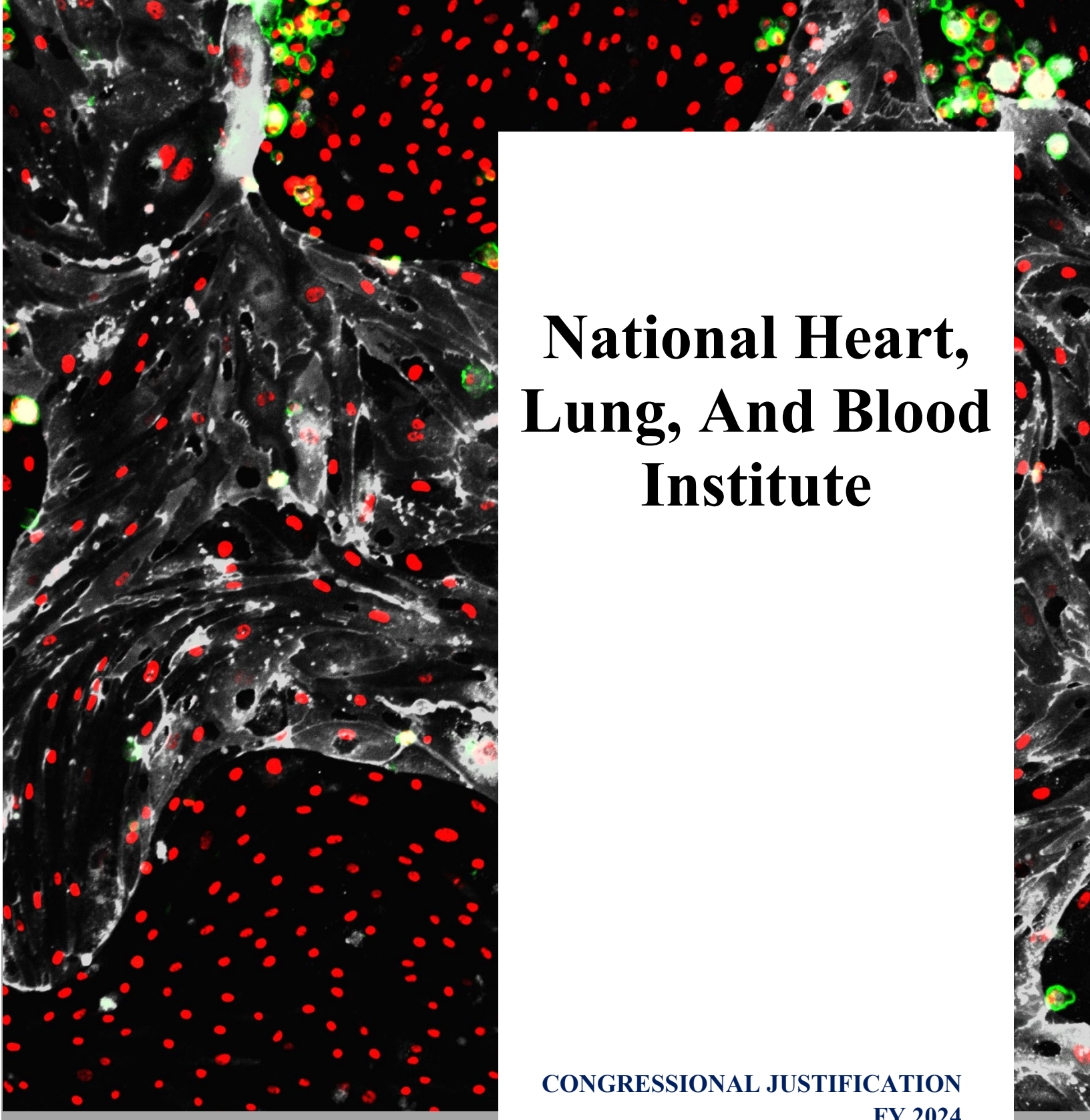

National Heart, Lung, And Blood Institute

CONGRESSIONAL JUSTIFICATION
FY 2024

Department of Health and Human Services
National Institutes of Health

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DEPARTMENT OF HEALTH AND HUMAN SERVICES

NATIONAL INSTITUTES OF HEALTH

National Heart, Lung, and Blood Institute (NHLBI)

FY 2024 Budget Table of Contents

General Notes

1. FY 2023 Enacted levels cited in this document include the effects of the FY 2023 HIV/AIDS transfer, as shown in the Amounts Available for Obligation table.
2. Detail in this document may not sum to the subtotals and totals due to rounding.

Cover page: Under specific laboratory culture conditions, adult mouse cells begin exhibiting characteristics of haematopoietic stem cells, as demonstrated by the appearance of CD45 (shown in green)—a protein known to be present in haematopoietic stem cells; nuclei are shown in red. *Source: NHLBI*

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Director's Overview

The National Heart, Lung, and Blood Institute (NHLBI) supports research to prevent and treat heart, lung, blood, and sleep disorders. NHLBI's portfolio includes basic science, epidemiological (population) studies, clinical trials, implementation science, health education and dissemination efforts, and initiatives in emergent fields such as artificial intelligence/machine learning, precision medicine, data science, and new and curative therapies for common and rare diseases and conditions. The Institute's research programs have helped improve longevity and quality of life for people in the United States and around the world. NHLBI is also focused on reaching communities disproportionately burdened by diseases of the heart, lung, and blood, as well as sleep disorders. Despite research advances, these disorders continue to be among the leading causes of death and disability in the United States.[1] In FY 2024, NHLBI will continue to support a robust spectrum of basic and applied research that aims to yield effective approaches for the prevention and early diagnosis, and treatment of diseases and disorders within our research portfolio, including the largest contributors to death and suffering in America.

Capitalizing on Community-Engaged Research to Advance Public Health
In the wake of the coronavirus disease 2019 (COVID-19) pandemic, the scientific community has learned a great deal about how to approach critical public health issues that impact vulnerable communities and populations. Clinical research is now acknowledging the need to address a complex network of influences on health and disease. Many of the diseases in NHLBI's portfolio have an inequitable effect upon people of color, people living in rural communities, and other underserved and vulnerable populations, and the road to discovery depends upon the trusting participation of these communities in the research enterprise.

In July 2020, NHLBI, along with the National Institute on Minority Health and Health Disparities (NIMHD), launched the National Institutes of Health (NIH) **Community Engagement Alliance (CEAL) Against COVID-19 Disparities**.[2] CEAL is an empowering driver of research using strategies that address the obstacles limiting participation in, and benefits from, biomedical research. The initiative brings together diverse teams that include researchers and trusted community partners including community-based organizations, minority professional societies, faith-based organizations, and others in communities affected by COVID-19. CEAL has since evolved into a robust, comprehensive research platform that can be used by other researchers to address misinformation, foster trust in science and research, and ensure inclusive participation in NIH research.

NHLBI is now leveraging the CEAL community engagement platform for other initiatives, including the **NHLBI Maternal Morbidity and Mortality Community Implementation**

[1] nhlbi.nih.gov/heart-lung-blood-sleep-data
[2] covid19community.nih.gov/

Program, the **NIH Implementing a Maternal health and PRegnancy Outcomes Vision for Everyone (IMPROVE) Initiative,** and the **NIH Climate Change and Health Initiative**. [3,4,5] The World Health Organization describes **climate change** as the biggest threat to human health and well-being moving into the future. Both short- and long-term effects will lead to increases in the incidence and worsening of chronic diseases within NHLBI's portfolio, including cardiovascular disease, respiratory conditions, and sleep disorders. Social determinants of health play a significant role in the effect of climate change, as low-income communities and communities of color will be disproportionately affected. NHLBI understands the important role it has to play in this massive challenge, and recognizes the value of leveraging community-engaged research platforms that evolved during the pandemic for other public issues. For this reason, NHLBI has provided significant funding to **NIH's Alliance for Community Engagement-Climate and Health (ACE-CH) initiative**. The Institute will also leverage CEAL as a research platform to strengthen community-based interventions. These interventions can raise awareness about climate stressors on health, and working to understand and build resilience in communities at highest risk.

Supporting Diversity, Equity, Inclusion, and Access Across the Research Enterprise
Studies show that teams that embrace diversity at every level of the research endeavor produce more, and more significant, scientific breakthroughs.[6] NHLBI believes that diversity isn't limited to researchers; it includes everyone who participates at every level of the research enterprise. Inclusive collaboration and co-creation posits members of communities and affected populations as partners from the formulation of the research questions, through the planning, design, and implementation of research protocols, and to the interpretation and dissemination of findings.

