level of funding will support high priority activities within existing programs and support the launch of the new Somatic Mosaicism across Human Tissues (SMaHT) and Community Partnerships to Advance Science for Society (ComPASS) programs, as described below.

PROGRAM DESCRIPTIONS

The CF supports approximately 25 programs, most of which consist of a series of integrated initiatives that collectively address a set of goals aiming to transform the way research is conducted, the way that health and disease are understood, and/or the way that diseases are diagnosed or treated within 5 to 10 years. Planned activities and budgets for CF programs are strategically developed, with clear milestones defined throughout the lifetime of the program to enable measurement of progress towards pre-defined goals. Therefore, CF programs often undergo planned budget shifts driven by the needs and activities for each program.

Several CF programs will receive their last year of support in FY 2022; funds are therefore not requested in FY 2023. These include Glycoscience,[165] Health Care Systems Research Collaboratory,[166] Metabolomics,[167] and Undiagnosed Diseases Network.[168] Information on these programs and their accomplishments can be found on the program websites. Additionally, the Global Health program will receive a small amount of additional Research Management Support

[165] https://commonfund.nih.gov/Glycoscience
[166] commonfund.nih.gov/hcscollaboratory
[167] commonfund.nih.gov/metabolomics
[168] commonfund.nih.gov/Diseases

(RMS) funds in FY 2023 to enable active management for awards in no-cost extensions that have remaining balances due to delays related to the COVID-19 pandemic.

Highlighted below are programs that exemplify the science to be supported in FY 2023, and/or which are undergoing significant programmatic changes in FY 2023.

Acute to Chronic Pain Signatures (A2CPS)
A2CPS[169] aims to improve understanding of the transition from acute to chronic pain following injury. Currently, this transition is poorly understood, and therefore prevention or treatment is difficult. A2CPS is addressing this challenge by developing an objective set of biomarkers (a "signature") to predict susceptibility of transitioning from acute to chronic pain. The high prevalence of chronic pain has contributed to the current opioid epidemic, and a signature to predict susceptibility to transition from acute to chronic pain could help accelerate therapy development and ultimately guide pain prevention strategies. A2CPS enhances the objectives of the NIH Helping to End Addiction Long-term℠ (HEAL) Initiative, a trans-agency effort to speed scientific solutions to end the opioid public health crisis. A2CPS will benefit the HEAL research priority to enhance pain management. Decreased funds requested in FY 2023 reflect the planned completion of clinical studies and data generation, while providing appropriate levels of support for continuing data integration efforts.

Budget Policy. The FY 2023 President's Budget request is $0.1 million, a decrease of $6.3 million or 98.1 percent compared with the FY 2022 CR level. These funds will allow the A2CPS program to continue to support data integration after completion of the clinical studies.

Enhancing the Diversity of the NIH-Funded Workforce
The Enhancing the Diversity of the NIH-Funded Workforce program, also known as the Diversity Program Consortium, is addressing the persistent disparities that exist in the biomedical workforce, despite years of investment by NIH and others to increase diversity. This program is developing, implementing, assessing, and disseminating innovative and effective training and mentoring approaches to enhance participation and persistence of individuals from underrepresented backgrounds in biomedical research careers, so that future programs may be more effective at recruiting and retaining a diverse workforce. Additionally, this program is supporting efforts to increase the productivity of sponsored program activities in institutions of higher learning, thereby enhancing capacity for biomedical research and/or research training. Decreased funding requested in FY 2023 reflects the planned ramping down of the program, as effective training and mentoring approaches piloted through this program are disseminated for widespread adoption.

Budget Policy. The FY 2023 President's Budget request is $39.5 million, a decrease of $4.7 million or 10.7 percent compared with the FY 2022 CR level. This decrease reflects a planned ramping down of program activities, with the expectation that successful training and mentoring approaches will be taken up by research institutions for widespread impact.

[169] commonfund.nih.gov/pain

Extracellular RNA Communication
Ribonucleic acid (RNA) was once thought to exist in a stable form only inside cells, where it plays a key role in translating information coded in genes into proteins that carry out cellular functions. However, we now know that RNA can play additional roles, including roles in cell-to-cell communication via RNAs that are exported from the cell and travel throughout the body. The Extracellular RNA Communication[170] program seeks to understand new paradigms of cellular information exchange based on these extracellular RNAs. This program has established data standards, developed a data portal, and made tools and reagents widely available to the scientific community. Additionally, it has cataloged extracellular RNA molecules from over 2,000 donors and identified potential extracellular RNA biomarkers for over 30 diseases, such as cardiovascular disease, pregnancy complications, glaucoma, diabetes, and multiple types of cancer. Decreased funding in FY 2023 reflects the planned ramping down in the program's final year, as the tools, resources, and new paradigms established through the Extracellular RNA Communication program continue to enable this growing area of research.

Budget Policy. The FY 2023 President's Budget request is $0.1 million, a decrease of $10.7 million or 99.1 percent compared with the FY 2022 CR level. This decrease reflects the planned ramping down of this program, which has catalyzed the field of extracellular RNA research.

Faculty Institutional Recruitment for Sustainable Transformation (FIRST)
The FIRST program aims to establish a more inclusive and diverse biomedical research workforce through support of cluster hiring and institutional culture change efforts. Based on early results from other cohort-based recruitment programs, FIRST will establish a faculty cohort model for hiring, mentoring, and professional development; integrated, institution-wide approaches to address bias, faculty equity, mentoring, and work/life issues; and a coordination and evaluation center to conduct independent evaluations of program impacts. The NIH expects its efforts to lead to the recruitment of talented researchers from all groups, to improve the quality of the training environment, to balance and broaden the perspective in setting research priorities, and to positively impact scientific discovery. Increased funds requested in FY 2023 will support awards to launch the third and final planned faculty cohort.

Budget Policy. The FY 2023 President's Budget request is $52.9 million, an increase of $21.8 million or 70.3 percent compared with the FY 2022 CR level. This increase will be supporting the launch of the third faculty cohort of promising researchers with demonstrated commitment to inclusive excellence.

Gabriella Miller Kids First Pediatric Research (Kids First)
The Kids First[171] program aims to generate new insights into childhood cancer and birth defects through development of a widely accessible data resource containing high-quality genetic and clinical data from pediatric patient cohorts, along with associated computational tools to facilitate data analysis. There is considerable evidence for undiscovered connections between childhood cancer and structural birth defects, and therefore examining these data sets together will facilitate new discoveries and novel ways of thinking about these conditions. Through FY 2021, the Kids First program selected 44 cohorts for whole genome sequencing, representing

[170] commonfund.nih.gov/exrna
[171] commonfund.nih.gov/KidsFirst

20,000 patients and 48,000 genomes. Kids First has developed one of the largest pediatric data resources of its kind and has fostered new biological insights into genetic causes of conditions such as childhood neuroblastoma, congenital heart defects, disorders of sex development, Ewing sarcoma, orofacial cleft, and syndromic cranial dysinnervation. Funds requested in FY 2023 from the Pediatric Research Initiative Fund will be used to support pediatric research, consistent with the Gabriella Miller Kids First Research Act, and remain constant at the statutory level set by this legislation. These funds will be used to continue support for the Kids First Data Resource, genetic sequencing of patient cohorts, and research projects to demonstrate the value of Kids First data. A small amount to support program management activities is requested from the general CF appropriation.

Budget Policy. The FY 2023 President's Budget request is $13.1 million, an increase of $8.3 million or 175.2 percent compared with the FY 2022 CR level. The FY 2022 CR level provided a reduced amount for the Kids First program due to depletion of funds in the Pediatric Research Initiative Fund. The FY 2022 CR level was used to support the Kids First data resource. Transfer of additional funds into the Pediatric Research Initiative Fund in FY 2023 restores the budget to historical levels and allows for additional data generation. In the FY 2023 President's Budget request, programmatic funding remains constant at the $12.6 million statutory level and will be used to conduct pediatric research in the second stage of this program. The remainder of the funds are requested in the regular CF appropriation to support research management activities.

Harnessing Data Science for Health Discovery and Innovation in Africa (DS-I Africa)
The DS-I Africa[172] program will leverage data science technologies and prior NIH investments to develop solutions to Africa's most pressing public health problems through a robust ecosystem of new partners from academic, government, and private sectors. Although many enabling factors, such as extensive mobile phone coverage, are already in place in Africa, data science applications to improve health are largely undeveloped. This represents an opportunity for strategic investment in data science with the potential for transformative impact on health outcomes in Africa and around the world, including in the United States. The program aims to promote sustainability of the African health research enterprise by encouraging innovative partnerships, and will also consider ethical, legal, and social issues (ELSI) for data science research and its applications to public health in Africa. Research supported through this program is leveraging data science to address some of the most pressing health needs not just in Africa, but in the world. These include tracking SARS-CoV-2 and HIV pandemic spread to inform potential interventions and enhance pandemic preparedness, improving maternal and child health, mitigating health impacts of climate change, and combating antimicrobial resistance. Increased funds requested in FY 2023 will be used to expand efforts to develop industry partnerships, as well as launch new short-term training activities and training for early-stage investigators.

Budget Policy. The FY 2023 President's Budget request is $16.4 million, an increase of $4.0 million or 31.8 percent compared with the FY 2022 CR level. This increase will support expansion of industry partnerships and new training activities.

[172] commonfund.nih.gov/AfricaData

TRANSFORMATIVE RESEARCH TO ADDRESS HEALTH DISPARITIES AND ADVANCE HEALTH EQUITY

NIH's UNITE initiative is an agency-wide effort to address structural racism and promote racial equity and inclusion at the NIH and within the larger biomedical research enterprise. One component of UNITE focuses on addressing long-standing health disparities and promoting health equity, ensuring that all populations benefit from the lifesaving and health promoting research supported by NIH. As a rapid response from the NIH Office of the Director that emerged from UNITE, the CF launched the Transformative Research to Address Health Disparities and Advance Health Equity initiative in FY 2021. This initiative is a bold approach to fund unusually innovative research projects with the potential to have a major impact on inequalities in health outcomes through development, dissemination, and/or implementation of innovative and effective interventions that address health disparities and advance health equity. Additionally, through dedicated support for researchers at under-resourced institutions that educate significant numbers of students from underrepresented backgrounds, this initiative also aims to expand the research base dedicated to health disparities research at minority-serving institutions. A second round of awards targeted toward minority serving institutions is being supported in FY 2022.

High-Risk, High-Reward Research (HRHR)

The HRHR program supports exceptionally creative scientists proposing innovative and transformative research in any scientific area within the NIH mission through four complementary initiatives: Pioneer Award, New Innovator Award, Transformative Research Award, and Early Independence Award. These awards are intended to support transformative science that is inherently difficult and risky, but necessary to accelerate the pace of scientific discovery and advance human health. Additionally, in FY 2021, the CF launched a new Transformative Research to Address Health Disparities and Advance Health Equity initiative to support research in developing, disseminating, or implementing innovative and effective interventions that prevent, reduce, or eliminate health disparities and health inequities. For all HRHR awards, "high risk" does not imply that additional risk is posed to research participants, as these awards use the same rigorous procedures to protect research participant safety as all other NIH-funded studies involving human subjects. To improve financial stewardship, starting in FY 2021, the New Innovator awards provide support for years one through three of the projects in the first fiscal year, and then provide support for years four and five in the fourth fiscal year. Prior to FY 2021, New Innovator awards provided all five years of funding in the first fiscal year; thus, this change in funding approach results in a temporary decline in funding levels while maintaining similar numbers of expected awards. Funds requested in FY 2023 will be used to support additional innovative projects with the potential for extraordinary impact.

Budget Policy. The FY 2023 President's Budget request is $177.3 million, an increase of $6.1 million or 3.5 percent compared with the FY 2022 CR level. These funds will continue to support highly creative, high-impact projects.

Illuminating the Druggable Genome (IDG)

Three protein families – G-protein coupled receptors, ion channels, and protein kinases – are well-established "druggable" protein families that have potential to be targets of pharmaceuticals. However, only a small number of proteins within each of these families are well-studied, representing an opportunity to greatly expand the druggable genome by catalyzing research into these understudied proteins. Additionally, these well-studied proteins are often present in many cells throughout the body, and drugs that target these proteins might therefore cause widespread adverse effects. In contrast, the lesser-known members of these protein

families may be present in fewer tissues, and thus have potential as specific drug targets that lead to fewer side effects. IDG is developing data, tools, and technologies to enable investigation of understudied proteins within these three protein families, expanding the repertoire of potential drug targets that may have high potential to impact human health. Having largely completed the goals of developing these resources for the biomedical research community, IDG will undergo a planned ramping down of the Data and Resource Generation Centers in FY 2023.

Budget Policy. The FY 2023 President's Budget request is $6.4 million, a decrease of $7.0 million or 52.2 percent compared with the FY 2022 CR level. This decrease reflects a planned ramping down of data and resource generation efforts, while continuing to support data analysis.

Molecular Transducers of Physical Activity in Humans
Physical activity has been demonstrated to contribute to health via a wide variety of measures, and lack of physical activity is at the root of many common chronic health problems. Despite this, we have a poor understanding of the molecular mechanisms by which the benefits of physical activity are realized. A better understanding of the molecules that underlie the benefits of physical activity could lead to the development of improved, personalized exercise recommendations as well as therapies for individuals who are unable to exercise due to illness or disability. The Molecular Transducers of Physical Activity in Humans Consortium (MoTrPAC) will improve our understanding of the molecular mechanisms by which physical activity improves health by extensively cataloguing the biological molecules affected by physical activity in people, identifying some of the key molecules that underlie the systemic effects of physical activity, and characterizing the function of these key molecules. Decreased funds requested in FY 2023 reflect the planned ramping down of human and animal physical activity studies and associated molecular analyses of samples.

Budget Policy. The FY 2023 President's Budget request is $13.5 million, a decrease of $27.0 million or 66.7 percent compared with the FY 2022 CR level. This decreased reflects the completion of human and animal physical activity studies, with continued support to explore the mechanisms of action of the molecules that underlie the benefits of physical activity.

Nutrition for Precision Health, powered by the *All of Us* Research Program (NPH)
Nutrition plays an integral role in human development and in the prevention and treatment of disease. However, there is no such thing as a perfect, one-size-fits-all diet. The goal of the NPH program[173] is to develop algorithms that predict individual responses to food and dietary patterns. NPH will leverage the *All of Us*[174] infrastructure and recent advances in biomedical science, such as artificial intelligence and microbiome research, to provide unprecedented opportunities to examine associations between nutrition and a variety of long-term outcomes. This program addresses some of the important scientific opportunities identified in the first Strategic Plan for NIH Nutrition Research.[175] Additionally, this program is closely coordinated with activities of the Office of Nutrition Research, to ensure NIH-wide nutrition efforts are complementary, not duplicative. Ultimately, the predictive algorithms developed through NPH are anticipated to enable tailored dietary recommendations to be provided by physicians, as well

[173] commonfund.nih.gov/nutritionforprecisionhealth
[174] allofus.nih.gov/
[175] niddk.nih.gov/about-niddk/strategic-plans-reports/strategic-plan-nih-nutrition-research

as development of tools to allow individuals to make more informed decisions about healthy food choices. Increased funds requested in FY 2023 will support ramping up of this program, particularly for the clinical and data generation centers.

Budget Policy. The FY 2023 President's Budget request is $37.1 million, an increase of $16.4 million or 79.3 percent compared with the FY 2022 CR level. This increase supports the ramping up of clinical studies and data generation efforts.

Somatic Cell Genome Editing (SCGE)

The SCGE program aims to develop quality tools to perform safe and effective genome editing in human patients, ultimately reducing the time and cost to develop new therapies for diseases caused by changes to the genetic code. These tools will need to function specifically on the disease gene to minimize unintended consequences. They will also need to be delivered selectively to the cells within the body that are affected by the disease, avoiding unaffected cells and reproductive cells so that changes are not passed on to future generations. The first stage of the SCGE program winds down in FY 2023, and a second stage of support is planned for FY 2023 to address new and ongoing opportunities in facilitating the transfer of genome editing approaches into the clinic. This second stage will aim to optimize and validate broadly applicable assays for preclinical studies, support Investigational New Device (IND)-enabling studies targeting multiple diseases in the same tissue or cell type, and identify and disseminate successful, streamlined strategies for initiating clinical trials for genome editing therapies.

SOMATIC MOSAICISM ACROSS HUMAN TISSUES (SMaHT)

An individual's personal genome is composed of the DNA sequence inherited from their parents and changes in DNA sequence that occur over the lifetime. The changes that occur over the lifetime result in genetically distinct cells within an individual, or somatic mosaicism. There is mounting evidence that somatic mosaicism plays important roles in biological processes such as fetal development, aging, and disease. However, technical challenges in detecting rare somatic variations means that this phenomenon is grossly understudied. The goal of the SMaHT program is to deepen understanding of how much variation there is within personal genomes, what causes this variation, and how this variation affects human health and disease. Launching in FY 2023, SMaHT will catalog somatic variants in select tissues from diverse human donors, develop innovative sequencing tools and analysis methods, and create a workbench to integrate analysis of somatic variation with the human genome. These resources, which will be widely available to the research community, are anticipated to catalyze an entirely new framework for understanding and probing the complexity of the human genome.

Budget Policy. The FY 2023 President's Budget request is $47.6 million, a decrease of $2.9 million or 5.7 percent compared with the FY 2022 CR level. This decrease reflects the net effect of the winding down of the first stage of the program and the launch of a planned second stage to facilitate the transfer to genome editing approaches into the clinic.

Stimulating Peripheral Activity to Relieve Conditions (SPARC)

The SPARC[176] program is accelerating the development of novel neuromodulatory therapeutic devices to advance bioelectronic medicine through provision of foundational data and tools. Modulation of nerve function has the potential to treat a variety of diseases and conditions, but there is an urgent need to better understand the precise pattern of connections between nerves and their end organs, so that the

[176] commonfund.nih.gov/sparc

nerves can be precisely and specifically stimulated. SPARC is addressing this need by generating maps and tools to identify and influence therapeutic targets within the neural circuitry of a wide range of organs and tissues. Ultimately, this therapeutic strategy could offer new treatment options for diverse diseases and conditions such as hypertension, heart failure, gastrointestinal disorders, type II diabetes, inflammatory disorders, and more. Increased funds requested in FY 2023 will support expansion of efforts to develop open-source neural engineering technologies and prizes for the research community to demonstrate proof of principle for neuromodulation therapeutic benefits.

Budget Policy. The FY 2023 President's Budget request is $35.7 million, an increase of $4.7 million or 15.3 percent compared with the FY 2022 CR level. This increase will support development of neuroengineering technologies and prizes, as described above.

Strategic Planning, Evaluation, and Infrastructure

Management of the CF requires that certain activities be undertaken for the benefit of the CF as a whole. These activities include strategic planning, evaluation, and support of infrastructure to support data-intensive CF programs. This infrastructure, referred to as the Common Fund Data Ecosystem (CFDE), is enabling researchers to query across and use multiple CF data sets, providing training for users to operate on the data in a cloud environment, and ensuring that CF data continue to be available after individual programs are completed. The CFDE will amplify the impact of many CF programs by enabling researchers to interrogate multiple disparate data sets, and thereby make new kinds of scientific discoveries that were not possible before.

Strategic planning is undertaken every year to identify new scientific challenges and opportunities. CF strategic planning involves the identification of broadly relevant scientific challenges and opportunities for strategic investments and the subsequent articulation of specific goals, milestones, and implementation plans for each broadly defined potential program topic. The initial activities for strategic planning often involve gathering broad input from stakeholders with diverse expertise as well as internal discussions about shared challenges and emerging opportunities. Subsequent refinement activities often involve specific consultations with external experts, analysis of NIH and worldwide research portfolios, and literature reviews to articulate specific gaps and areas of research where opportunities for transformative progress are possible.

Since CF programs are goal-driven, evaluation is critical to monitoring progress and developing strategies to adapt program management. Evaluation includes both formal and informal evaluative activities. Informal evaluation involves convening grantees and NIH-wide teams to review progress, discuss new challenges, and develop strategies to adapt as part of routine program management. It also involves gathering input from external consultants and using their input, together with internal analysis, to help guide the implementation of the program. Formal evaluations involve the development of baseline data for new programs and the development of multiple metrics of outcomes. The utility of data, resources, technologies, and other program outputs is assessed through surveys, expert opinion, and the analysis of bibliometric data such as citation analyses.

Funds Available for New Initiatives

Planning for potential new FY 2023 CF programs leveraged the wide-ranging expertise of NIH's senior leaders and scientific staff. One new FY 2023 program, Somatic Mosaicism Across Human Tissues, described above, has already undergone extensive planning to develop a robust scientific strategy for program implementation. Funds for this program are therefore included within the overall CF budget.

With additional resources, CF would support the Community Partnerships to Advance Science for Society (ComPASS) program to develop and test structural interventions addressing a broad range of upstream drivers of persistent health disparities. These partnerships may be funded as Other Transaction Awards to organizations not traditionally involved with research but with deep reach into communities that are underserved by traditional research. These partnerships may include community health storefronts, that have extensive coverage in rural as well as urban America and that are willing to partner with academic organizations to engage local communities across the country in research. Partnerships will also include local community-based organizations and/or Tribal Health organizations that are interested in forming a network so that their local communities can work together for large scale clinical studies. This program will support workforce development in these academic and community-based organizations to establish research and community engagement expertise that leads to sustainable health equity partnerships. Once expertise is established within partner organizations, research opportunity announcements will be established in future years to demonstrate the capacity of these networks to engage communities in research that addresses health issues of importance to those communities and that addresses the pervasive and devastating health disparities and health inequities that plague the Nation.

In addition, one current CF program, Somatic Cell Genome Editing, is planning for a potential second stage to launch in FY 2023. As described above, the second stage would focus on facilitating IND-enabling studies, establishing pathways to regulatory approval for genome editing approaches, and disseminating successful strategies for initiating first in human clinical trials. Funds for the second stage are included within the overall CF budget.

Office of AIDS Research

Congressional Justification FY 2023

NIH in a Changing World:
Science to Enhance
Human Health

NIH National Institutes of Health
Office of AIDS Research

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DEPARTMENT OF HEALTH AND HUMAN SERVICES

NATIONAL INSTITUTES OF HEALTH

Office of AIDS Research (OAR)

FY 2023 Budget Table of Contents

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Director's Overview

Maureen M. Goodenow, Ph.D.

Associate Director for AIDS Research and Director, Office of AIDS Research
National Institutes of

In June 2021, we commemorated the 40th anniversary of the first published cases of what later became known as AIDS and lauded the remarkable accomplishments in HIV prevention and treatment to date. At the same time, the world faces the ongoing consequences of a new global pandemic—coronavirus disease 2019 (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)—which has brought unprecedented challenges. The HIV workforce—from infectious disease doctors to basic laboratory researchers to community health advocates—enlisted quickly to fight COVID-19 and to apply knowledge, tools, infrastructure, and practices honed during the response to HIV/AIDS. As COVID-19 spread in the United States and globally, the same kinds of social inequalities and health disparities that characterize the HIV pandemic emerged. Attention to such inequalities was heightened by a resurgent racial justice movement that, along with the immediacy of COVID-19, has forced everyone to think about how to do things differently. Now there is evidence of the cumulative impact of COVID-19 on progress against HIV. Both service provision and research are significantly affected in the United States and globally.[177,178] This underscores the need to rekindle support for research that will yield novel and nimble tools to address the ongoing challenges of the HIV pandemic and contribute to solutions for other infectious disease pandemics.

The National Institutes of Health (NIH) Office of AIDS Research (OAR) has provided leadership in setting the national and global HIV research agenda since its establishment in 1988 through Section 2353 of the Public Health Service Act. Located within the NIH Office of the Director, the OAR is authorized to—

- Oversee, coordinate, and manage all NIH HIV-related research;
- Establish research priorities and develop the strategic plan for HIV research;
- Ensure that funds are invested in the areas of highest scientific priority and track and report on funding; and
- Address emerging needs and opportunities.

[177] Chenneville T, et al. 2020. The impact of COVID-19 on HIV treatment and research: A call to action. *Int. J Environ Res Public Health* 17(12): 4584; doi: 10.3390/ijerph17124548.

[178] Mermelstein E. 2021. At the intersection of two pandemics: The impact of COVID-19 on HIV. *Infectious Disease Advisor*, July 9, 2021. Available at: www.infectiousdiseaseadvisor.com/home/topics/hiv-aids/how-covid-19-affected-the-hiv-pandemic.

OAR operationalizes its authorities through activities related to the following four Strategic Goals outlined in the *Fiscal Year (FY) 2021–2025 NIH Strategic Plan for HIV and HIV-Related Research*.[179]

Advance rigorous and innovative research to end the HIV pandemic and improve the health of people with, at risk for, or affected by HIV across the lifespan: OAR catalyzes multidisciplinary and novel approaches in HIV prevention, treatment, cure, and co-morbidities research and supports research to better address underlying HIV-associated health disparities and inequalities related to age, race, ethnicity, sex, gender, economic status, and geographic location.

Ensure that the NIH HIV research program remains flexible and responsive to emerging scientific opportunities and discoveries: OAR works with the NIH Institutes, Centers, and Offices (ICOs) and other partners to develop novel approaches to HIV prevention, treatment, and cure, including long-acting injectables for prevention and treatment, new therapeutic targets, messenger RNA (mRNA) vaccines, and gene therapy. OAR continues to apply lessons learned from the COVID-19 pandemic to HIV science and to monitor the effects of COVID-19 on HIV research.

Promote dissemination and implementation of research discoveries for public health impact across agencies, departments, and stakeholders within the U.S. government and globally: OAR is expanding NIH activities in support of the *Ending the HIV Epidemic* (EHE) initiative;[180] extending its Listening Sessions and other stakeholder outreach and engagement activities;[181] and supporting national and international HIV-related conferences to ensure broad access to the latest scientific knowledge.

Strengthen human resource and infrastructure capacity to enhance sustainability of HIV research discovery and the implementation of findings by a diverse and multi-disciplinary workforce: OAR is expanding its initiatives to build and diversify the cadre of early-career HIV investigators and is implementing novel ways to conduct research that are attentive to the needs of diverse communities. OAR is committed to supporting HIV researchers from underrepresented communities and expanding capacity in historically under-resourced academic institutions.

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[179] OAR, NIH. 2020. *FY 2021–2025 NIH Strategic Plan for HIV and HIV-Related Research.* Available at: www.oar.nih.gov/sites/default/files/NIH_StrategicPlan_FY2021-2025.pdf.

[180] HIV.gov. 2021. Overview: What is *Ending the HIV Epidemic in the U.S.*? Available at: www.hiv.gov/federal-response/ending-the-HIV-epidemic/overview.

[181] OAR, NIH. 2020. *HIV Stakeholder Outreach and Engagement Report: June 2018–February 2020.* Available at: www.oar.nih.gov/sites/default/files/2020_OAR_Stakeholder_Outreach_Report_12-18-21_508.pdf.

The Strategic Goals provide the framework for how OAR promotes the NIH Director's theme of *NIH in a Changing World: Science to Enhance Human Health.*

Leveraging HIV research and infrastructure to respond to the COVID-19 pandemic: OAR continues to drive scientific progress to protect the health of the American people and the global community at a time of unprecedented challenge.