Results from several NHLBI community-embedded initiatives launched in 2020 in response to the COVID-19 pandemic have illuminated the importance of implementation science strategies to improve community health and increase resilience in populations most vulnerable to the unequal burdens of diseases. This fundamentally changes the meaning of a multidisciplinary research team; it now includes not only a diversity of scientific expertise and skills, but, equally as important, the viewpoints and inputs of people in and across diverse communities, whose differing life experiences add crucial insights into how to tackle complex health conditions.

For example, since its inception in 2021, the **NIH Researching COVID to Enhance Recovery (**RECOVER) initiative has depended upon the input and support of those most affected by Long COVID: the people living with the condition. The initiative has evolved a robust patient and community engagement approach unprecedented for NIH. Grounded in evidence-based approaches to patient engagement, RECOVER puts patients and community representatives from all walks of life at the core of its governance structure and across the research enterprise. This large-scale, diverse representation ensures that the voices of those disproportionately affected by COVID-19 meaningfully contribute their viewpoints to the research endeavor.

[3] maternalhealthcip.org/
[4] grants.nih.gov/grants/guide/notice-files/NOT-OD-20-104.html
[5] nhlbi.nih.gov/sites/default/files/media/docs/ACE_CH_ROA_6_08_2022_FINAL.pdf
[6] https://academic.oup.com/jid/article/220/Supplement_2/S33/5552350

NHLBI continues to further its commitment to increasing diversity in the research workforce. The **Mentored Career Development Award to Promote Faculty Diversity in Biomedical Research** provides funding for mentoring opportunities to highly trained investigators from groups underrepresented in research areas of interest to NHLBI.[7] Additionally, **Programs to Increase Diversity among Individuals Engaged in Health-Related Research (PRIDE)** offers hands-on, mentored research lab experiences, small project awards for pilot research, and grant writing courses for junior faculty and transitioning post-doctoral candidates from diverse backgrounds.[8] NHLBI is committed to sustaining a pipeline for biomedical research professionals. As these programs make critical strides in recruiting and nurturing the next generation of scientists from backgrounds historically underrepresented in biomedical research, NHLBI is also garnering additional pathways toward scientific careers as the community-engaged research initiatives harness the excitement of younger scientific minds in a quest to tackle health disparities.

Fostering Key Partnerships and Leveraging Platforms to Address Complex Diseases
The future of biomedical research is collaborative and dependent upon multidisciplinary teams with the expertise to answer complex questions about common and rare diseases. For example, more than 6.2 million adults in the United States have heart failure. Roughly half of them have **heart failure with preserved ejection fraction (HFpEF).** In HFpEF, the heart muscle contracts normally, but the walls of the heart's chambers (ventricles) are thicker and stiffer than usual and can't relax enough between heart beats to adequately fill with blood. Death rates are higher for this type of heart failure because of the reduction in the amount of blood available to pump through the body. Years of NHLBI research has confirmed that HFpEF is the result of the interplay of impairments in cardiac, pulmonary, renal, musculoskeletal, and vascular function. This makes HFpEF a complicated disease to address.

Given its complex nature, HFpEF required a strategic, multidisciplinary approach to accelerate the development of treatments. In 2020, NHLBI launched **HeartShare**, an initiative that set up clinical centers across the country to collect a wide range of clinical, laboratory, and imaging data from people with and without HFpEF.[9,10] It has established collaborative networks of researchers and given them a collection and analysis hub that provides access to advanced data science tools and strategies that will help identify biological targets that could be used to develop therapeutic drugs or other interventions.

Building on this collaborative research platform, in September 2022, NHLBI and the Foundation for the National Institutes of Health (FNIH) tapped into the **Accelerating Medicines Partnership® (AMP®)**. AMP is a public-private partnership between NIH, the U.S. Food and Drug Administration (FDA), and biopharmaceutical and life science companies that integrates their distinct resources and expertise about drug discovery and development into established NHLBI programs and initiatives. This new program, known as AMP Heart Failure, is forming working groups to systematically analyze data from HeartShare, Trans-Omics for Precision

[7] grants.nih.gov/grants/guide/rfa-files/RFA-HL-22-010.html
[8] nhlbi.nih.gov/grants-and-training/training-and-career-development/diversity/pride
[9] grants.nih.gov/grants/guide/rfa-files/rfa-hl-21-015.html
[10] grants.nih.gov/grants/guide/rfa-files/RFA-HL-21-016.html

Medicine (TOPMed), and other NHLBI resources to turn discovery of novel therapeutic targets into safe and effective treatments.

Developing Targeted Preventions and Cures

While heart health is important at every stage of life, it is especially crucial immediately before, during, and after pregnancy. Recent research shows that approximately half of all American women have at least one risk factor for heart disease (such as high blood pressure, diabetes, or overweight/obesity) before pregnancy. Members of certain racial and ethnic groups have disproportionately high rates of these risk factors. NHLBI's **Chronic Hypertension and Pregnancy (CHAP)** trial seeks to prevent adverse pregnancy and fetal growth outcomes due to mild chronic hypertension by focusing on interventions to safely control the condition during pregnancy. Recent results from this study have shown that treatment for mild chronic hypertension leads to better pregnancy outcomes and has no negative effect on fetal growth, a concern that had previously constrained interventions.[11] This discovery has been so significant that it led to immediate changes in the American College of Obstetricians and Gynecologists' clinical practice guidelines for treatment of mild chronic hypertension during pregnancy.[12]

NHLBI has always supported research to improve the lives of people with **sickle cell disease (SCD)**, an inherited blood disorder that often leads to chronic pain, organ failure, and premature death. SCD affects 100,000 people in the United States and millions worldwide, with most cases in people of African descent (including African Americans). Scientific progress to date situates the research enterprise in a position to support the development of genetic-based curative strategies through interactions with scientific and patient communities. The **NHLBI Cure Sickle Cell Initiative** focuses on curative gene therapies while further examining SCD in a comprehensive manner by considering the total effect on a patient in areas such as mental health and the cost of living with the disease. As part of the Initiative, NHLBI is conducting clinical trials for potential curative therapies. NHLBI researchers are now using the **ReFRAME Drug Repurposing Library,** which looks at already FDA-approved drugs with the potential to treat SCD pain, to find more cost-effective options for relief.[13]

Additionally, researchers are using cutting-edge technology to create molecular and cellular maps of the human body. This year, the NHLBI-funded **LungMAP Consortium**, a group of researchers and experts in the pulmonary biology community, synthesized current data into a comprehensive and practical cellular census of the lung.[14] This flagship program will lead to novel therapeutic targets for lung diseases.

These scientific approaches leverage the latest technologies to redefine biomedical research for the 21st century. By actively engaging communities, supporting diversity at all levels of the research enterprise, and fostering new and diverse types of partnerships—all while continuing to invest in critical research—the Institute is leaning in to wield scientific findings to accelerate discoveries for the enhancement of public health.

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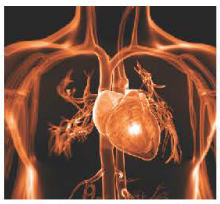
[11] .nejm.org/doi/full/10.1056/NEJMoa2201295

[12] acog.org/clinical/clinical-guidance/practice-advisory/articles/2022/04/clinical-guidance-for-the-integration-of-the-findings-of-the-chronic-hypertension-and-pregnancy-chap-study

[13] pnas.org/doi/10.1073/pnas.2210779119?cookieSet=1#core-collateral-metrics

[14] sciencedirect.com/science/article/pii/S1534580721008923?via%3Dihub

NIH National Heart, Lung, and Blood Institute

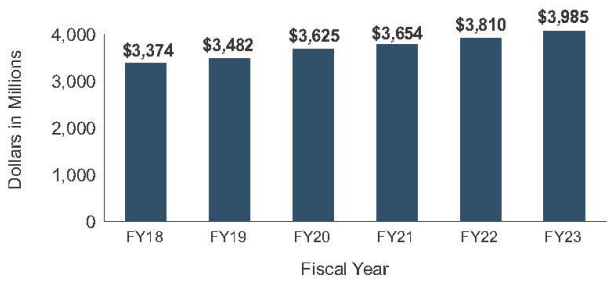


February 2023

ABOUT NHLBI

- NHLBI is the nation's leader in supporting research on the prevention and treatment of heart, lung, blood, and sleep disorders.
- We were established in 1948 to address rising rates of cardiovascular disease, the nation's leading cause of death.
- Our mission has expanded to lead NIH research efforts in lung diseases, including asthma and chronic obstructive pulmonary disease (COPD).
- We lead research on blood transfusion and blood diseases, such as sickle cell disease.
- In 1993, we became the home for the National Center on Sleep Disorders Research (NCSDR), which coordinates NIH programs related to sleep biology.
- NHLBI's research advances scientific knowledge, improves public health, and saves lives.

FUNDING HISTORY



In FY20, NHLBI received $103 million in supplemental appropriations through the CARES Act (not shown). The FY24 President's budget request is $3,985 million.

Director Profile: Gary H. Gibbons, M.D., is Director of the National Heart, Lung, and Blood Institute (NHLBI). He received his M.D. from Harvard Medical School and has served on the faculty at Harvard, Stanford University, and Morehouse School of Medicine in Atlanta.

Facts and Figures

Full-Time Staff**	899
Awards	1,118
Principal Investigators	1,247
ESI Success Rates***	39.4%
K Award Success Rates***	41.3%

Current Major Initiatives

- NHLBI and the Foundation for the National Institutes of Health launched the **Accelerating Medicines Partnership® Heart Failure Program**, a public–private partnership between NIH, the U.S. Food and Drug Administration, and biopharmaceutical and life science companies. The program will integrate their distinct resources and expertise about drug discovery and development into established NHLBI programs and initiatives to turn discovery of novel therapeutic targets into safe and effective treatments.
- NHLBI is leveraging its community-engaged research model and funding NIH's **Alliance for Community Engagement-Climate and Health (ACE-CH)** initiative to strengthen community-level engagement with underserved populations. This will provide a firm foundation for raising awareness about climate stressors on health, reducing health threats from climate change across the lifespan, and building resilience in high-risk communities.
- The 2021 **NIH Sleep Research Plan** incorporates cross-cutting NIH priorities that address topics such as minority health and health disparities, sex/gender, sleep across the lifespan, the impact of opioid addiction, and how poor sleep may exacerbate the risk and outcome of infectious diseases. Additionally, NHLBI will investigate how climate change affects sleep. The plan is based on a set of research needs and opportunities identified with input from researchers, public representatives, NIH workshop participants, and NHLBI programmatic staff.

*** Full-time staff, awards, and extramural principal investigators are FY22 data.*
**** These success rates were averaged over 3 years (FY20, 21, and 22) and calculated as (# awards/# of percentiled applications x 100).*
For more about percentiles, see **https://grants.nih.gov/grants/peer-review.htm#Summary**.

National Heart, Lung, and Blood Institute



Accomplishments in…

Heart Health

- NHLBI is examining causes of hypertension, including the gut–brain axis. New research demonstrated a link between the gut microbiome and blood pressure.
- Researchers defined the entire network of protein interactions between two factors critical for normal heart development, identifying genes that interact within this array of proteins.
- Embryonic stem (ES) cells can initially become any type of cell in the body. Researchers found that mouse ES cells coaxed to become heart cells could completely transform into brain cells. This finding could have important implications for heart disease pathology.

Lung Health

- Researchers used data from **Trans-Omics for Precision Medicine (TOPMed)** to determine that a novel framework called a "polygenic transcriptome risk score" improved the accuracy of predictions regarding risk of COPD.
- Researchers discovered that a drug initially developed to treat cancer shows promise as a therapeutic for idiopathic pulmonary fibrosis.
- The **Molecular Atlas of Lung Development Program (LungMAP)** Consortium synthesized current data into a comprehensive and practical cellular census of the lung.

Sleep Health

- A study showed that time spent awake while in bed and wakefulness after sleep onset were associated with poorer cognitive function.
- Exposure to even a small amount of light while sleeping was linked with obesity, diabetes, and high blood pressure in older adults.

Blood Health

- The **Cure Sickle Cell Initiative** is funding two clinical trials in conjunction with the California Institute for Regenerative Medicine.
- Researchers found that adult blood cells originate from two sources, not one as previously believed. These findings could spark new strategies for developing treatments for blood disorders and cancers, as well as improve outcomes of bone marrow transplants.

NHLBI'S COVID-19 Response

- The **NIH Community Engagement Alliance (CEAL) Against COVID-19 Disparities** is an NIH-wide initiative, led by NHLBI, that leverages existing community-engaged research capacities to address misinformation, foster trust in science, and ensure inclusive participation of ethnic and racial minority communities disproportionately affected by the COVID-19 pandemic.
- NHLBI is addressing post-acute sequelae of COVID-19 (PASC), also known as long COVID, by recruiting participants into the **NIH Researching COVID to Enhance Recovery (RECOVER) Initiative**'s clinical trials to develop successful therapeutics for lingering symptoms.
- One research group discovered that certain antibodies found in some COVID-19 patients cause a condition that may lead to blood clots. The authors suggest that patients with severe COVID-19 be screened to evaluate their risk for the condition. Patients at high risk may benefit from treatments used in traditional cases of severe antiphospholipid syndrome, a disorder of the immune system that causes an increased risk of blood clots.

Major Changes in the Budget Request

Major changes by budget mechanism and/or budget activity detail are briefly described below. Note that there may be overlap between budget mechanisms and activity detail; and these highlights may not sum to the total change for the FY 2024 budget request for the NHLBI, which is $3,985.2 million, which is the same as the FY 2023 Enacted level. NHLBI is committed to the continuous support for key strategic priorities along with other scientific areas of the Institute's research portfolio. Within the framework of the Administration's fiscal policy goals for the Federal Government, NHLBI will pursue its highest research priorities through strategic investments and careful stewardship of the appropriated funds.

Research Project Grants (RPGs) (-$6.0 million; total $2,750.8 million):
NHLBI will slightly decrease funding for RPGs in FY 2024, supporting 1,059 competing RPGs and 2,880 noncompeting RPG awards, and 199 awards to small businesses to stimulate research technology in key strategic areas.

Research Centers (-$6.9 million; total $9.6 million):
NHLBI will decrease funding for Centers by 42.0 percent, which is a $6.9 million decrease compared to the FY 2023 Enacted level. The total funding will support the continuation of major initiatives for all programmatic areas and basic, translational and clinical research.

Research Training ($1.2 million; total $123.0 million):
NHLBI will increase funding for Research Training by 1.0 percent, a $1.2 million increase compared to the FY 2023 Enacted Level of $121.8 million. These increases are to support general annual adjustments for trainees, and to continue stimulating research training focused on strategic priorities and programmatic goals.

Intramural Research (IR) ($5.7 million; total $258.8 million):
NHLBI will increase funding for Intramural Research by 2.2 percent, which is a $5.7 million increase compared to the FY 2023 Enacted Level of $253.2 million. These increases accommodate proposed pay increases for IR staff, changes in NIH-wide assessments on the IR program, and other inflationary costs.

Research Management and Support (RMS) ($4.9 million; total $161.5 million):
NHLBI will increase funding for Research Management Support by 3.1 percent, which is a $4.9 million increase compared to the FY 2023 Enacted level of $156.6 million. These increases accommodate proposed pay increases for RMS staff, changes in NIH-wide assessments on the RMS program, and other inflationary costs.

NATIONAL INSTITUTES OF HEALTH
National Heart, Lungs, and Blood Institute

Budget Mechanism*
(Dollars in Thousands)