- ***Pivot HIV research to respond to the COVID-19 pandemic:*** The HIV research and infrastructure that OAR has supported for decades recently resulted in the rapid development of two highly effective mRNA SARS-CoV-2 vaccines within one year of the onset of the COVID-19 pandemic and positioned the United States as a world leader in vaccine research.
- ***Translate tools and technologies to develop COVID-19 treatments:*** OAR promoted the development of monoclonal antibodies for HIV prevention and treatment and supported the repurposing of these technologies to identify and develop monoclonal antibodies to add to the limited toolkit to help improve COVID-19 patient outcomes.
- ***Furnish NIH HIV clinical trials infrastructure for COVID-19 therapeutic development:*** OAR supports the HIV clinical trials infrastructure, including the HIV Prevention Trials Network (HPTN), HIV Vaccine Trials Network (HVTN), AIDS Clinical Trials Group (ACTG), and International Maternal Pediatric Adolescent AIDS Clinical Trials Network (IMPAACT). These resources were enlisted to address the emergent COVID-19 pandemic and continue to be employed to test the safety and efficacy of COVID-19 vaccines and therapeutics as part of the Accelerating COVID-19 Therapeutic Interventions and Vaccines (ACTIV) partnership.
- ***Monitor the impact of COVID-19 on HIV research and services:*** The OAR HIV and COVID-19 Task Force, formed in May 2020, continues to provide recommendations to the NIH OAR on programmatic, scientific, and operational focus areas and action plans that are relevant at the intersection of HIV and COVID-19 and to monitor effects of COVID-19 on HIV research progress.

Focusing on research topics that need additional support: Forty years after the first cases of AIDS were reported, HIV remains a significant domestic and global health challenge. OAR works with stakeholders from academic, community, industry, and public health organizations to identify basic, clinical, behavioral, and implementation research strategies to address those challenges.

- ***End the HIV epidemic in the United States and globally:*** OAR catalyzes the development and implementation of innovative approaches to reaching the EHE goal of reducing new HIV infections in the United States by 75 percent by 2025 and by at least 90 percent by 2030. Working with the NIH ICOs, OAR supports international research and partners with the President's Emergency Plan for AIDS Relief (PEPFAR) to help reach the 2025 global targets for HIV control.[182]

[182] Joint United Nations Programme on HIV/AIDS (UNAIDS). 2021. *2025 Targets: Putting people living with HIV and communities at risk at the centre.* Available at: aidstargets2025.unaids.org/#section-targets.

- ***Expand HIV prevention, treatment, and cure strategies:*** OAR is committed to supporting cutting-edge research to expand the repertoire of long-acting formulations and other novel methods for pre-exposure prophylaxis (PrEP); uncover novel strategies for long-term viral suppression; reduce the emergence of drug-resistant HIV variants; and eliminate HIV viral replication in cellular reservoirs.
- ***Address the consequences of aging with HIV:*** OAR promotes interdisciplinary research to understand comorbidities that are prevalent in people aging with HIV who have had long-term use of antiretroviral therapies. Comorbidities include neurological, cardiovascular, and metabolic diseases and some types of cancers and are influenced by lengthy exposure to chronic inflammation. OAR supports research on the psychosocial aspects of aging with HIV, including such things as survival guilt and trauma.

Learning new ways to conduct research: OAR is engaged in an extensive consultation process with early-stage and established investigators to determine the parameters that will foster the development of a new cadre of HIV investigators representing a range of disciplines, perspectives, and population groups.

- ***Diversify the HIV research workforce:*** OAR prioritizes researcher training and development across the NIH to expand the pool of diverse early career investigators (ECIs)—including early-stage investigators (ESIs) and early established investigators[183]—in HIV research. OAR engages with junior and senior investigators from diverse academic institutions to identify strategies to support, retain, and expand the pool of HIV ECIs and has developed a webpage to provide links to relevant resources. OAR is committed to working with the National Institute on Minority Health and Health Disparities (NIMHD) to support HIV research and research training at institutions serving underrepresented and vulnerable populations.
- ***Capitalize on the use of new technologies and platforms:*** OAR promotes community research to assess the acceptability and effectiveness of technologies, such as the expanded use of telemedicine, to facilitate health care access. OAR supports expansion of virtual research technologies to capitalize on advanced imaging and computer modeling to identify new therapeutic targets that may curtail the emergence of drug-resistant HIV variants.

Critically examining health disparities in research and medicine: OAR is committed to supporting the NIH UNITE initiative[184] to address structural racism in the content and conduct of health research. OAR works with the NIH ICOs to expand social, behavioral, and epidemiological research to mitigate HIV-related health disparities.

- ***Increase attention to social determinants of health:*** OAR supports research to mitigate the negative effects of social factors, including stigma and discrimination, that perpetuate HIV-related health inequalities in different populations and settings.

[183] NIH. 2017. NOT-OD-17-101. Policy Supporting the Next Generation Researchers Initiative. Available at: grants.nih.gov/grants/guide/notice-files/NOT-OD-17-101.html.

[184] NIH. 2021. UNITE. Available at: www.nih.gov/ending-structural-racism/unite.

Advancing dissemination and implementation research and strategies: OAR regularly works to assess the acceptability and effectiveness of social and technological strategies to deliver effective HIV interventions.

- ***Intensify efforts to optimize effective HIV prevention and treatment strategies:*** OAR supports implementation research to improve uptake, equity, and adherence to HIV prevention and treatment strategies in diverse population groups and settings.
- ***Develop and implement effective community outreach and communication strategies:*** OAR supports behavioral and social research and engages in ongoing outreach activities with community stakeholders to better understand the nuances of delivering appropriate and effective HIV prevention and treatment strategies to different populations.

Returns on Funding Increases for FY 2017–FY 2022

There was no funding increase for HIV research in FY 2017. Between FY 2018 and FY 2021, a cumulative increase of $86.5 million supported high-priority research in HIV vaccines and neurological and cardiovascular comorbidities, enhancing the number and diversity of ECIs, and renovations of research facilities in Research Centers in Minority Institutions (RCMIs). NIH funding increases of $16.0 million in FY 2020 and FY 2021 supported NIH EHE research through the Centers for AIDS Research (CFARs) and the AIDS Research Centers (ARCs); in addition, the Minority HIV/AIDS Fund in the U.S. Department of Health & Human Services (HHS) Office of Infectious Disease and HIV/AIDS Policy provided $2.3 million in FY 2021 to support HIV research at RCMIs.

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National Institutes of Health
Office of AIDS Research

OAR History

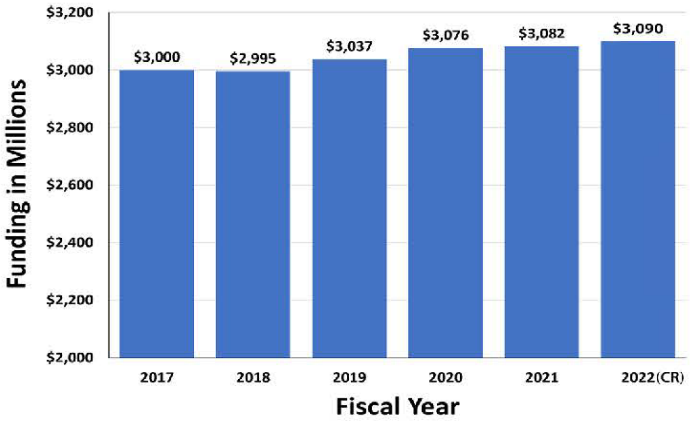
In 1988, the U.S. Congress authorized the establishment of the OAR to oversee, coordinate, and manage NIH HIV/AIDS-related research. Located within the Office of the NIH Director, specifically within the Division of Program Coordination, Planning, and Strategic Initiatives, OAR—

- Establishes NIH HIV/AIDS research priorities;
- Allocates HIV/AIDS research funds in line with scientific priorities;
- Manages HIV/AIDS research across the NIH ICOs; and
- Collaborates across the U.S. government and with scientists, community groups, and organizations globally.

OAR Vision: *Advance research to end the HIV pandemic and improve health outcomes for people with HIV.*

OAR Mission: *Ensure that NIH HIV/AIDS research funding is directed at the highest-priority research areas and facilitate maximal return on the investment.*

NIH HIV/AIDS Funding History FY 2017–2022



The FY 2023 President's Budget request for the NIH-wide HIV/AIDS research program is $3.10 billion, an increase of $10.0 million or 0.3 percent compared to the FY 2022 CR level. Funding at this level will expedite NIH efforts to end HIV.

OAR Facts and Figures

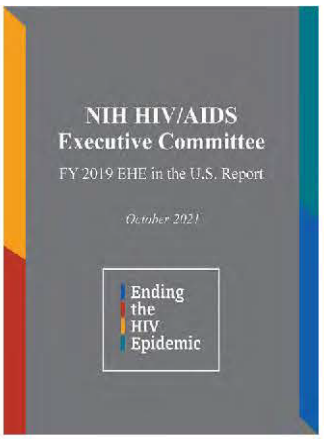
Maureen M. Goodenow, Ph.D.
Associate Director for AIDS Research and Director, Office of AIDS Research National Institutes of Health

- With 33 full-time equivalent employees, OAR coordinates the largest public investment (~$3.1 billion annually) in HIV/AIDS research globally.
- OAR supports HIV/AIDS-related research administered by a majority of the 27 NIH ICOs.
- The NIH Revitalization Act of 1993 authorized OAR to plan, coordinate, and evaluate HIV/AIDS research; set scientific priorities for the NIH research agenda; and determine budgets for all NIH HIV/AIDS research.
- The NIH AIDS Executive Committee (NAEC) meets monthy and facilitates communication between OAR and all ICOs that administer HIV/AIDS funding.
- The OAR Advisory Council (OARAC) provides advice to the OAR director on the planning, coordination, and evaluation of research and other HIV/AIDS activities conducted or supported by the NIH.

Research Highlights

- Two major studies demonstrated the efficacy and superiority of a long-acting injectable drug cabotegravir for the prevention of HIV.
- The Microbicide Trials Network (MTN) 034 study found high levels of adherence among young women to both oral pre-exposure prophylaxis (PrEP) and an intravaginal ring with dapivirine.
- HIV prevention studies using several triple broadly neutralizing antibody combinations are currently in Phase I trials.
- The IMPAACT 2010/VESTED study showed that antiretroviral regimens containing dolutegravir and emtricitabine/tenofovir alafenamide fumarate are the safest and most effective HIV treatment for women during pregnancy.
- Lenacapavir showed potent antiviral activity in heavily treatment-experienced people with multidrug-resistant HIV.
- A rapid enzymatic assay to monitor short- and long-term adherence to HIV drugs was recently developed.
- The first FDA-approved clinical trial of a CRISPR-based gene therapy for HIV cure started in September 2021.

Recent Accomplishments



- Released the *NIH/HIV AIDS Executive Committee FY 2019 EHE in the U.S. Report* (cover at right) establishing a baseline to quantify the initial NIH contribution to EHE and to track future NIH-funded research efforts.
- Coordinated NIH development of HIV research objectives for inclusion in the update to the National HIV/AIDS Strategy.
- Established the NIH OAR Taskforce on COVID-19 and HIV to ensure NIH research priorities reflect the demands of the converging COVID-19 and HIV pandemics.
- Leveraged HIV clinical trials infrastructure to test potential COVID-19 vaccines and therapeutics as part of NIH's Accelerating COVID-19 Therapeutic Interventions and Vaccines (ACTIV) partnership.
- Accelerated expansion of Research Centers in Minority Institutions (RCMI) research capacity with supplements for laboratory improvements.
- Launched a study to assess the efficacy of mobile, "one-stop" integrated HIV health services for people with opioid use disorder who inject drugs.

Current Activities

- Continuation of OAR's listening sessions (image) and community engagement events to obtain stakeholder input on NIH HIV research priorities and inform future activities.
- Analysis of immune correlates from the Imbokodo (HVTN 705) vaccine trial to better evaluate human immune responses to HIV vaccine models.
- In partnership with NIH ICOs, implementation of a framework to increase the number and diversity of HIV early career investigators, particularly women and those from underrepresented minority groups and under-resourced academic institutions.
- Development of funding initiatives for high-risk, high-reward HIV projects focused on promising new technologies.

Future Initiatives

- Research effective HIV vaccines built on the success of COVID-19 mRNA vaccine models.
- Develop effective antibody-mediated HIV protection strategies.
- Develop new therapies that are safe and effective against multidrug-resistant HIV.
- Explore the effect of HIV and SARS-CoV-2 coinfection on immune dysfunction.
- Improve the quality of life and health outcomes for people aging with HIV.
- Expand basic science research on the viral life cycle to inform HIV cure strategies.
- Develop new methods and delivery of HIV self-testing, point-of-care treatment, PrEP, and post-exposure prophylaxis (PEP).
- Conduct clinical, behavioral, social, translational, and implementation research to address HIV-associated stigma, health disparities, and inequalities.
- Continue focused stakeholder outreach and engagement efforts to identify new research and community partners for local and regional collaborations.

Budget Policy Statement

The FY 2023 President's Budget request for the NIH-wide HIV/AIDS research program is $3,100.0 million, an increase of $10.0 million or 0.3 percent compared to the FY 2022 CR level. Funding at this level will expedite NIH efforts to end the HIV epidemic in the United States and globally; expand HIV prevention, treatment, and cure strategies; and address the consequences of aging with HIV. The NIH will continue to leverage HIV research and infrastructure to respond to the COVID-19 pandemic, engage with ECIs and established investigators to develop effective approaches for diversifying the HIV research workforce, and prioritize research training and development across the NIH ICOs to expand the pool of ECIs in HIV research. The NIH will capitalize on the use of new technologies and platforms and will continue the critical examination of health disparities in research and medicine. The NIH will continue to advance dissemination and implementation research and strategies to identify efforts to optimize effective HIV prevention and treatment strategies to develop and implement effective community outreach and communication strategies.