Mechanism	FY 2022 Final		FY 2023 Enacted		FY 2024 President's Budget		FY 2024 +/- FY 2023	
	Number	Amount	Number	Amount	Number	Amount	Number	Amount
Research Projects:	-	-	-	-	-	-	-	-
Noncompeting	2,853	$1,876,959	2,894	$1,936,585	2,880	$1,935,713	-14	-$872
Administrative Supplements	*(191)*	$16,018	*(175)*	$14,663	*(90)*	$7,500	*-(85)*	-$7,163
Competing:	-	-	-	-	-	-	-	-
Renewal	140	$96,724	145	$101,173	143	$101,679	-2	$506
New	844	$520,508	927	$577,595	916	$578,483	-11	$888
Supplements	0	$0	0	$0	0	$0	0	$0
Subtotal, Competing	**984**	**$617,233**	**1,072**	**$678,768**	**1,059**	**$680,162**	**-13**	**$1,394**
Subtotal, RPGs	3,837	$2,510,210	3,966	$2,630,017	3,939	$2,623,376	-27	-$6,641
SBIR/STTR	192	$121,936	199	$126,813	199	$127,447	0	$634
Research Project Grants	4,029	$2,632,146	4,165	$2,756,830	4,138	$2,750,823	-27	-$6,007
Research Centers	-	-	-	-	-	-	-	-
Specialized/Comprehensive	6	$15,761	6	$16,486	3	$9,564	-3	-$6,922
Clinical Research	0	$0	0	$0	0	$0	0	$0
Biotechnology	0	$0	0	$0	0	$0	0	$0
Comparative Medicine	0	$455	0	$0	0	$0	0	$0
Research Centers in Minority Institutions	0	$0	0	$0	0	$0	0	$0
Research Centers	**6**	**$16,216**	**6**	**$16,486**	**3**	**$9,564**	**-3**	**-$6,922**
Other Research:	-	-	-	-	-	-	-	-
Research Careers	804	$133,827	816	$135,983	816	$136,662	0	$680
Cancer Education	0	$0	0	$0	0	$0	0	$0
Cooperative Clinical Research	39	$10,268	42	$11,389	42	$11,446	0	$57
Biomedical Research Support	0	$0	0	$0	0	$0	0	$0
Minority Biomedical Research Support	0	$1,484	0	$1,484	0	$1,484	0	$0
Other	155	$153,040	160	$158,755	158	$158,549	-2	-$206
Other Research	**998**	**$298,618**	**1,018**	**$307,611**	**1,016**	**$308,141**	**-2**	**$531**
Total Research Grants	5,033	$2,946,980	5,189	$3,080,927	5,157	$3,068,528	-32	-$12,398
Ruth L Kirschstein Training Awards:	FTTPs	-	FTTPs	-	FTTPs	-	FTTPs	-
Individual Awards	511	$24,693	531	$26,194	526	$26,456	-5	$262
Institutional Awards	1,370	$91,063	1,410	$95,612	1,396	$96,569	-14	$956
Total Research Training	**1,881**	**$115,756**	**1,941**	**$121,807**	**1,922**	**$123,025**	**-19**	**$1,218**
Research & Develop. Contracts	898	$356,216	912	$372,660	891	$373,312	-21	$652
SBIR/STTR (non-add)	*(3)*	*($2,663)*	*(3)*	*($2,786)*	*(3)*	*($2,800)*	*(0)*	*($14)*
Intramural Research	500	$241,213	502	$253,168	502	$258,826	0	$5,658
Res. Management & Support	399	$150,206	464	$156,596	464	$161,467	0	$4,871
SBIR Admin. (non-add)	-	*($261)*	-	*($375)*	-	*($383)*	-	*($8)*
Construction	-	$0	-	$0	-	$0	-	$0
Buildings and Facilities	-	$0	-	$0	-	$0	-	$0
Total, NHLBI	**899**	**$3,810,371**	**966**	**$3,985,158**	**966**	**$3,985,158**	**0**	**$0**

*All items in italics and brackets are non-add entries

NATIONAL INSTITUTES OF HEALTH

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, [$3,982,345,000]*$3,985,158,000*.

NATIONAL INSTITUTES OF HEALTH
National Heart, Lungs, and Blood Institute

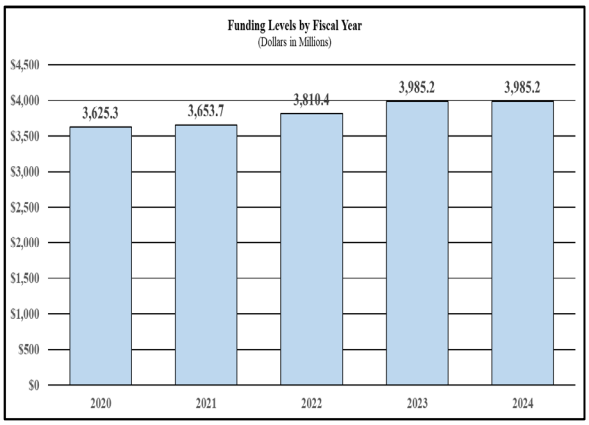
Summary of Changes
(Dollars in Thousands)

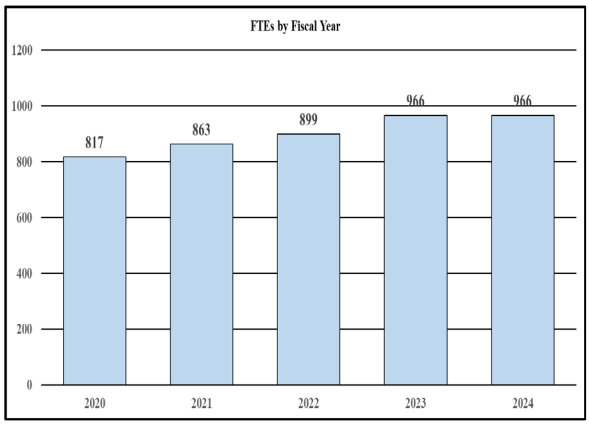
FY 2023 Enacted $3,985,158
FY 2024 President's Budget $3,985,158
Net change $0

CHANGES	FY 2023 Enacted		FY 2024 President's Budget		Built-In Change from FY 2023 Enacted	
	FTEs	Budget Authority	FTEs	Budget Authority	FTEs	Budget Authority
A. Built-in:	-	-	-	-	-	-
1. Intramural Research:	-	-	-	-	-	-
. Annualization of FY 2023 pay and benefits increase	-	$104,882	-	$110,068	-	$1,165
. FY 2024 pay and benefits increase	-	$104,882	-	$110,068	-	$4,022
. Paid days adjustment	-	$104,882	-	$110,068	-	$404
. Differences attributable to change in FTE	-	$104,882	-	$110,068	-	$0
. Payment for centrally furnished services	-	$39,238	-	$39,238	-	$0
. Cost of laboratory supplies, materials, other expenses, and non-recurring costs	-	$109,048	-	$109,519	-	$2,650
Subtotal	-	-	-	-	-	$8,240
2. Research Management and Support:	-	-	-	-	-	-
a. Annualization of FY 2023 pay and benefits increase	-	$79,859	-	$84,122	-	$883
b. FY 2024 pay and benefits increase	-	$79,859	-	$84,122	-	$3,057
c. Paid days adjustment	-	$79,859	-	$84,122	-	$307
d. Differences attributable to change in FTE	-	$79,859	-	$84,122	-	$0
e. Payment for centrally furnished services	-	$2,083	-	$2,116	-	$33
. Cost of laboratory supplies, materials, other expenses, and non-recurring costs	-	$74,655	-	$75,229	-	$1,791
Subtotal	-	-	-	-	-	$6,072
Subtotal, Built-in	-	-	-	-	-	$14,312
CHANGES	**No.**	**Amount**	**No.**	**Amount**	**No.**	**Amount**
B. Program:	-	-	-	-	-	-
1. Research Project Grants:	-	-	-	-	-	-
a. Noncompeting	2,894	$1,951,248	2,880	$1,943,213	-14	-$8,035
b. Competing	1,072	$678,768	1,059	$680,162	-13	$1,394
c. SBIR/STTR	199	$126,813	199	$127,447	0	$634
Subtotal, RPGs	4,165	$2,756,830	4,138	$2,750,823	-27	-$6,007
2. Research Centers	6	$16,486	3	$9,564	-3	-$6,922
3. Other Research	1,018	$307,611	1,016	$308,141	-2	$531
4. Research Training	1,941	$121,807	1,922	$123,025	-19	$1,218
5. Research and development contracts	912	$372,660	891	$373,312	-21	$652
Subtotal, Extramural	-	$3,575,394	-	$3,564,865	-	-$10,529
6. Intramural Research	502	$253,168	502	$258,826	0	-$2,582
7. Research Management and Support	464	$156,596	464	$161,467	0	-$1,202
8. Construction	-	$0	-	$0	-	$0
9. Buildings and Facilities	-	$0	-	$0	-	$0
Subtotal, Program	966	$3,985,158	966	$3,985,158	0	-$14,312
Total built-in and program changes	-	-	-	-	-	$0

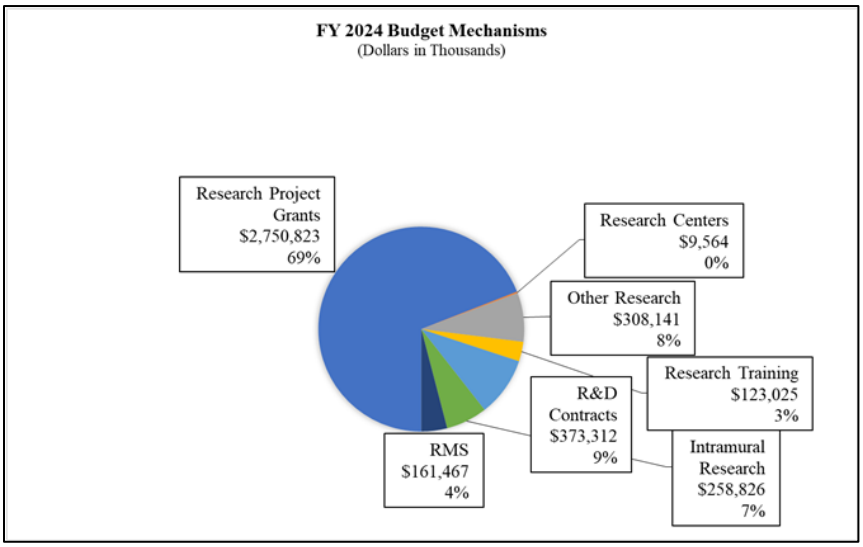
Fiscal Year 2024 Budget Graphs

History of Budget Authority and FTEs:

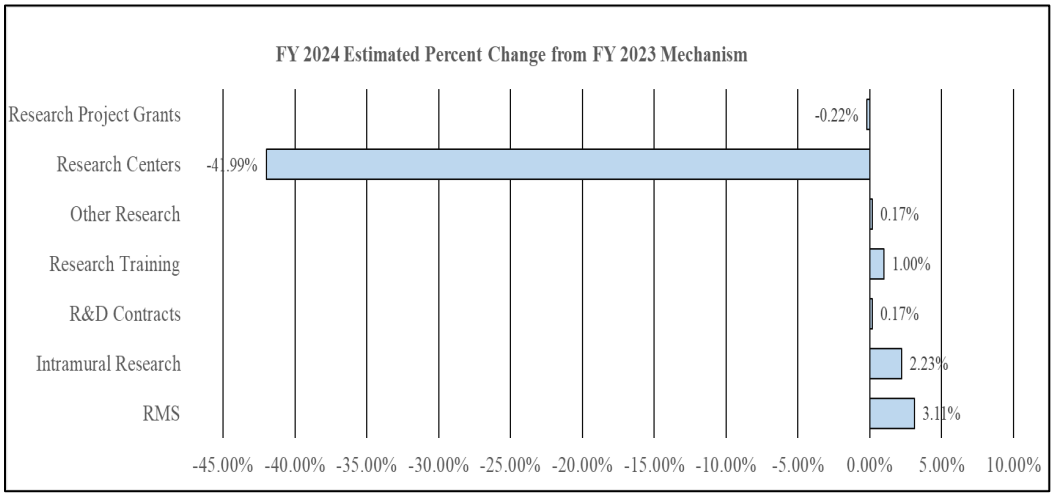




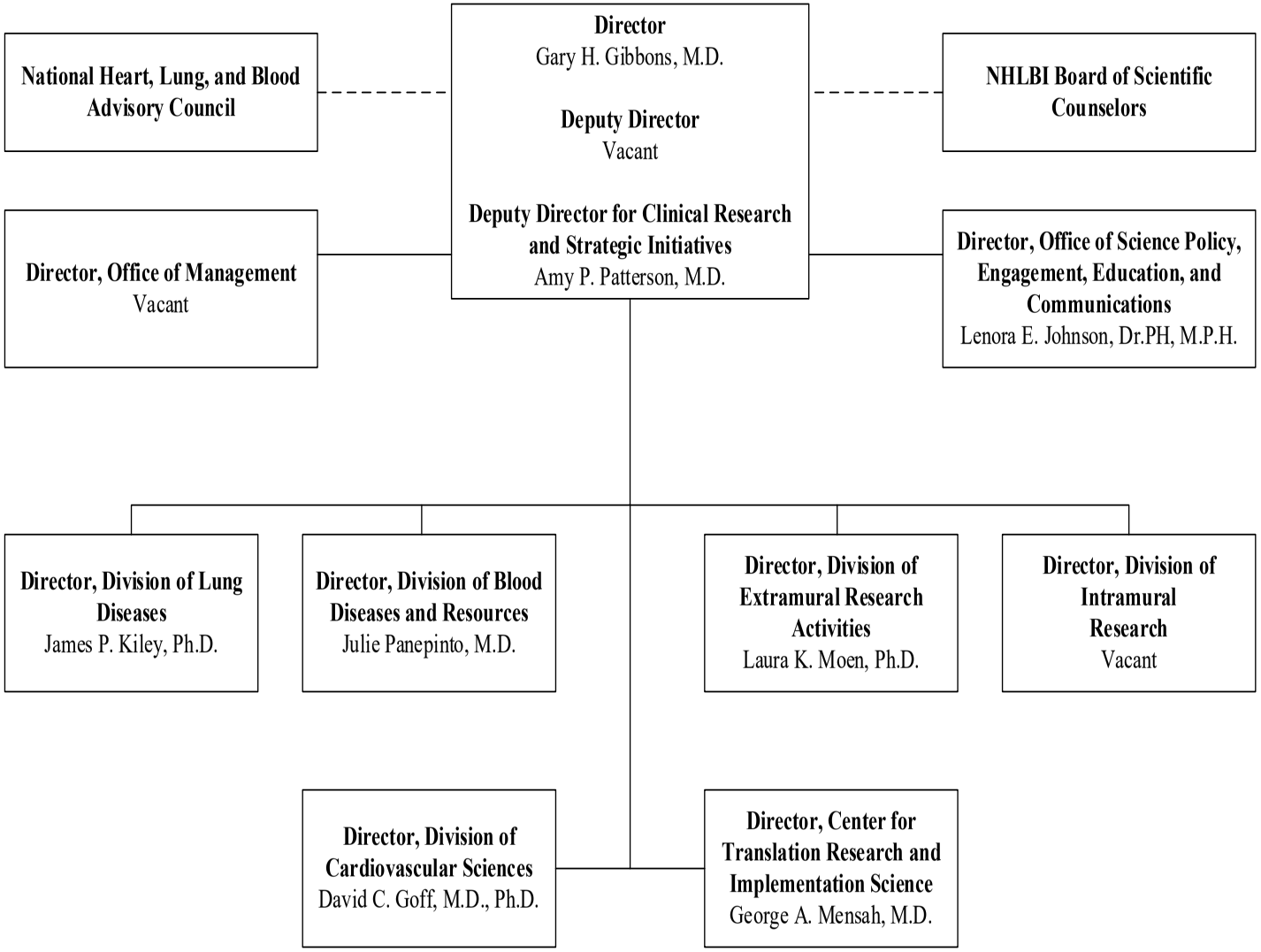
Distribution by Mechanism:



Change by Selected Mechanisms:



NATIONAL INSTITUTES OF HEALTH
NATIONAL HEART, LUNG, AND BLOOD INSTITUTE



NATIONAL INSTITUTES OF HEALTH
National Heart, Lungs, and Blood Institute

Budget Authority by Activity*
(Dollars in Thousands)

Activity	FY 2022 Final		FY 2023 Enacted		FY 2024 President's Budget		FY 2024 +/- FY 2023 Enacted	
Extramural Research	**FTE**	**Amount**	**FTE**	**Amount**	**FTE**	**Amount**	**FTE**	**Amount**
Detail	NA	NA	NA	NA	NA	NA	NA	NA
Center for Translation, Implementation Sciences	NA	$59,478	NA	$103,469	NA	$103,469	NA	$0
Heart and Vascular Diseases	NA	$2,037,346	NA	$2,105,542	NA	$2,106,418	NA	$877
Lung and Sleep Health	NA	$807,642	NA	$834,676	NA	$829,050	NA	-$5,627
Blood Diseases and Resources	NA	$514,486	NA	$531,707	NA	$525,928	NA	-$5,779
Subtotal, Extramural	NA	**$3,418,953**	NA	**$3,575,394**	NA	**$3,564,865**	NA	**-$10,529**
Intramural Research	**500**	**$241,213**	**502**	**$253,168**	**502**	**$258,826**	**0**	**$5,658**
Research Management & Support	**399**	**$150,206**	**464**	**$156,596**	**464**	**$161,467**	**0**	**$4,871**
TOTAL	**899**	**$3,810,371**	**966**	**$3,985,158**	**966**	**$3,985,158**	**0**	**$0**

*Includes FTEs whose payroll obligations are supported by the NIH Common Fund.

National Heart, Lung, and Blood Institute

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

Budget Authority (BA):

	FY 2022 Final	FY 2023 Enacted	FY 2024 President's Budget	FY 2024 +/- FY 2023
BA	$3,810,371,000	$3,985,158,000	$3,985,158,000	$0
FTE	899	966	966	0

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

Overall Budget Policy: The FY 2024 President's Budget request is $3,985.2 million, the same as the FY 2023 Enacted level. Included in this amount is funding to sustain the FY 2023 Enacted increase of $30.0 million for continued support of the NIH Community Engagement Alliance (CEAL) Against COVID-19 Disparities program so that it can operationalize a community engagement plan to reduce research participation hesitancy, address misinformation and mistrust of science, and promote diverse inclusion in NIH clinical trials and research in COVID-19 treatments, vaccination uptake, and other community mitigation and preventive strategies. The **Alliance for Community Engagement- Climate and Health**'s goal is to reduce health threats across the lifespan and build health resilience in individuals, communities, and nations around the world, especially among those at highest risk. NHLBI will work with climate scientists, citizen scientists, and decision-makers to develop, monitor, and evaluate programs to control sensitivity (e.g., age, access to green space), control exposure (e.g., wildfires, outdoor activities in extreme heat), and create adaptive environments (e.g., cooling centers, heat warnings). NHLBI is also targeting sleep research to improve the negative health impacts of climate change on heart, lung, and blood health.