National Institutes of Health
Office of AIDS Research

Budget Authority by Institute, Center, and Office

(Dollars in Thousands)

Institute, Center, and Office	FY 2021 Final[1]	FY 2022 CR[2]	FY 2023 President's Budget	FY 2023 +/- FY 2022
NCI	$240,513	$242,285	$241,238	-$1,047
NHLBI	84,715	84,823	84,715	-108
NIDCR	18,984	19,008	18,984	-24
NIDDK	34,135	34,179	34,135	-44
NINDS	38,528	41,135	38,655	-2,480
NIAID	1,783,470	1,791,391	1,798,843	7,452
NICHD	147,273	145,081	147,716	2,635
NEI	195	388	195	-193
NIEHS	5,342	5,349	5,342	-7
NIA	23,350	22,651	23,350	699
NIAMS	4,573	4,593	4,587	-6
NIDCD	2,128	2,131	2,128	-3
NIMH	185,868	184,227	186,421	2,194
NIDA	261,336	261,474	262,123	649
NIAAA	31,879	31,920	31,879	-41
NINR	16,350	16,371	16,350	-21
NHGRI	3,538	3,306	3,538	232
NIBIB	1,831	1,841	1,839	-2
NIMHD	23,530	22,809	23,530	721
NCCIH	666	749	666	-83
FIC	24,316	24,420	24,389	-31
NLM	7,685	9,334	7,685	-1,649
OD				
OAR	63,593	62,336	63,593	1,257
ORIP	78,099	78,199	78,099	-100
Subtotal, OD	141,692	140,535	141,692	1,157
TOTAL, NIH	**$3,081,897**	**$3,090,000**	**$3,100,000**	**$10,000**

[1] Reflects effects of Secretary's transfers.

[2] Does not include HIV/AIDS transfers.

National Institutes of Health
Office of AIDS Research

Budget Mechanism – AIDS[1]
(Dollars in Thousands)

Mechanism	FY 2021 Final[2]		FY 2022 CR[3]		FY 2023 President's Budget		FY 2023 +/- FY 2022	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount
Research Projects:								
Noncompeting	1,382	$1,028,454	1,407	$1,405,627	1,312	$1,389,496	-95	-$16,131
Administrative Supplements	*(99)*	40,762	*(78)*	34,395	*(64)*	27,038	*(14)*	-7,357
Competing	519	724,047	480	319,077	498	343,424	18	24,347
Subtotal, RPGs	1,901	$1,793,263	1,887	$1,759,099	1,810	$1,759,958	-77	$859
SBIR/STTR	27	14,649	26	18,319	24	17,276	-2	-1,043
Research Project Grants	1,928	$1,807,912	1,913	$1,777,418	1,834	$1,777,234	-79	-$184
Research Centers:								
Specialized/Comprehensive	62	$146,798	60	$144,302	61	$147,599	1	$3,297
Clinical Research	0	0	0	0	0	0	0	0
Biotechnology	0	0	0	0	0	0	0	0
Comparative Medicine	16	72,035	15	70,496	15	70,396	0	-100
Research Centers in Minority Institutions	0	0	0	2,522	0	2,602	0	80
Research Centers	78	$218,833	75	$217,320	76	$220,597	1	$3,277
Other Research:								
Research Careers	270	$47,528	266	$47,338	246	$44,265	-20	-$3,073
Cancer Education	0	0	0	0	0	0	0	0
Cooperative Clinical Research	0	116	11	4,000	16	9,950	5	5,950
Biomedical Research Support	1	1,838	0	1,600	1	1,600	1	0
Minority Biomedical Research Support	0	0	0	0	0	0	0	0
Other	123	66,433	119	68,020	117	64,703	-2	-3,317
Other Research	394	$115,915	396	$120,958	380	$120,518	-16	-$440
Total Research Grants	2,400	$2,142,660	2,384	$2,115,696	2,290	$2,118,349	-94	$2,653
Ruth L. Kirschstein Training Awards:	FTTPs		FTTPs		FTTPs			
Individual Awards	66	$3,553	75	$3,497	65	$3,173	-10	-$324
Institutional Awards	254	13,309	228	14,823	225	14,786	-3	-37
Total Research Training	320	$16,862	303	$18,320	290	$17,959	-13	-$361
Research & Develop. Contracts	119	$344,624	92	$379,548	98	$385,705	6	$6,157
SBIR/STTR (non-add)	*(5)*	*(1,604)*	*(12)*	*(5,896)*	*(12)*	*(6,104)*	*(0)*	*208*
Intramural Research		$348,197		$345,906		$342,034		-$3,872
Res. Management and Support		165,961		168,194		172,360		4,166
SBIR Admin (non-add)		*0*		*0*				*0*
Office of the Director - Appropriation[4]		*141,692*		*140,535*		*141,692*		*1,157*
Office of the Director - Other		63,593		62,336		63,593		1,257
ORIP (non-add)[4]		*78,099*		*78,199*		*78,099*		*-100*
Total, NIH Discretionary B.A.		**$3,081,897**		**$3,090,000**		**$3,100,000**		**$10,000**

[1] All items in italics and brackets are non-add entries.

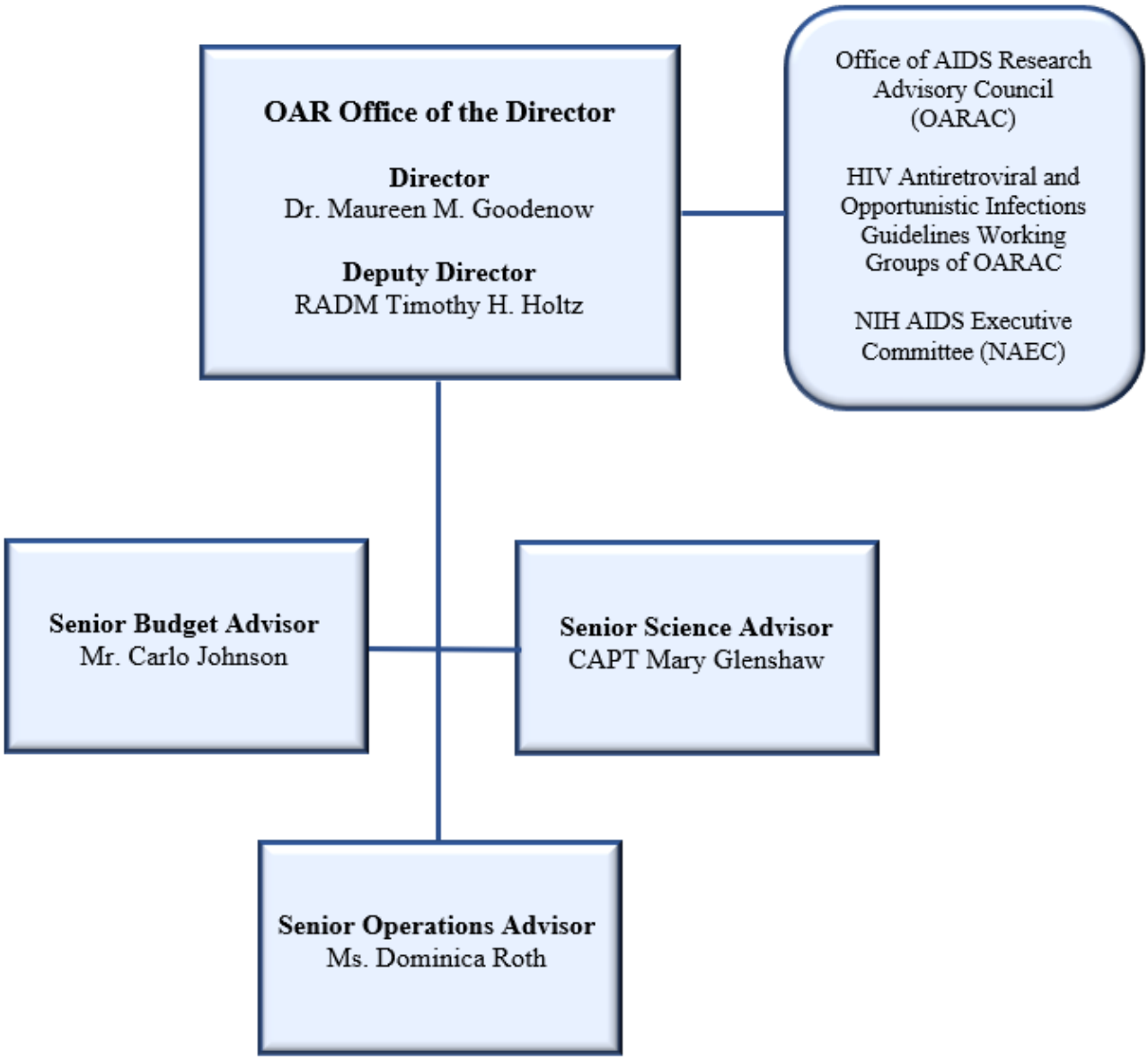
[2] Reflects effects of Secretary's transfers.

[3] Does not include HIV/AIDS transfers.

[4] Number of grants and dollars for the ORIP component of OD are distributed by mechanism and are noted here as a non-add. Office of the Director - Appropriation is the non-add total of these amounts and the funds accounted for under OD - Other.

National Institutes of Health
Office of AIDS Research

ORGANIZATIONAL CHART



National Institutes of Health
Office of AIDS Research

Budget Authority by Activity

(Dollars in Thousands)

Overarching Priorities	FY 2019 Actual[1]	FY 2020 Actual	FY 2021 Final[1]	FY 2022 CR[2]	FY 2023 President's Budget	FY 2023 +/- FY 2022
Reduce the Incidence of HIV	$741,401	$719,217	$684,570	$689,839	$672,848	-$16,991
Develop Next-Generation HIV Therapies	368,912	345,378	331,927	341,552	347,969	$6,417
Research Toward a Cure for HIV	187,777	209,133	224,737	207,147	211,767	$4,620
Address HIV-Associated Comorbidities, Coinfections, and Complications	531,440	554,452	560,766	561,314	565,872	$4,558
Cross-Cutting Areas	1,207,770	1,247,881	1,279,897	1,290,148	1,301,544	$11,396
Total	**$3,037,300**	**$3,076,061**	**$3,081,897**	**$3,090,000**	**$3,100,000**	**$10,000**

[1] Reflects effects of Secretary's transfer.

[2] Does not include HIV/AIDS transfers.

JUSTIFICATION OF BUDGET REQUEST

Office of AIDS Research (OAR)

Budget Authority (BA):

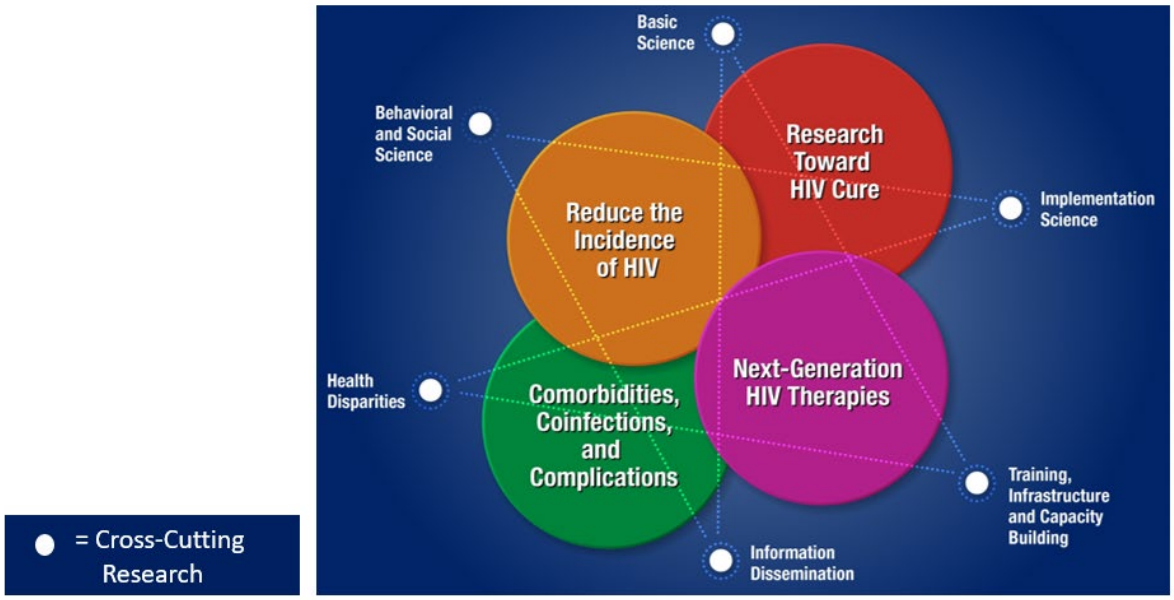
	FY 2021 Final	FY 2022 CR	FY 2023 President's Budget	FY 2023 +/- FY 2022
BA	$3,081,897,000	$3,090,000,000	$3,100,000,000	$10,000,000

Program funds are allocated as follows: Competitive Grants/Cooperative Agreements; Contracts; Direct Federal/Intramural and Other.

PROGRAM DESCRIPTIONS, ACCOMPLISHMENTS, AND FUTURE DIRECTIONS

The following selected program areas and activities focus on the highest HIV research priorities as they further the NIH director's theme of *NIH in a Changing World: Science to Enhance Human Health.*

NIH Priorities for HIV and HIV-related Research



Reduce the Incidence of HIV

Each year, approximately 1.5 million people become newly infected with HIV,[185] about 37,000 of whom live in the United States.[186] Globally, HIV incidence disproportionately affects key population groups, including gay men and other men who have sex with men, sex workers and their clients, people who inject drugs, adolescent girls and young women, and transgender people. The special needs of different populations call for differentiated prevention strategies. Much progress has been made in a number of biomedical and behavioral HIV prevention methods—used alone or in combination—that are appropriate for different population groups, although the ultimate strategy—a vaccine—remains elusive.

PrEP: One of the most promising advances in HIV prevention research supported by the NIH is the development and testing of long-acting forms of PrEP. Results from HPTN 083 and 084 Phase 3 studies demonstrated that a long-acting injectable PrEP treatment containing cabotegravir, administered once every eight weeks, is safe, effective, and superior to a daily oral PrEP pill with tenofovir/emtricitabine (Truvada®) across populations.[187-190] Additionally, interim results from the NIH-funded Microbicide Trials Network (MTN) 034 Phase 2a study with young women in Uganda, South Africa, and Zimbabwe found higher levels of adherence than expected both to a vaginal ring containing dapivirine (about 50 percent)

[185] Centers for Disease Control and Prevention (CDC). 2021. HIV: Basic Statistics. Available at: www.cdc.gov/hiv/basics/statistics.html.