Heart and Vascular Diseases

The cardiovascular disease (CVD) program supports research to advance understanding of and interventions for promoting heart and vascular health across the lifespan. It supports research aimed at preventing and treating pediatric and adult cardiovascular diseases, including heart attack and heart failure, stroke, complications of diabetes and obesity, high blood pressure, congenital heart disease, and other heart and vascular diseases.

Additionally, NHLBI and FNIH recently launched the Accelerated Medicines Partnership® for Heart Failure (AMP HF).[15] The program will focus on heart failure with preserved ejection fraction (HFpEF), a condition in which the heart cannot meet the body's oxygen and nutrient needs. AMP HF is a public-private partnership between NIH, FDA, multiple biopharmaceutical and life sciences companies, and non-profit organizations. The program will use cutting-edge technologies, including digital measurements and artificial intelligence analytic methods, to find novel proteins or genes that could alleviate this disease. Further, the program will use imaging, multi-omics in blood and other tissues, and deep clinical phenotyping to identify disease subtypes and novel biologic pathways and mechanisms underlying development and progression of HFpEF, with the goal of advancing effective targeted therapeutics.

Hypertension has major impacts on health including morbidity, mortality, and consumption of health care resources. Approximately 50 percent of American adults have high blood pressure, and this rate is rising. Even with drugs and lifestyle modifications widely available, blood pressure is inadequately controlled in about one of five hypertensive individuals. NHLBI is examining alternative causes of hypertension, including what is known as the gut-brain axis, which is the biochemical system of communication between the gastrointestinal tract and the central nervous system. Previous studies demonstrated that the gut microbiome is connected to inflammation, but new research showed that it may also affect blood pressure.[16] Gut-brain axis dysfunction results in brain inflammation and irregular activity in the autonomic nervous system, leading to elevated blood pressure. That high blood pressure

CHAP: Treating Chronic Hypertension during Pregnancy

Hypertension, or elevated blood pressure, accounts for approximately 20 percent of deaths in American women. Hypertension can be particularly dangerous in pregnant women, both for themselves and their unborn babies.[1] For example, elevated blood pressure during pregnancy can lead to decreased blood flow to the placenta, which means that the fetus receives less oxygen and nutrients to grow and develop normally. It can also cause placental abruption (the separation of the placenta from the wall of the uterus before delivery), which can be life-threatening to both the woman and her fetus.

The NIH Chronic Hypertension and Pregnancy (CHAP) Project launched in 2014 to examine the effects of mild chronic hypertension on maternal and fetal health. The study includes women ages 12 and older with mild chronic hypertension who are less than 23 weeks pregnant with one fetus. The purpose of the study is to determine whether maternal and fetal outcomes were affected when being treated for mild chronic hypertension. The findings from this study led the American College of Obstetricians and Gynecologists to update their clinical guidelines, recommending that clinicians utilize blood pressure of 140/90 as the threshold for initiation of treatment for chronic hypertension in pregnancy, rather than the previously recommended threshold of 160/110.[2]

1. https://www.mayoclinic.org/healthy-lifestyle/pregnancy-week-by-week/in-depth/pregnancy/art-20046098#:~:text=High%20blood%20pressure%20during%20pregnancy%20poses%20the%20following%20risks%3A,birth%20weight%20or%20premature%20birth

2. https://www.acog.org/clinical/clinical-guidance/practice-advisory/articles/2022/04/clinical-guidance-for-the-integration-of-the-findings-of-the-chronic-hypertension-and-pregnancy-chap-study

[15] nih.gov/research-training/accelerating-medicines-partnership-amp/heart-failure
[16] ahajournals.org/doi/10.1161/CIRCRESAHA.121.319816?cookieSet=1

then negatively affects gut function, exacerbating the problem. This discovery provides a better understanding of the gut-brain axis and could lead to more successful treatments for high blood pressure.

Another issue of great interest to NHLBI is congenital heart disease (CHD), which affects one percent of newborns. In recent years, whole-exome sequencing has accelerated understanding of CHD. However, despite the growing catalog of human genome variants, the cause of over 50 percent of CHD cases remains unknown. In a recent study, researchers defined the entire network of protein interactions between two factors (*GATA4* and *TBX5*) critical for normal heart development.[17] Using genome sequences from more than 3,000 children with CHD and their parents, they identified the genes that interact with this array of proteins. Computational analyses further refined the list of gene variants, which included *GYR1*—a gene that they showed plays a key role in heart development. This novel method of integrating protein interaction analyses, DNA sequence data, and computational approaches could greatly improve the ability of scientists to discover elusive genes contributing to many diseases.

Embryonic stem (ES) cells can initially become any type of cell in the body. This property can be beneficial in scientific explorations. By growing ES cells in particular laboratory conditions, scientists can push these cells to mature into specific cell types (e.g., liver cells or bone cells). Once cells are programmed to become a particular cell type, scientists had previously thought that they could not change their identity to a completely different one without first reverting to an immature state and then following a new developmental path. In a recent study, researchers found that mouse ES cells coaxed to become heart cells could completely transform to a brain cell fate, simply by experimentally deleting a gene called *Brm.*[18] While it remains unclear whether ES cells in the body can undergo the dramatic reprogramming observed in a culture dish, these findings have important implications not only for the pathology of heart disease, but more broadly for the general rules governing the influence of developmental genes in normal cell fate determination, as well as disease progression.

Budget Policy: The FY 2024 President's Budget request for NHLBI heart and vascular disease research is $2,106.4 million, an increase of $0.9 million or 0.04 percent compared with the FY 2023 Enacted Level.

[17] sciencedirect.com/science/article/pii/S0092867422000794?via%3Dihub
[18] nature.com/articles/s41586-021-04336-y

Lung and Sleep Health

The lung diseases program supports research on the causes, diagnosis, prevention, and treatment of lung diseases and sleep disorders, while also training the next generation of pulmonary researchers. Some areas covered include asthma, chronic obstructive pulmonary disease (COPD), cystic fibrosis, sleep-disordered breathing, acute lung injury, pediatric lung diseases, pulmonary fibrosis, and other rare lung disorders.

The mapping of the human genome in 2003 was a significant step forward for biology and medicine. Since then, a number of genetic tests have become widely available in the United States. Genetic testing allows people to better understand their genetic risks for certain diseases and health conditions. However, calculating these risks across racial and ethnic groups limits the accuracy of the tests. Researchers used data from NHLBI's Trans-Omics for Precision Medicine (TOPMed) program to determine that, compared to using the standard "polygenic risk scores," a novel framework called a "polygenic transcriptome risk score" improved the accuracy of predictions regarding risk of COPD.[19]

Idiopathic pulmonary fibrosis (IPF) is a serious chronic disease that affects the tissue surrounding the air sacs, or alveoli, in the lungs.[20] This condition develops when that lung tissue becomes thick and stiff for unknown reasons. Over time, these changes can cause permanent scarring in the lungs, called fibrosis, that makes it progressively more difficult to breathe. Life expectancy after diagnosis is approximately three years and most patients die from respiratory failure. Currently, there are two FDA-approved drugs to slow the rate of decline in lung function, but they do not cure the condition and side effects are common. Researchers discovered that saracatinib, a drug initially developed to treat cancer, shows promise as an IPF therapeutic and is currently being tested in a clinical trial.[21] Repurposing drugs to treat conditions other than the one for which they were developed and/or approved can make effective, more affordable treatments available to patients sooner.

NIH Sleep Research Plan

Sleep and circadian rhythms profoundly influence the crucial functions of nearly every cell and organ in the body. Unfortunately, some groups are disproportionately affected by poor sleep, such as racial and ethnic minorities and those of lower socioeconomic status.[1] Suboptimal sleep environments, including those burdened by climate change, also influence how and how well people sleep. Studies have shown that elevated nighttime temperature lowers sleep quality, with the largest effects being felt by older adults and low-income participants.[2] There are also biological differences in sleep quality and its health impacts. For example, women report poorer sleep quality and have higher risk for insomnia than do men and may be affected by changes in sleep related to menstruation, pregnancy, post-childbirth, and menopause.

The 2021 NIH Sleep Research Plan incorporates crosscutting NIH priorities that address topics such as minority health and health disparities, sex/gender, sleep across the lifespan, the impact of opioid addiction, and how poor sleep may exacerbate the risk and outcome of infectious diseases such as COVID-19. The plan also covers the development of personalized treatments for sleep and circadian disorders. The plan is based on a set of research needs and opportunities identified with input from researchers, public representatives, NIH workshop participants, and NHLBI programmatic staff. The scientific recommendations are based on discussions with the Sleep Disorders Research Advisory Board (SDRAB), members of the public attending SDRAB meetings, and representatives of NIH extramural programs participating in the NIH Sleep Research Coordinating Committee (SRCC). The plan identifies timely and actionable research goals with the potential to significantly impact sleep, circadian, and biomedical sciences.