[186] UNAIDS. 2021. Global HIV & AIDS statistics—Fact sheet. Available at: www.unaids.org/en/resources/fact-sheet.

[187] National Institute of Allergy and Infectious Diseases (NIAID). 2020. Long-acting injectable drug prevents HIV among men who have sex with men and transgender women. News Release. Available at: www.niaid.nih.gov/news-events/long-acting-injectable-drug-prevents-hiv-among-men-who-have-sex-men-and-transgender.

[188] NIAID. 2020. Long-acting injectable form of HIV prevention outperforms daily pill in NIH study. News Release. Available at: www.niaid.nih.gov/news-events/long-acting-injectable-form-hiv-prevention-outperforms-daily-pill-nih-study.

[189] NIAID. 2020. Statement—NIH study finds long-acting injectable drug prevents HIV acquisition in cisgender women. News Release. Available at: www.niaid.nih.gov/news-events/statement-nih-study-finds-long-acting-injectable-drug-prevents-hiv-acquisition.

[190] Landovitz R, et al. 2021. Cabotegravir for HIV prevention in cisgender men and transgender women. *N Engl J Med* 385:595-608. doi: 10.1056/NEJMoa2101016.

and to oral PrEP (about 59 percent). Both options were well tolerated and rated as highly acceptable by participants.[191–193]

Measuring adherence to various forms of PrEP is critical to assessing the potential impact of PREP on HIV incidence. A rapid enzymatic assay for selective detection of HIV drugs to monitor short- and long-term adherence was recently developed. The NIH will continue support for the development and dissemination of technologies that improve both speed and accuracy in measuring PrEP adherence.

Uptake and adherence to various PrEP methods is affected by user preferences, provider attitudes, and accessibility (including cost). The NIH is supporting research that examines user, provider, and health systems stakeholder attitudes and preferences to optimize implementation of long-acting injectable and oral PrEP. The NIH Adolescent Medicine Trials for HIV/AIDS Interventions Network (ATN) 143:P3 study is testing the efficacy of a novel, theory-based mobile app that utilizes game mechanics and social networking features to improve PrEP adherence, retention in PrEP clinical care, and PrEP persistence among young men who have sex with men and young trans women who have sex with men.

Vaccines: Developing safe, effective, and durable preventive vaccines against HIV is a high priority to end the HIV pandemic. This is a formidable scientific challenge that can be met only by multidisciplinary teams of researchers across different fields of basic, translational, and behavioral science from the very beginning of the development process. The scientific complexity and cost of these endeavors has led to the establishment of public–private partnerships to advance the evaluation of vaccine candidates.

NIH partnered with pharmaceutical companies in two large-scale, multinational trials: Imbokodo (HVTN 705) and Mosaico (HVTN 706). The Imbokodo clinical trial, conducted with women in sub-Saharan Africa starting in late 2017, recently was determined to be ineffective in preventing HIV infection.[194] However, the study did provide sufficient data for immunological

[191] American Association for the Advancement of Science. 2021. EurekAlert. Study finds adolescent girls and young women in Africa will use HIV prevention products. Available at: www.eurekalert.org/news-releases/612191.

[192] Wits RHI. 2021. REACH study finds adolescent girls and young women in Africa will use HIV prevention products. Media Release. Available at: www.wrhi.ac.za/media/detail/reach-study-interim-results.

[193] Nair G., et al. 2021. Adherence to the dapivirine vaginal ring and oral PrEP among adolescent girls and young women in Africa: Interim results from the REACH study. Abstract presentation. 11th IAS Conference on HIV Science. Available at: theprogramme.ias2021.org/Abstract/Abstract/2487.

[194] NIAID. 2021. HIV vaccine candidate does not sufficiently protect women against HIV infection. Press Release. Available at: www.nih.gov/news-events/news-releases/hiv-vaccine-candidate-does-not-sufficiently-protect-women-against-hiv-infection.

correlates research, a stepping stone for basic and clinical research to evaluate the human immune response to HIV vaccine models. The Mosaico Phase 3 trial to prevent HIV-1 infection in cisgender men and transgender individuals who have sex with cisgender men and/or transgender individuals is ongoing.

Development of VIR-1111, a novel cytomegalovirus-based HIV vaccine platform, resulted from a sustained research effort enabled by support from the NIH Office of Research Infrastructure Programs (ORIP), National Institute of Allergy and Infectious Diseases (NIAID), and National Cancer Institute (NCI), as well as the Bill & Melinda Gates Foundation. This model incorporates fragments of HIV virus into a weakened form of human cytomegalovirus capable of triggering potent responses from effector-memory T cells. The first human Phase 1 clinical trial testing this vaccine strategy was initiated in December 2020.

NIH HIV vaccine research supported the development of the mRNA vaccine platform that was deployed to generate highly effective COVID-19 vaccines in record time. Researchers now are capitalizing on this experience to reach an even more ambitious goal: a partnership in the first human trial of mRNA forms of two promising HIV vaccines. The NIH continues to invest in all aspects of translational science, as well as in the strategic expansion of vaccine product manufacturing capabilities to meet future supply demands.

Concomitant to vaccine-based prevention strategies, antibody-mediated protection using passive immunity is being tested as an alternative way to prevent HIV infection. A triple broadly neutralizing antibody (bNAb) combination is predicted to afford high levels of protection for 4 to 6 months. Several of these bNAb concepts are currently being tested in Phase I trials.

Budget Policy: The FY 2023 President's Budget request to reduce the incidence of HIV is $672.8 million, a decrease of $17.0 million or 2.5 percent compared to the FY 2022 CR level.

Develop Next-Generation HIV Therapies

Decades of NIH-supported research have produced highly effective antiretroviral therapies that have helped people with HIV live long and healthy lives. An ongoing goal of HIV treatment research is to find ways to minimize the pill-taking burden on individuals with HIV while maintaining their viral suppression and other good health outcomes. One approach is to reduce the number of drugs one takes on a daily basis. A recent clinical trial demonstrated that among virally suppressed adults, switching to the two-drug regimen of dolutegravir/lamivudine (DTG/3TC) fixed-dose combination is as effective as continuing a three-drug regimen through 24 weeks.[195]

[195] Llibre JM, et al. 2021. Switching to the 2-drug regimen of dolutegravir/lamivudine (DTG/3TC) fixed-dose combination (FDC) is non-inferior to continuing a 3-drug regimen through 24 weeks in a randomized clinical trial (SALSA). Abstract presentation. Available at: https:/theprogramme.ias2021.org/Abstract/Abstract/1457.

The development of long-acting and injectable formulations of antiretrovirals is another approach to optimizing HIV treatment (as it is to HIV prevention). The once-monthly long-acting regimen of cabotegravir and rilpivirine (brand name Cabenuva) was recently approved by the U.S. Food and Drug Administration (FDA) as a complete treatment regimen for HIV-1-infected adults.[196] Lenacapavir (LEN), a long-acting first-in-class inhibitor of HIV-1 capsid function, also is showing promise. LEN showed potent antiviral activity in heavily treatment-experienced people with HIV who had multidrug resistance, as well as in people with HIV who were treatment-naïve, when used subcutaneously or orally in combination with tenofovir alafenamide fumarate (F/TAF).[197] LEN was well tolerated, and its pharmacokinetics support its use every 6 months, which will be a significant reduction in daily pill burden.

A number of new antiretroviral treatment (ART) classes and drugs are in various stages of preclinical and clinical development and target different parts of the HIV life cycle. These include entry inhibitors, nucleoside reverse transcriptase inhibitors, non-nucleoside reverse transcriptase inhibitors, integrase strand transfer inhibitors, capsid inhibitors, and maturation inhibitors. Additionally, different novel delivery systems (subcutaneous, intravenous, topical, implantable, long-acting oral) for these new drugs and classes, as well as newer drug delivery platforms and technologies (microarray patches, implants, reduced volume injections) are currently being developed and tested in clinical trials. By providing a wider array of choices and options for individuals, these new delivery systems and technologies likely will improve adherence to drug regimens and reduce the burden on health systems.

It is essential to determine the best HIV treatment regimens for different populations. The NIH-funded IMPAACT 2010/VESTED study recently showed that antiretroviral drug regimens containing dolutegravir and emtricitabine/tenofovir alafenamide fumarate (DTG+FTC/TAF) are the safest and most effective HIV treatment regimen for women during pregnancy.[198] This Phase III study, which enrolled more than 640 pregnant women with HIV across four continents, affirms updated World Health Organization recommendations for HIV treatment during pregnancy.

[196] FDA. 2021. FDA approves Cabenuva and Vocabria for the treatment of HIV-1 infection. Available at: www.fda.gov/drugs/human-immunodeficiency-virus-hiv/fda-approves-cabenuva-and-vocabria-treatment-hiv-1-infection.

[197] Gilead. 2021. Gilead submits New Drug Application to U.S. Food and Drug Administration for Lenacapavir, and investigational, long-acting capsid inhibitor for the treatment of HIV-1 people with limited therapy options. Press Release. Available at: www.gilead.com/news-and-press/press-room/press-releases/2021/6/gilead-submits-new-drug-application-to-us-food-and-drug-administration-for-lenacapavir-an-investigational-longacting-capsid-inhibitor-for-the-tre.

[198] NIAID. 2020. Newer anti-HIV drugs safest, most effective during pregnancy. News Release. Available at: www.niaid.nih.gov/news-events/newer-anti-hiv-drugs-safest-most-effective-during-pregnancy.

Budget Policy: The FY 2023 President's Budget request to develop next-generation HIV therapies is $348.0 million, an increase of $6.4 million or 1.9 percent compared to the FY 2022 CR level.

Address HIV-Associated Comorbidities, Coinfections, and Complications
Although ART increases the life expectancy of persons living with HIV, many challenges and opportunities persist for the treatment of HIV and HIV-associated comorbidities, coinfections, and complications across the lifespan.

Much progress has been achieved in preventing perinatal transmission of HIV in the United States; only 65 HIV infections were attributed to perinatal transmission in 2018.[199] Limited ART formulations for infants and children make HIV management in these age groups challenging. Questions remain about the impact of HIV and ART exposure *in utero*, as well as HIV infection and long-term antiretroviral therapy on the growing and developing child. Although early treatment reduces morbidity and mortality from HIV, whether very early ART can ameliorate complications of HIV and preserve neurodevelopment, optimal cognitive functioning, and mental health in children living with HIV is unclear.

In 2019, young people aged 13–24 years represented 21 percent of all new HIV infections in the United States. Although improved routine HIV testing has reduced undiagnosed HIV infection overall in the United States, up to 80 percent of young people still are unaware of their infection. Durable linkage to care, which is associated with improved outcomes, remains an elusive goal for young persons. Regulatory approvals for the use of novel treatment strategies in adolescents lag behind approvals for adults. Adolescents with perinatally or behaviorally acquired HIV face unique challenges during the transition from pediatric to adult health care settings, including interruptions in HIV care, changing socioeconomic and health insurance status, and new stigma and disclosure issues. Cognitive development and mental health issues, medication adherence, and sexual, reproductive, and gender health concerns are paramount in young adults with HIV.

Over half of Americans currently living with HIV in the United States are 50 years or older, and about 20 percent of new infections occur in older individuals. This group is projected to expand with increased use of effective ART among those newly diagnosed with HIV. However, individuals aging with HIV are also more likely to suffer from the effects of accelerated aging, higher rates of neurocognitive and cardiovascular complications, some malignancies, and metabolic and bone disorders, most likely caused by chronic low-level activation of the immune system.[200] An increase in the risk of experiencing cardiovascular diseases and increased arterial "age" are some examples of health problems affecting people aging with HIV.

[199] CDC. 2020. HIV and Pregnant Women, Infants, and Children. Available at: www.cdc.gov/hiv/pdf/group/gender/pregnantwomen/cdc-hiv-pregnant-women.pdf.

[200] Szanjawski MA and Spivak AM. 2020. Senotherapeutics for HIV and aging. *Curr Opin HIV AIDS.* 15(2):83-93. doi: 10.1097/COH.0000000000000609.

An interdisciplinary approach that includes geroscience[201]—the study of the intersection between basic aging biology and chronic disease—and the social sciences is required to address the growing health concerns and improve health outcomes in people living and aging with HIV, given that most comorbidities are multifactorial and include lifestyle factors.

At a population level, COVID-19 is threatening gains achieved by four decades of HIV research.[202,203] The intersection of two global pandemics is a continuously evolving situation that requires careful analysis of emerging data and creative interventions to mitigate regressive outcomes for HIV research objectives.

Many details are unknown about the impact of COVID-19 among people with HIV, particularly considering preexisting health inequalities and adverse social determinants of health.[204,205] A recent analysis of data from the NIH-funded U.S. National COVID Cohort Collaborative (N3C) found that, after adjusting for covariates, people with HIV had higher odds of COVID-19 death than people without HIV; older, male, Black, African American, Hispanic, and Latinx adults with HIV had elevated odds of death; and a lower CD4 cell count was associated with all the adverse COVID-19 outcomes, while viral suppression was associated only with reduced hospitalization.[206]

Although COVID-19 is an acute crisis, tuberculosis constitutes the most significant cause of mortality for people with HIV globally. Hepatitis viruses, some viral-associated cancers, and other concomitant sexually transmitted infections (STIs) are also significant challenges for people with HIV.

Additionally, behavioral health issues—including alcohol and tobacco use, substance abuse disorders, and mental health disorders—co-occur with HIV infection and frequently are associated with violence, marginalization, social discrimination, stigma, and other behavioral and

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[201] Justice J. 2021. Translational science and the application of geroscience approach in understanding the mechanisms of aging in HIV. Invited Presentation. 11th IAS Conference on HIV Science. Available at: theprogramme.ias2021.org/Programme/Session/230.