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3884220/
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5446217/

[19] cell.com/ajhg/fulltext/S0002-9297(22)00103-3
[20] nhlbi.nih.gov/health/idiopathic-pulmonary-fibrosis
[21] biorxiv.org/content/10.1101/2022.01.04.474955v1.abstract

Human lungs are a unique organ in the body and have specific cell types found only in the lungs. Other cell types, while having counterparts in the rest of the body, have evolved to meet the specific needs of the respiratory system. The NHLBI-funded LungMAP Consortium is a group of researchers and experts in the pulmonary biology community. This year, the Consortium synthesized current data into a comprehensive and practical cellular census of the lung.[22] These results are publicly available and will be a foundational resource for lung research moving forward.[23]

Appropriate sleep is key to the proper function of the human body. Sleep dysfunction and insufficient sleep are associated with Alzheimer's Disease and Alzheimer's Disease Related Dementias (AD/ADRD). Unfortunately, African American people are disproportionately affected by higher rates and earlier onset of ADRDs relative to White Americans. In a study sample of predominantly African American older adults, both the amount of time spent awake while in bed (known as low sleep efficiency) and frequently waking up while sleeping (known as wakefulness after sleep onset, or WASO) were associated with poorer cognitive function.[24] Improving sleep health may help prevent ADRD and reduce health disparities.

Budget Policy: The FY 2024 President's Budget request for NHLBI lung disease research is $829.1 million, a decrease of $5.6 million or -0.7 percent compared with the FY 2023 Enacted Level.

Blood Diseases and Resources

The blood program is a leader in research on the causes, prevention, and treatment of non-cancerous blood diseases. The program also helps ensure the adequacy and safety of the nation's blood supply and supports scientific advances in stem cell biology and new gene and cell-based therapies to repair and regenerate human tissues and organs.

NHLBI supports research that has improved health outcomes for people with sickle cell disease (SCD), an inherited blood disorder that can lead to chronic pain, organ failure, and premature death. This condition affects approximately 100,000 people in the United States and millions more around the world, a large percentage of whom are of African descent (including African Americans). Unfortunately, the cost of treating SCD is a significant burden for many patients. The NHLBI Cure Sickle Cell Initiative (CureSC) was developed to facilitate the development of genetic-based curative strategies to build upon the success of stem cell transplants.[25] While stem cell transplants can cure sickle cell disease, many patients do not have a suitable donor for the procedure. Gene therapy allows a patient's own stem cells to be collected, genetically modified, and given back to the patient. The corrected stem cells then produce red blood cells without the sickle mutation. Another genetic-based strategy is to treat the patient's stem cells to increase fetal hemoglobin, preventing the sickled hemoglobin from being dominant, and thus lessening symptoms of the disease. CureSC is funding two clinical trials in conjunction with the California Institute of Regenerative Medicine (CIRM) as well as funding data collection to allow for a

[22] sciencedirect.com/science/article/pii/S1534580721008923?via%3Dihub
[23] lungmap.net/
[24] content.iospress.com/articles/journal-of-alzheimers-disease/jad215530
[25] curesickle.org/

comparative, contemporaneous cohort of patients who have not received curative therapies.[26] This will provide comparator data to the investigators as well as to the FDA to demonstrate the effects of these genetically based curative therapies.

Hemoglobin, a protein in the blood that transports oxygen throughout the body, is essential to human life. SCD and another disorder called beta-thalassemia (a condition in which when the body does not produce enough hemoglobin) are caused by certain mutations in a gene that creates hemoglobin. The gene, called *beta-globin*, is turned on in red blood cells (RBCs) around the time of birth as the fetal version, called *gamma-globin*, is turned off. However, under the stress condition of hypoxia (low oxygen), *gamma-globin* genes are turned on in adults, and adult expression of *gamma-globin* can alleviate symptoms in people with SCD and beta-thalassaemia. A recent NHLBI-supported study identified a new molecular pathway, which is sensitive to oxygen levels, that turns on the *gamma-globin* gene in adult RBCs.[27] Hypoxia stabilizes a protein called Hypoxia-inducible factor 1 (HIF1), which turns on the *gamma-globin* gene in adult RBCs. Researchers then tested whether prolyl hydroxylase inhibitors (PHIs), which can stabilize the HIF1 protein, could induce fetal hemoglobin. Using young red blood cells from individuals with SCD and testing in vitro, they found that PHIs can stabilize HIF1, leading to increased fetal hemoglobin and significantly less sickling of cells. This important finding could lead to new therapeutic approaches for reversing disease progression in people with these conditions.

It is imperative to better understand the origins of adult blood to best treat a myriad of blood disorders and cancers. This year, researchers supported by NHLBI made great strides in this area. It has long been believed that blood cells created in the developing fetus (known as embryonic blood progenitors) decrease as a person reaches adulthood. However, researchers used an enzyme called transposase to insert unique genetic sequences into mice embryos; these "barcodes" were then present in any cell that descended from the original, allowing the researchers to trace their lineages. The results showed that adult blood cells derived not just from blood stem cells (hematopoietic stem cells) as previously believed, but also from long-lived embryonic blood progenitors. These findings could spark new strategies for developing treatments for blood disorders and cancers, as well as improve outcomes of bone marrow transplants.

Budget Policy: The FY 2024 President's Budget request for this research program is $525.9 million, an decrease of $5.8 million or 1.1 percent compared with the FY 2023 Enacted level.

Center for Translation Research and Implementation Sciences (CTRIS)
This program was established in 2014 to help plan, foster, and support research to ensure the successful integration of evidence-based interventions within clinical and public health settings, such as health centers, worksites, communities, and schools.

[26] curesickle.org/phase-2
[27] pubmed.ncbi.nlm.nih.gov/36224385/

The COVID-19 pandemic provided a stark reminder of how social determinants of health and existing health disparities can contribute to unequal burden of disease. The NIH Community Engagement Alliance Against COVID-19 Disparities (CEAL) is an NIH-wide initiative that leverages existing community-engaged research efforts to address misinformation, foster trust in science, and ensure inclusive participation of ethnic and racial minority communities disproportionately affected by the COVID-19 pandemic, in important life-saving research efforts focused on the mitigation, prevention, and treatment of COVID-19.[28] NHLBI is continuing this community-engaged approach in 21 states and territories with approximately 1,000 community partners to address the lingering effects of COVID-19 and recruiting participants for the NIH Researching COVID to Enhance Recovery's (RECOVER) clinical trials for therapeutics to treat post-acute sequelae of COVID-19 (PASC), commonly known as Long COVID.[29] Enrollment in clinical trials is expected to begin in early 2023.

Additionally, the Network for Community-Engaged Primary Care Research (NCPCR) supports the CEAL mission by leveraging community-engaged research in primary care settings to address health inequities.[30] Primary care providers use their role as a trusted professional to address misinformation and disinformation related to prevention and treatment of COVID-19 and its lingering effects and symptoms.

NHLBI is also using lessons learned from CEAL to work with communities on other health issues. For example, the United States currently has the highest rates of maternal mortality and morbidity in the developed world, more than half of which are preventable. Despite relative national wealth, significant racial, ethnic, and geographic disparities contribute substantially to overall poor maternal health outcomes in the United States. One of the ways NHLBI is addressing this important issue is by funding the Maternal Health Community

CEAL and RECOVER: Community Engagement in Response to COVID-19 Disparities and Long COVID

More than a million people in the United States have died from infection with the virus that causes COVID-19. Soon after the pandemic began, it became clear that the hardest hit communities were those of people of color, who were more likely to be hospitalized, and whose mortality rates were much higher than others. In July 2020, NHLBI and the National Institute on Minority Health and Health Disparities launched the NIH Community Engaged Alliance (CEAL) Against COVID-19 Disparities. CEAL was charged with developing community-based initiatives to counter COVID-19 misinformation, foster trust in science and research, and encourage the participation of under-represented populations in NIH research. Since then, CEAL has evolved into a robust, comprehensive research platform compromised of research teams in 21 locations across the country.

NHLBI is also participating in another community-based initiative — RECOVER (Researching COVID to Enhance Recovery), launched in 2021 to better understand why some people develop what has come to be called Long COVID, a constellation of symptoms (such as fatigue, loss of taste and smell, and "brain fog") that persists after the initial infection resolves. At the center of RECOVER is a longitudinal observational study currently recruiting adults and children from other ongoing studies of COVID-19, CEAL sites, Long COVID clinics, and other places that have a history of including people from communities disproportionately burdened by disease. RECOVER will significantly expand knowledge about the full clinical spectrum of symptoms, long-term outcomes, and underlying biology of Long COVID, as well as accelerate the ability to develop safe and effective therapeutic interventions. As of March 2023, more than 16,000- people have been enrolled, which far exceeds RECOVER's initial target recruitment of 6,000. A significant percent of enrollees live in federally designated medically underserved areas.