[202] Chebbeville T et al. The Impact of COVID-19 on HIV Treatment and Research: A Call to Action. *Int J Environ Res Public Health.* 2020 Jun;17(12):4548.

[203] The Global Fund. 2021. Global Fund results report reveals COVID-19 devastating impact on HIV, TB, and malaria programs. News Release. Available at: www.theglobalfund.org/en/news/2021-09-08-global-fund-results-report-reveals-covid-19-devastating-impact-on-hiv-tb-and-malaria-programs.

[204] Mandavilli A. 2021. COVID is especially risky for people with HIV, large study finds. *New York Times,* July 15, 2021. Updated September 7, 2021. Available at: www.nytimes.com/2021/07/15/health/covid-hiv-risk-study.html.

[205] Mirzaei H et al. 2020. COVID-19 among people living with HIV: A systematic review. *AIDS Behav*, July 30:1-8. doi: 10.1007/s10461-020-02983-2 (Epub ahead of print).

[206] Yang X et al. 2021. Associations between HIV infection and clinical spectrum of COVID-19: A population level analysis based on US National COVID Cohort Collaborative (N3C) data. *Lancet HIV*. Published online October 13, 2021. doi.org/10.1016/S2352-3018(21)00239-3.

psychosocial challenges. These complex, intersecting conditions need to be better recognized, understood, and addressed to make lasting improvements in the health and well-being of people living and aging with HIV.

Budget Policy: The FY 2023 President's Budget request to address HIV-associated comorbidities, coinfections, and complications (CCC) is $565.9 million, an increase of $4.6 million or 0.8 percent compared to the FY 2022 CR level.

Research Toward a Cure for HIV

The persistence of HIV reservoirs in people after ART is discontinued is a formidable obstacle to achieving sustained virologic remission or cure. Spontaneous remission is extremely rare and HIV cure using medical technologies, such as complex bone marrow transplantation, is costly and impractical to use in large groups of people with HIV. The rare examples of HIV cure—only three cases worldwide—provide a glimpse into the areas of research that need to be addressed to understand the dynamics of viral reactivation and the nature of cellular reservoirs.

NIH investment in HIV virology will continue to advance the understanding of the viral reservoir composition and localization and its relationship with viral replication and long-term viral suppression; the host genetic factors that may influence the size and composition of latent reservoirs in people with HIV on ART regimes; virus/host cell interactions; and how to ward off the development of drug resistance. A range of techniques, including single-cell imaging technologies, is being used to identify and describe the HIV reservoir and discover mechanisms of viral reactivation from latently infected cells.

Experimental treatments under development include latency reversing agents that make the HIV virus visible to the immune system so that the virus can be cleared; cure-inducing immunotherapies using bNAbs and genetically engineered immune cells that are resistant to HIV infection; therapeutic vaccines; and long-acting antiretrovirals that can suppress virus for a few months or longer.

The recent discovery of a bacterial gene editing mechanism called CRISPR-Cas led to the immediate testing of this new research tool to excise viral HIV from the genomic DNA of people with HIV. The first clinical trial investigating CRISPR-based gene therapy as a possible means to achieve HIV cure was approved for initiation by the FDA in September 2021.[207]

The NIH is supporting behavioral and social science research to ascertain what kind of cure strategies are desirable among different groups of people with HIV. In the end, the goal of integrated HIV cure research is to develop safe, scalable, and sustainable strategies that will be available to all people with HIV globally.

Budget Policy: The FY 2023 President's Budget request to promote research toward a HIV cure is $211.8 million, an increase of $4.6 million or 2.2 percent compared to the FY 2022 CR level.

[207] Parkins K. 2021. FDA approves first trial investigating CRISPR gene editing as HIV cure. Clinical Trials Arena. Available at: www.clinicaltrialsarena.com/news/crispr-gene-editing-hiv-cure.

Cross-Cutting Areas

Basic Science: Continued basic biomedical research is indispensable to advance discovery in HIV virology, immunology, and pathogenesis. The unusual characteristics of the viral life cycle present significant challenges to the development of effective vaccine and cure strategies.

A significant breakthrough in understanding fundamental aspects of HIV-1 structure and viral life cycle within host cells was achieved recently by novel imaging technologies. NIH intramural researchers developed a method to label infectious viral complexes with a green fluorescent protein.[208] Using the imaging technology, the scientists showed that HIV-1 capsids remain intact until minutes before uncoating in the nucleus to achieve viral integration into the host cell genome. Novel imaging work further demonstrated that nuclear pores are larger than previously estimated. This characteristic allows HIV-1 capsids to enter the nucleus in an intact form and to release HIV genomic complexes inside the nucleus, not in the cytoplasm, as previously thought.[209]

The NIH will continue to approach HIV research from a systems biology perspective to achieve an HIV cure. Of particular importance is the gap in our understanding of fundamental aspects of innate immunity, viral reservoir composition and localization, cell type contribution to the HIV reservoir, and host genetic factors that may influence the size and composition of latent reservoirs in people with HIV on ART.

***Behavioral and Social Science*:** Progress in HIV prevention and treatment, even with the best biomedical advances, is affected by numerous social factors that influence knowledge, attitudes, availability, uptake, and adherence among individuals and groups. Also referred to as social determinants of health, these factors shape the environment in which individuals interact with health systems and interventions[210] and include, for example, stigma, discrimination, racism, sexism, food security/insecurity, housing stability/instability, and economic inequality. Although the importance of social factors for HIV-related outcomes was recognized from the beginning of the pandemic, the ability to rigorously model, map, and measure nuanced social dynamics persists as a challenge. The NIH supports studies of a range of innovative methodologies appropriate for analyzing social factors in diverse settings.

The COVID-19 pandemic highlights the need for better understanding of health communications, particularly in the context of uncertainty and rapidly evolving health

[208] Burdick RC et al. 2020. HIV-1 uncoats in the nucleus near sites of integration. *Proc Natl Acad Sci USA*, 117(10):5486-5493. doi: 10.1073/pnas.1920631117.

[209] Zila V et al. 2021. Cone-shaped HIV-1 capsids are transported through intact nuclear pores. *Cell*, 184(4):1032-1046.e18. doi: 10.1016/j.cell.2021.01.025.

[210] Office of the Assistant Secretary for Health. Healthy People 2030. Social Determinants of Health. Available at: health.gov/healthypeople/objectives-and-data/social-determinants-health.

information.[211] The NIH will enhance support for behavioral and social research on effective ways to communicate complex and dynamic evidence-based health information and to mitigate misinformation campaigns that undermine public health practice.

Epidemiology: Persistent monitoring of the global HIV pandemic, including how it is affected by the COVID-19 pandemic, is critical. The NIH supports research using advanced technology for surveillance, big data mining, advanced bioinformatics, phylodynamics, epigenetics, and other epidemiological analyses.

Health Disparities: HIV incidence and prevalence are not distributed evenly across population groups and settings. In the United States, Black/African American and Hispanic/Latino gay and other men who have sex with men, Black/African American women, and people residing in the South have the highest rates of new HIV infections.[212,213] The NIH supports research to better understand and address HIV and associated health disparities that stem from social inequalities related to sex, gender, race, ethnicity, socioeconomic status, age, substance use behavior, and geographic location.

Implementation Science: The NIH supports research on the optimal provision and uptake of effective HIV prevention, care, and treatment strategies, particularly as these further the goals of the *National HIV/AIDS Strategy for the United States* (NHAS) and the EHE initiative.

Information Dissemination: OAR will continue its series of listening sessions and community engagement meetings in various locales to obtain stakeholder input on recent research findings, research priorities, and optimal translation and dissemination strategies.

Training, Infrastructure, and Capacity-Building: The NIH remains committed to supporting and nurturing the next generation of HIV researchers and to ensuring that the HIV research workforce is diverse and representative of historically underrepresented groups.

Budget Policy: The FY 2023 President's Budget request to advance the critical framework of cross-cutting areas of research is $1,301.5 million, an increase of $11.4 million or 0.9 percent compared to the FY 2022 CR level. This includes a $10.0 million increase above the FY 2022 CR level to expand implementation research activities under the Ending the HIV Epidemic in the U.S. (EHE) initiative conducted by the Centers for AIDS Research (CFARs) and AIDS Research Centers (ARCs).

NIH- and HHS-Wide Initiatives

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[211] Han PK et al. 2021. Communicating scientific uncertainty about the COVID-19 pandemic: Online experimental study of an uncertainty-normalizing strategy. *J Med Internet Res*, 23(4):e27832. doi: 10.2196/27832.

[212] CDC. 2021. Estimated HIV Incidence and Prevalence in the United States, 2015–2019. HIV Surveillance Supplemental Report 26(No.1). Available at www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-supplemental-report-vol-26-1.pdf.

[213] Bosh, K.A., et al. 2021. Estimated Annual Number of HIV Infections – United States, 1981–2019. *Morbidity and Mortality Weekly Report* 70(22):801-806. Available at www.cdc.gov/mmwr/volumes/70/wr/mm7022a1.htm?s_cid=mm7022a1_w.

***Ending the HIV Epidemic in the U.S. (EHE)*:** OAR continues to collaborate with NIH and HHS partners to advance the EHE goals of reducing new HIV infections in the United States by 75 percent by 2025 and by at least 90 percent by 2030. EHE focuses on four key strategies or pillars: Diagnose, Treat, Prevent, and Respond to Outbreaks. OAR is responsible for monitoring, tracking, and reporting EHE investments across all NIH ICOs for this initiative.

OAR collaborated with the NIH HIV/AIDS Executive Committee (NAEC) EHE Working Group to develop the NIH *FY 2019 EHE in the U.S. Report*, released in 2021. This report establishes a baseline to quantify the initial NIH contribution to EHE and to track future NIH-funded research efforts.

***National HIV/AIDS Strategy for the U.S. (NHAS) Update*:** OAR partnered with the White House Office of National HIV/AIDS Policy (ONAP) in the update of the NHAS for 2022–2025, released on World AIDS Day, December 1, 2021. As the NIH representative on the Steering Committee for the NHAS, OAR coordinated NIH-wide input for comments related to strengthening the research component of the document. OAR provided revised language for the NHAS goals and objectives, based on the consolidated NIH input. OAR continues to work with ONAP to highlight the critical role of research in achieving the goals of the NHAS.

Drug Control Programs

RESOURCE SUMMARY

	Budget Authority (in millions)		
	FY 2021 Final	FY 2022 CR	FY 2023 Request
Drug Resources by Function			
Research and Development: Prevention	$592.103	$600.944	$736.638
Research and Development: Treatment	$948.880	$944.035	$1,173.396
Total, Drug Resources by Function	$1,540.983	$1,544.979	$1,910.034
Drug Resources by Decision Unit			
National Institute on Alcohol Effects and Alcohol-Associated Disorders (NIAAA)			
Research and Development: Prevention	$53.304	$53.470	$54.607
Research and Development: Treatment	$11.812	$11.849	$12.101
National Institute on Drugs and Addiction (NIDA)			
Research and Development: Prevention	$538.799	$547.474	$682.031
Research and Development: Treatment	$937.068	$932.186	$1,161.295
Total, Drug Resources by Decision Unit	$1,540.983	$1,544.979	$1,910.034
Drug Resources Personnel Summary			
Total FTEs (direct only)	389	398	398
Drug Resources as a Percent of Budget			
Total Agency Discretionary Budget (in Billions)	$41.4	$41.5	$50.5
Drug Resources percentage	3.72%	3.72%	3.78%

NIDA PROGRAM SUMMARY

MISSION

The National Institute on Drugs and Addiction (NIDA) and the National Institute on Alcohol Effects and Alcohol-Associated Disorders (NIAAA), 2 of the 27 Institutes and Centers of the National Institutes of Health (NIH), support research in pursuit of the objectives of the National Drug Control Strategy.[214]

NIDA is the lead federal agency supporting scientific research on drug use and its consequences. Its mission is to advance science on drug use and addiction and apply that knowledge to improve individual and public health. This includes basic and clinical research on drug use (including nicotine), addiction, and the underlying neurobiological, behavioral, and social mechanisms involved. NIDA also works to ensure the effective translation, implementation, and dissemination of scientific research findings to improve the prevention and treatment of substance use disorder (SUD) and to enhance public awareness of addiction as a brain disorder.

[214] The FY 2023 President's Budget proposes to rename the National Institute on Drug Abuse to the National Institute on Drugs and Addiction and to rename the National Institute on Alcohol Abuse and Alcoholism to the National Institute on Alcohol Effects and Alcohol-Associated Disorders.

While NIDA's mission broadly encompasses substance use, addressing opioid misuse and addiction is a top priority at NIDA.

Substance use and SUD cost the U.S. more than $740 billion a year in healthcare, crime, and lost productivity;[215] but dollars cannot capture the devastating human cost of addiction to individuals, families, and communities. Drug overdose is now the leading cause of unintentional fatal injury in our nation. Centers for Disease Control and Prevention (CDC) show that a record high of nearly 92,000 people died of an overdose in the United States in 2020, an unprecedented one-year increase of 30 percent.[216] The collision of the overdose crisis with the coronavirus disease 2019 (COVID-19) pandemic puts people with substance use disorders (SUD) at particular risk. Individuals with SUD, particularly those with opioid use disorder (OUD), are at higher risk for COVID-19 and its adverse outcomes.[217]

METHODOLOGY

NIDA's entire budget is drug-related and classified as a part of the National Drug Control Budget.

NIDA BUDGET SUMMARY

The FY 2023 Request for drug-related activities at NIH is $1,910.0 million ($1,843.3 million for NIDA and $66.7 million for NIAAA), a 23.6 percent increase compared with the FY 2022 Continuing Resolution (CR) level.

NIH-supported research has provided and will continue to provide the scientific basis for drug control policy. For example, NIH continues to explore the many biological, behavioral, and environmental influences on substance misuse and addiction vulnerability, which will allow the development of more targeted and effective prevention approaches. Research shows that universal prevention programs not only reduce drug use, underage drinking, and other risky behaviors that can lead to HIV and other adverse outcomes, but can also promote other positive outcomes, such as strengthening young people's sense of community or "connection" to school—key to reducing substance misuse, violence, and mental health problems.

Another top priority continues to be the development and deployment of therapeutic interventions to treat SUD, including medications, biologics, behavioral interventions, and non-pharmacological interventions such as transcranial magnetic stimulation or neurofeedback. NIH is now poised to capitalize on a greater understanding of the neurobiology underlying addiction, and of newly identified candidate molecules and brain circuits that show promise as potential targets for the treatment of SUD. However, discovering new therapies is not sufficient to combat SUD if these therapies do not reach the people who need them. In many cases, such as medications for the treatment of OUD (MOUD), studies suggest that effective treatments are under-utilized despite strong evidence of their effectiveness. To address this issue, NIH is also exploring ways of improving the dissemination and implementation of evidence-based practices (implementation science) in real-world settings to improve the prevention and treatment of SUD

[215] https://nida.nih.gov/drug-topics/trends-statistics
[216] https://wonder.cdc.gov/
[217] pubmed.ncbi.nlm.nih.gov/32929211/

and co-occurring conditions such as HIV and psychiatric disorders, thereby enhancing the public health impact of NIH-supported research.

In April 2018, NIH launched the HEAL Initiative, an aggressive, trans-agency effort to speed scientific solutions to stem the national opioid public health crisis. This Initiative is built on extensive, well-established NIH research, including basic science of the complex neurological pathways involved in pain and addiction, implementation science to develop and test treatment models, and research to integrate behavioral interventions with MOUD.

As part of the NIH HEAL Initiative, NIDA (and to a lesser extent, NIAAA) supports a variety of projects aimed at advancing our understanding of how to prevent and treat opioid misuse and addiction and reverse opioid overdose. This includes research studies focused on:

- Enhancing the NIDA Clinical Trials Network to Address Opioids[218]
- Focusing Medication Development to Treat Opioid Use Disorder and Prevent and Treat Opioid Use Disorder and Overdose[219]
- Determining strategies to reduce opioid overdose in communities hardest hit by the opioid crisis (the HEALing Communities Study)[220]
- Determining ways to improve the effectiveness and adoption of interventions within justice systems. (The Justice Community Opioid Innovation Network)[221]
- Preventing At-Risk Adolescents Transitioning into Adulthood from Developing Opioid Use Disorder[222]
- Prevention of Progression to Moderate or Severe Opioid Use Disorder [223]
- Optimizing the Duration, Retention, and Discontinuation of Medication Treatment for Opioid Use Disorder[224]
- Studying the effects of environmental factors, including opioids and other substance use, on early brain development from pregnancy through early childhood (HEALthy Brain and Child Development Study)[225]
- Integrative Management of Chronic Pain and Opioid Use Disorder[226]

Stimulants have also emerged as an overdose threat. From 2019 to 2020, overdose deaths involving methamphetamine increased by 45 percent, and overdose deaths involving cocaine increased by more than 24 percent.[227] Given the urgent need to confront these dramatic increases, NIDA has also prioritized the development of medications to treat stimulant use disorders.

National Institute on Drugs and Addiction
FY 2023 Request: $1,843.3 million

[218] https://heal.nih.gov/research/research-to-practice/enhancing-clinical-trials-network
[219] https://heal.nih.gov/research/medication-options/focusing-development
[220] https://heal.nih.gov/research/research-to-practice/healing-communities
[221] https://heal.nih.gov/research/research-to-practice/jcoin
[222] https://heal.nih.gov/research/new-strategies/at-risk-adolescents
[223] https://heal.nih.gov/research/new-strategies/prevent-progression
[224] https://heal.nih.gov/research/new-strategies/duration-retention-discontinuation
[225] https://heal.nih.gov/research/infants-and-children/healthy-brain
[226] https://heal.nih.gov/news/stories/new-impowr-research-program-puts-people-first
[227] https://wonder.cdc.gov/mcd-icd10.html

($363.7 million above the FY 2022 CR Level)

NIDA's efforts consist of Neuroscience and Behavioral Research; Epidemiology, Services and Prevention Research; Therapeutics and Medical Consequences; Clinical Trials Network; High-Tech Biomedical Product Development; Responding to the Opioid Crisis; Intramural Research Program (IRP); and Research Management and Support (RMS). The section entitled "Responding to the Opioid Crisis" details how NIDA is using dollars budgeted to the HEAL Initiative for the purpose of opioid research, but those dollars supplement base funding for opioid and pain research that are included within other NIDA program areas. Funding for the HEAL Initiative® in NIDA will increase by $135.1 million or 50.0 percent compared with the FY 2022 CR level. In addition, funding for research into opioids and pain management outside the HEAL Initiative® will increase by an additional $196.3 million.

Division of Neuroscience and Behavioral Research
FY 2023 Request: $603.5 million
($107.6 million above the FY 2022 CR Level)

NIDA's Division of Neuroscience and Behavior (DNB) advances knowledge of the basic biological mechanisms that underlie substance use and SUDs and that guide the development of novel prevention and treatment strategies for SUDs and overdose. This includes identifying the effects of illicit substances on brain structure and function throughout the lifespan and across stages of drug use and SUDs. Areas of focus include identifying the genetic variants and epigenetic modifications that determine vulnerability to SUDs; the effects of drugs on gene expression and brain development and function; the nature and dynamics of drug-receptor interactions at the atomic level; and the cellular signaling engaged by these interactions that may underlie the development of addiction. DNB-supported research has elucidated the neurobiology of opioid, nicotinic, cannabinoid, and benzodiazepine receptors, and this knowledge is being leveraged to guide the development of novel therapeutics to treat SUD, the adverse consequences of illicit drugs, and pain. The DNB portfolio also includes research that is advancing our understanding of the mechanisms by which neuromodulation, such as transcranial stimulation, deep brain stimulation, and neurofeedback, can be used to treat SUD by identifying specific brain circuits that can be modulated by these approaches with precision to yield therapeutically beneficial effects. DNB-supported research using cutting-edge genetics and neuro-engineering approaches to interrogate and modulate populations of brain cells is revealing a complex map of neural circuits that are engaged by addictive drugs and that underlie their rewarding and aversive effects. Research using advanced computational approaches including theoretical modeling and novel methods for analyzing large, diverse data sets are being used to link SUD-related behaviors to underlying neural mechanisms.

DNB is also pioneering Big Data Science as a tool to understand the biology of addiction. A cross-cutting research theme in the Division is that of sex differences. DNB promotes research to elucidate the neurobiological basis of sex differences in drug effects and in the development of addiction. This is critical for developing individually tailored prevention and treatment strategies. Finally, DNB supports a robust research portfolio focused on the shared biological mechanisms underlying drugs and HIV, and how these mechanisms are involved in HIV-associated neurological disorders.

Division of Epidemiology, Services, and Prevention Research
FY 2023 Request: $421.3 million
($75.1 million above the FY 2022 CR Level)

NIDA's Division of Epidemiology, Services, and Prevention Research (DESPR) supports integrated approaches to understanding and addressing the interactions between individuals and environments that contribute to drug use, addiction, and related health problems. Through the annual Monitoring the Future survey of substance use and related attitudes among youth and young adults, the Population Assessment of Tobacco and Health, which collects biospecimens and behavioral data associated with tobacco use, as well as other studies, DESPR monitors trends in drug use, including marijuana, vaping/e-cigarettes, and other drugs, as well as the potential risks and health outcomes related to these behaviors. Preventing the initiation of substance use to minimize risks of harmful consequences is an essential part NIDA's mission. To this end, DESPR funds a portfolio of prevention research to understand and intervene upon mechanisms that underlie risk for and resilience to drug use and addiction, and common comorbidities. This includes studies on how biological, psychosocial, and environmental factors operate to enhance or mitigate an individual's propensity to initiate substance use or to escalate from use to misuse to SUD across different developmental stages. This information, along with rapidly growing knowledge about substance use and addiction, is helping to inform the development of evidence-based prevention strategies. NIDA also supports research on integrating prevention and treatment services into healthcare and community systems to reduce the burden of drug problems across the lifespan. For example, ongoing research is examining efforts to implement evidence-based SUD treatment in jails and prisons, expand the use of effective medications for OUD in primary care settings, develop strategies to reduce transmission of viral infections related to substance use (e.g., HIV and Hepatitis C), and increase uptake and retention in treatment for SUDs and HIV. DESPR also funds research into the efficacy of screening, brief intervention, and referral to treatment in primary care settings for reducing drug use and SUDs.

Division of Therapeutics and Medical Consequences
FY 2023 Request: $136.0 million
($24.2 million above the FY 2022 CR Level)

NIDA's Division of Therapeutics and Medical Consequences (DTMC) supports research to evaluate the safety and efficacy of pharmacological and non-pharmacological interventions to prevent and treat SUDs and drug overdose. This work spans all phases of medical product development including synthesis and preclinical evaluation of potential therapeutics, clinical trial design and execution, and preparing regulatory submissions. Through these investments, NIDA helps to mitigate the risks of developing new treatments for SUDs. For example, in collaboration with US WorldMeds, DTMC supported clinical trials on LUCEMYRA™, the first medication targeted specifically to treat the physical symptoms associated with opioid withdrawal,[228] which was approved by the FDA in May 2018. NIDA also supports research to identify promising compounds and make them more feasible for pharmaceutical companies to

[228] https://nida.nih.gov/about-nida/noras-blog/2018/05/nida-supported-science-leads-to-first-fda-approved-medication-opioid-withdrawal

complete costly clinical studies for SUD indications. As part of the HEAL Initiative[SM], described below, DTMC leads efforts to develop safe and effective new and repurposed medications to prevent and treat OUD and overdose. NIDA is also prioritizing the development of new treatments for stimulant (i.e., cocaine and methamphetamine) overdose and stimulant use disorders. This portfolio includes developing novel pharmacotherapies, repurposing medications already approved by the U.S. Food and Drug Administration for other indications, as well as developing novel vaccines and monoclonal antibodies to treat stimulant use disorders. (See program portrait for "Immunotherapies for Substance Use Disorder and Overdose" in the NIDA chapter of the NIH Congressional Justification documents.)

Center for Clinical Trials Network
FY 2023 Request: $48.0 million
($8.6 million above the FY 2022 CR Level)

The overarching mission of the NIDA Clinical Trials Network (CTN) is to allow treatment providers, treatment researchers, patients, and NIDA to collaboratively develop, validate, refine, and deliver new treatment options to patients. The CTN comprises 16 research nodes with 30 Node principal investigators affiliated with academic medical centers and large health care networks; 2 research coordinating centers; and more than 240 community-based treatment programs and provider organizations. This unique partnership enables the CTN to conduct studies of behavioral, pharmacological, and integrated treatment interventions in multisite clinical trials to test their effectiveness across a broad range of settings and populations. It also allows the CTN to facilitate the transfer of research results to providers and patients. The network evaluates interventions, implementation strategies, and health system approaches to addressing SUD and co-occurring conditions such as mental illnesses and HIV. Using support from the NIH HEAL Initiative, the CTN was able to add five new nodes, expanding its geographical reach and capacity to develop and test interventions in diverse populations.

Through the HEAL Initiative, the CTN has launched several multisite trials examining methods for optimizing the treatment of OUD. One study will examine if rapid transition to extended-release naltrexone following detoxification is more effective than standard detoxification and naltrexone initiation. Another study is underway to evaluate strategies to improve medication treatment retention and strategies to improve outcomes among patients who have achieved stable remission on OUD medications and want to discontinue medication. The CTN is conducting studies to evaluate a collaborative care intervention for preventing progression of opioid misuse to OUD, medications for treating OUD during pregnancy, and strategies for integrating OUD screening and treatment into emergency departments, hospitals, primary care clinics, and AI/AN communities. The network has supported studies to capture important data for research on SUD in electronic health record (EHR) systems in primary care and emergency departments and is currently testing clinical decision support that integrates with EHR systems to help doctors diagnose OUD and provide treatment or refer patients to appropriate care. Complementing the work supported through NIDA's DTMC, CTN studies are investigating the effectiveness and safety of pharmacotherapies, and transcranial magnetic stimulation, for methamphetamine and cocaine use disorders. A CTN study recently demonstrated that a combination of bupropion and extended-release naltrexone successfully reduced methamphetamine use and cravings in adults with methamphetamine use disorder.

Office of Translational Initiatives and Program Innovations
FY 2023 Request: $48.5 million
($8.6 million above the FY 2022 CR Level)

NIDA's Office of Translational Initiatives and Program Innovations (OTIPI) takes research discoveries in prevention, detection, and treatment of SUDs into candidate health applications for commercialization. OTIPI manages NIDA's Small Business Innovation Research/Small Business Technology Transfer Programs to advance health applications. It also uses novel fit-for-purpose funding authorities, such as Prizes and Open Competitions, and establishes teaching programs that equip scientists with the competence to translate advances in addiction research into products. Many of these efforts take the form of innovative new technology applications, from mobile apps that help patients find open beds in addiction treatment facilities or connect to support communities, to more sophisticated medical devices. These tools provide or support psychosocial and medication-based treatment, help individuals sustain their recovery from SUDs, and even facilitate prevention. For example, reSET and reSET-O are mobile applications (apps) that deliver cognitive behavioral therapy to people with non-opioid SUDs (reSET) and OUD (reSET-O), and were the first "digital medicines" to receive FDA approval for the treatment of addiction.[229] With NIDA support, another company developed a hospital bassinet pad that delivers gentle, random vibrations to reduce irritability and improve cardiorespiratory function in newborns born dependent on opioids, which received breakthrough device designation from the FDA. In addition, a cloud-based referral tool called OpenBeds was expanded to facilitate patient referrals to addiction treatment facilities.[230] OTIPI also helps startups develop technology to help people in recovery. For example, Sober Grid is an app that connects patients with others in recovery and with peer coaches to help them remain drug-free.[231] We the Village, Inc. uses telehealth and a social support network to deliver a care model based on community reinforcement and family training.[232] Finally, to prevent diversion of drugs, one company developed systems to monitor controlled substances in hospitals, and another developed a tool to detect and report illicit online sales of controlled substances.[233,234]

Responding to the Opioid Crisis
FY 2023 Request: $405.4 million
($135.1 million above the FY 2022 CR Level)

Through the HEAL Initiative, NIDA continues to expand support for research to combat opioid misuse and addiction and increase the efficiency of translating research into benefits for people. HEAL funds are being used to accelerate the development and availability of novel treatments for OUD and overdose, including developing longer-acting formulations of existing OUD drugs like buprenorphine and methadone, and developing novel immunotherapies including vaccines

[229] https://peartherapeutics.com/products/reset-reset-o/
[230] https://apprisshealth.com/solutions/openbeds/
[231] https://www.sobergrid.com/
[232] https://wethevillage.co/
[233] https://invistics.com/
[234] https://www.s-3.io/

that could block the effect of opioids in the brain to help people with OUD and decrease overdoses.

Opioid misuse often begins during adolescence and young adulthood, so behavioral interventions and treatment options tailored to this population are crucial to maximize positive outcomes. HEAL funds are used to support research to develop and test effective technology-driven, scalable interventions that can prevent opioid misuse and OUD among adolescents and young adults, with a focus on vulnerable populations such as AI/AN and Black communities.

Using HEAL funds, NIDA supports research to develop effective implementation strategies for evidence-based interventions, with a focus on high-risk populations. The Justice Community Opioid Innovation Network (JCOIN) is testing strategies for expanding effective OUD treatment and care for people in justice settings in partnership with local and state justice systems and community-based treatment providers. This research will help improve OUD treatment access for vulnerable individuals during incarceration and after release. The HEALing Communities Study, an unprecedented multisite implementation study being conducted in 67 communities across New York, Massachusetts, Kentucky, and Ohio, aims to reduce opioid-related overdose deaths by deploying evidence-based strategies to prevent and treat opioid misuse and OUD. Researchers work with community members and local coalitions to launch intervention activities and communications campaigns, engage at-risk populations, create data dashboards to help guide community decision-making, and develop community action plans to implement specific evidence-based practices to facilitate sustainable, successful solutions tailored to the needs of the local communities.

The HEALthy Brain and Child Development Study is a trans-NIH effort led by NIDA with support from HEAL and 10 NIH Institutes and Offices to prospectively examine brain and behavioral development in children from birth to 9-10 years of age. This study is establishing a cohort of pregnant women across a variety of regions and demographics in the USA and will follow their children through the first decade of life to determine how environmental factors, including maternal drug exposure and genetics, influence early brain development and behavioral and clinical outcomes, such as mental illnesses and addiction.

Finally, the HEAL Initiative is building the Integrative Management of chronic Pain and OUD for Whole Recovery (IMPOWR) network to develop effective treatment interventions for people who experience both chronic pain and OUD. The IMPOWR network consists of clinical research centers that collaborate to develop effective interventions, best models of care for delivery of services, and sustainable implementation strategies for a variety of patients with co-occurring chronic pain and OUD or opioid misuse, with an emphasis on highly vulnerable groups, such as AI/AN, Black, Hispanic, and rural populations.

Intramural Research Program
FY 2023 Request: $106.8 million
($2.6 million above the FY 2022 CR Level)

NIDA conducts research in high priority areas through its Intramural Research Program (IRP). The IRP portfolio includes research to 1) elucidate the mechanisms underlying the development of SUDs; 2) evaluate potential new therapies for SUDs, including pharmacological and non-

pharmacological interventions; and 3) identify and characterize emerging drugs such as synthetic opioids, stimulants, and cannabinoids.

One example of treatment evaluation at the IRP is a bench-to-bedside project in which IRP investigators are testing a novel compound to treat OUD that activates the same receptors as traditional opioids but has only a subset of their cellular actions. IRP investigators are testing whether the compound reduces self-administration of opioids in animal models and people with OUD, and whether it prevents opioid withdrawal with fewer side effects than medications in current use. If successful, this compound could be a new medication for OUD.

The IRP is also working with the National Center for Advancing Translational Sciences on a dopamine D3 receptor antagonist that could be taken together with opioid pain relievers to reduce the chance of developing OUD. Preliminary animal studies suggest that the compound reduces opioid self-administration and drug-seeking behavior without reducing the pain-relieving effects of opioids. This compound holds promise as an adjunct to opioid treatment for pain and potentially for OUD.

Non-pharmacological addiction treatments are also being developed in NIDA's IRP. The on-site treatment-research clinic includes efforts to develop a smartphone app that uses machine learning to detect or predict stress, craving, and drug use within hours—and a parallel project to develop content that the app could deliver "just in time." Because current apps purporting to serve these functions do not meet scientific standards of evidence, IRP is addressing a major gap in mobile health. Using passive measurement and digital phenotyping techniques, the IRP is also developing interventions and big data methodologies to prevent HIV transmission associated with unprotected sex in the context of substance use.

Research Management and Support
FY 2023 Request: $82.3 million
($1.8 million above the FY 2022 CR Level)

Research Management and Support (RMS) activities provide administrative, budgetary, logistical, and scientific support in the review, award, and monitoring of research grants, training awards, and research and development contracts. Additionally, the functions of RMS encompass strategic planning, coordination, dissemination of latest research findings and funding opportunities, and evaluation of NIDA's programs, regulatory compliance, international coordination, and liaison with other Federal agencies, Congress, and the public. RMS staff at NIDA play leadership roles in helping to coordinate NIDA's involvement in the NIH HEAL℠ Initiative, spearheading NIH's response to the opioid overdose epidemic.

In addition to the infrastructure required to support research and training, NIDA strives to provide evidence-based resources and educational materials about substance use and addiction, including information about timely public health topics such as opioid overdose prevention, marijuana research, use rates and consequences of vaping, synthetic drug trends, and medications for treatment of SUDs, including OUD. To this end, the RMS portfolio incorporates education and outreach activities to inform public health policy and practice with the goal of ensuring that NIDA is the primary trusted source for scientific information on substance use and addiction in

English and Spanish. Staff supported by NIDA's RMS budget coordinate key activities that help to train the next generation of addiction scientists. In addition, NIDA's RMS portfolio includes the NIDAMED initiative, which is aimed at engaging and educating clinicians in training and in practice in the latest science related to substance use and addiction.

NIAAA PROGRAM SUMMARY

MISSION

NIAAA's mission is to generate and disseminate fundamental knowledge about the effects of alcohol on health and well-being, and apply that knowledge to improve diagnosis, prevention, and treatment of alcohol-related problems, including alcohol use disorder, across the lifespan. A major priority within NIAAA's mission is research on the prevention and treatment of underage drinking and its harmful consequences.

Alcohol misuse has profound effects on the health and well-being of individuals, families, and communities, costing the United States an estimated $249 billion per year. NIAAA is committed to reducing the burden of alcohol misuse for individuals at all stages of life and supports a diverse portfolio of research to accomplish this goal. Research areas include biological and behavioral mechanisms underlying alcohol misuse, alcohol use disorder (AUD), and alcohol-related health conditions; epidemiological assessments of patterns and trends in alcohol use; and the development and evaluation of interventions to identify, prevent, and treat alcohol misuse and its consequences, including among youth. NIAAA also supports efforts to translate research findings to improve prevention and treatment of alcohol-related problems and co-occurring conditions and to disseminate evidence-based information to health care providers, researchers, policy makers, and the public. These ongoing efforts have significantly broadened our understanding of alcohol misuse and AUD and have provided support for the integration of alcohol prevention and treatment services into mainstream health care.

METHODOLOGY

The prevention and treatment components of NIAAA's underage drinking research program are classified as a part of the National Drug Control Budget. Underage drinking research is defined as research that focuses on alcohol use by youth (individuals under the legal drinking age of 21), as well as the negative consequences of underage alcohol use (e.g., alcohol-related injuries, impact on adolescent development including on the developing brain, and risk for AUD). It includes basic biological and behavioral research, epidemiological research, screening studies, the development and testing of preventive and treatment interventions, and efforts to disseminate evidence-based information. NIAAA's methodology for developing budget estimates for the Budget and Performance Summary is a two-step process. First, NIAAA identifies its underage drinking projects using NIH's automated, electronic text mining system for research, condition, and disease categorization. Once these projects are verified as underage drinking projects, NIAAA conducts a manual review of the project listing and codes each verified project as relevant to prevention or treatment.

NIAAA BUDGET SUMMARY

National Institute on Alcohol Effects and Alcohol-Associated Disorders
FY 2023 Request: $66.7 million
($1.4 million above the FY 2022 CR Level)

Although the prevalence of alcohol consumption among 8th, 10th, and 12th graders has declined by one-third over the past decade, alcohol remains the most widely used substance among U.S. youth. Binge drinking[235] and high intensity drinking (i.e., two or more times the gender-specific binge drinking thresholds) among young people remain significant concerns. These drinking patterns are particularly troubling as they increase risks for poor academic performance, alcohol-related blackouts, injuries, overdoses, sexual assault, unsafe sexual behavior, AUD, and other detrimental consequences. NIAAA supports a broad range of basic, translational, and clinical research to improve our understanding of the impact of alcohol exposure on adolescent health and to improve interventions for alcohol-related problems among youth in community and healthcare settings. NIAAA also disseminates information about evidence-based interventions through the development of resources for the public.

Basic research is key to informing the development of innovative prevention and treatment strategies for underage drinking. Within its portfolio on adolescent brain research, NIAAA supports two key initiatives: 1) the Neurobiology of Adolescent Drinking in Adulthood (NADIA) consortium to examine, using animal models, the mechanisms by which adolescent drinking leads to changes in brain structure and function that persist into adulthood; and 2) the National Consortium on Alcohol and Neurodevelopment in Adolescence (NCANDA), a longitudinal study of approximately 800 youth ages 12-21 to identify brain characteristics that may predict alcohol misuse or occur as a consequence of adolescent alcohol exposure. NCANDA laid the methodological foundation for NIH's Adolescent Brain Cognitive Development (ABCD) study, the largest longitudinal study of brain development and child health in the United States.

Prevention of underage drinking has long been one of NIAAA's top priorities. NIAAA's portfolio in this area includes studies to develop, evaluate, and implement evidence-based prevention programs for youth. These programs include individual-, family-, school-, community-, and environmental-level interventions for underage individuals at large, as well as those tailored for underserved populations and specific settings, including the college setting. NIAAA provides the College Alcohol Intervention Matrix (CollegeAIM), an online resource that rates over 60 evidence-based alcohol interventions in terms of effectiveness, cost, and other factors, allowing school officials to select among the many potential interventions to address harmful and underage student drinking. NIAAA also supports research to address alcohol misuse in young adults who are not enrolled in college.

[235] NIAAA defines binge drinking as a pattern of drinking that increases an individual's blood alcohol concentration to 0.08 percent or higher. This typically occurs after 4 drinks for women and 5 drinks for men – in about 2 hours. Research suggests that fewer drinks in the same timeframe result in the same blood alcohol concentration in youth.

Increasing implementation of alcohol screening and brief intervention in primary care and developing evidence-based behavioral therapies to reduce underage drinking is another priority area for NIAAA. For example, NIAAA developed the Alcohol Screening and Brief Intervention for Youth: A Practitioner's Guide to assist pediatric and adolescent health practitioners in identifying patients at risk for underage drinking and associated problems. This screening resource has been validated among youth in pediatric emergency room settings, in school settings, in primary care settings (including among racially and ethnically diverse youth), and among youth with chronic health conditions.

EQUITY

Equity is a vital consideration in NIDA and NIAAA efforts to support the objectives of the National Drug Control Strategy. Both NIDA and NIAAA support the NIH UNITE initiative that was established to identify and address structural racism within the NIH-supported and greater scientific community. Both Institutes are also part of NIH's broader efforts to advance health equity research by improving minority health, reducing health disparities, and removing barriers to advancing health disparities research as well as the agency's efforts to expand, sustain, and promote scientific workforce diversity.

The COVID-19 pandemic highlighted racial health disparities that are particularly stark in the field of addiction, where punitive approaches to drug use have disproportionately affected Black individuals and other communities of color.[236] Moreover, the fastest increases in opioid overdose deaths are among Black Americans,[237,238] and children of minority groups are more likely to have lost a parent to COVID-19 than white children.[239]

To address these disparities, in July 2020 NIDA established its Racial Equity Initiative to eliminate racism in NIDA's workplace, scientific workforce, and research portfolio. NIDA is tracking its minority health and health disparities portfolios to identify gaps and create targeted funding opportunities to which $100 million will be dedicated over 10 years. NIDA is funding research on the impact of racism on drug use outcomes, ameliorating disparities in SUD care, and implementing culturally-tailored interventions. In addition, researchers are developing solutions to address digital inequalities in communities heavily impacted by drug addiction. NIDA is also increasing its support for highly meritorious projects carried out by scientists from underrepresented minority groups.

NIAAA supports a range of efforts aimed at reducing health disparities and promoting health equity. One area of interest is the social determinants of health that influence the initiation of underage alcohol use. Current studies are exploring factors that drive alcohol misuse—including sleep quality, adverse childhood experiences, and family or peer stress—among minority adolescent populations. Understanding the social and environmental factors that influence

[236] www.tandfonline.com/doi/pdf/10.1080/07418825.2012.761721?needAccess=true
[237] ajph.aphapublications.org/doi/10.2105/AJPH.2021.306431
[238] pubmed.ncbi.nlm.nih.gov/33211981/
[239] https://pubmed.ncbi.nlm.nih.gov/34620728/

alcohol misuse can inform targeted prevention approaches. NIAAA also supports development of culturally-adapted interventions to reduce underage drinking.