[28] covid19community.nih.gov/
[29] recovercovid.org/
[30] covid19community.nih.gov/Network-for-Community-Engaged-Primary-Care-Research

Implementation Project (MH-CIP).[31] This program supports the development and testing of promising community-based strategies to increase adoption, uptake, and scale-up of evidence-based interventions to improve pre-pregnancy, pregnancy, perinatal, and postpartum care. This can advance maternal health and maternal health equity in disproportionately affected communities. MH-CIP supports four community coalitions, comprised of research organizations and community partners, to engage communities and pilot test the implementation of proven interventions in vulnerable populations.

NIH understands that climate change is one of the greatest existential threats to the health of the planet and to human health. Similarly, a collaborative, cross-disciplinary approach is needed to address this urgent issue. For example, extreme weather, rising sea levels, rising temperatures, and increases in carbon dioxide levels disproportionately affect the most vulnerable communities. Some of these adverse health outcomes may be short-lived, but others lead to chronic cardiovascular or respiratory illnesses. NHLBI is working closely with the National Institute of Environmental Health Sciences (NIEHS) to fund climate change-related research, including community outreach efforts. The Alliance for Community Engagement-Climate and Health's (ACE-CH) goal is to reduce health threats across the lifespan and build health resilience in individuals, communities, and nations around the world, especially among those at highest risk.[32] NHLBI will work with climate scientists, citizen scientists, and decision-makers to develop, monitor, and evaluate programs to control sensitivity (e.g., age, access to green space), control exposure (e.g., wildfires, outdoor activities in extreme heat), and create adaptive environments (e.g., cooling centers, heat warnings). NHLBI is also targeting sleep research to improve the negative health impacts of climate change on heart, lung, and blood health.

Budget Policy: The FY 2024 President's Budget request for CTRIS is $103.5 million, equal to the FY 2023 Enacted level.

Intramural Research

The NHLBI Division of Intramural Research (DIR) performs robust scientific and clinical research leading to a better understanding of biology and pathology of heart, lung, and blood systems. The research portfolio is broad, encompassing the basic principles of molecular, cellular, and organ-level biology and their relationship to disease, and goes all the way to conducting clinical trials and training.

DIR investigators play a significant role in federal research efforts to address COVID-19. One DIR group discovered that certain antibodies found in some COVID-19 patients drive endotheliopathy.[33] Endotheliopathy occurs when endothelial cells (the primary cell type inside the linings of blood vessels, lymph nodes, and the heart) do not function properly, potentially leading to blood clots. These findings have potential clinical implications. For example, the authors suggest consideration for patients with severe COVID-19 to be screened to evaluate their risk for endotheliopathy, and that patients at high risk may benefit from treatments used in

[31] maternalhealthcip.org/
[32] nhlbi.nih.gov/sites/default/files/media/docs/ACE_CH_ROA_6_08_2022_FINAL.pdf
[33] onlinelibrary.wiley.com/doi/10.1002/art.42094

traditional cases of severe antiphospholipid syndrome, a disorder of the immune system that causes an increased risk of blood clots.

NHLBI is dedicated to developing and improving treatments for severe pain episodes, also known as pain crises for those with SCD. These pain crises may happen without warning when sickle cells block blood flow. People describe this pain as sharp, intense, stabbing, or throbbing.[34] This year, a proof-of-concept clinical study by NHLBI scientists showed that the pyruvate kinase activator mitapivat (AG-348) improved molecular hallmarks of SCD, increased blood oxygen levels, and reduced sickling in patients with sickle cell anemia.[35] Similar to the use of saracatinib, a drug initially developed to treat cancer or pulmonary fibrosis, another SCD study identified 20 compounds in existing, FDA-approved drugs that may be repurposed to treat SCD pain.[36] Should some of these therapies become available, millions around the world will have improved access to safe, affordable treatments.

Budget Policy: The FY 2024 President's Budget request for NHLBI intramural research is $258.8 million, an increase of $5.7 million or 2.2 percent compared with the FY 2023 Enacted level. These increases accommodate proposed pay increases for IR staff, changes in NIH-wide assessments on the IR program, and other inflationary costs.

Research Management and Support (RMS)
RMS activities include administrative and technical functions that support and enhance the effectiveness of the Institute's research investments. This includes providing administrative, budgetary, logistical, and scientific support in the review, award, and monitoring of research grants and clinical trials, training awards, and research and development contracts. RMS functions also encompass strategic planning, trans-NHLBI and NIH coordination, evaluation of the Institute's programs, regulatory compliance, international coordination, interactions with other Federal agencies and Congress, and dissemination of research findings to the public.

Budget Policy: The FY 2024 President's Budget request for RMS at NHLBI is $161.5 million, an increase of $4.9 million or 3.1 percent compared with the FY 2023 Enacted level.

[34] nhlbi.nih.gov/health/sickle-cell-disease/health-effects
[35] ashpublications.org/blood/article-abstract/doi/10.1182/blood.2022015403/485276/A-Phase-1-Dose-Escalation-Study-of-the-Pyruvate?redirectedFrom=fulltext
[36] pnas.org/doi/10.1073/pnas.2210779119#core-collateral-metrics

NATIONAL INSTITUTES OF HEALTH
National Heart, Lungs, and Blood Institute

Appropriations History

Fiscal Year	Budget Estimate to Congress	House Allowance	Senate Allowance	Appropriation
2015	$2,987,685,000	-	-	$2,997,870,000
Rescission	-	-	-	$0
2016	$3,071,906,000	$3,035,062,000	$3,135,519,000	$3,115,538,000
Rescission	-	-	-	$0
2017 [1]	$3,113,533,000	$3,190,474,000	$3,242,685,000	$3,206,589,000
Rescission	-	-	-	$0
2018	$2,534,803,000	$3,256,521,000	$3,322,774,000	$3,383,201,000
Rescission	-	-	-	$0
2019	$3,112,032,000	$3,423,604,000	$3,490,171,000	$3,488,335,000
Rescission	-	-	-	$0
2020	$3,002,696,000	$3,658,822,000	$3,694,771,000	$3,624,258,000
Rescission	-	-	-	$0
Supplemental	-	-	-	$103,400,000
2021	$3,298,004,000	$3,655,428,000	$3,728,307,000	$3,664,811,000
Rescission	-	-	-	$0
2022	$3,845,681,000	$3,866,828,000	$3,841,998,000	$3,808,494,000
Rescission	-	-	-	$0
2023	$3,822,961,000	$3,943,702,000	$3,946,557,000	$3,982,345,000
Rescission	-	-	-	$0
2024	$3,985,158,000	-	-	-

[1] Budget Estimate to Congress includes mandatory financing.

NATIONAL INSTITUTES OF HEALTH
National Heart, Lungs, and Blood Institute

Authorizing Legislation

	PHS Act/ Other Citation	U.S. Code Citation	2023 Amount Authorized	FY 2023 Enacted	2024 Amount Authorized	FY 2024 President's Budget
Research and Investigation	Section 301	42§241	Indefinite	$3,985,158,000	Indefinite	$3,985,158,000
National Heart, Lung, and Blood Institute	Section 401(a)	42§281	Indefinite		Indefinite	
Total, Budget Authority				$3,985,158,000		$3,985,158,000

NATIONAL INSTITUTES OF HEALTH
National Heart, Lungs, and Blood Institute

Amounts Available for Obligation[1]
(Dollars in Thousands)

Source of Funding	FY 2022 Final	FY 2023 Enacted	FY 2024 President's Budget
Appropriation	$3,808,494	$3,982,345	$3,985,158
OAR HIV/AIDS Transfers	$1,877	$2,813	$0
Subtotal, adjusted budget authority	$3,810,371	$3,985,158	$3,985,158
Unobligated balance, start of year	$0	$0	$0
Unobligated balance, end of year (carryover)	$0	$0	$0
Subtotal, adjusted budget authority	**$3,810,371**	**$3,985,158**	**$3,985,158**
Unobligated balance lapsing	-$65	$0	$0
Total obligations	$3,810,306	$3,985,158	$3,985,158

[1] Excludes the following amounts (in thousands) for reimbursable activities carried out by this account:
FY 2022 - $23,323 FY 2023 - $23,323 FY 2024 - $23,323

NATIONAL INSTITUTES OF HEALTH
National Heart, Lungs, and Blood Institute

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

OBJECT CLASSES		FY 2023 Enacted	FY 2024 President's Budget	FY 2024 +/- FY 2023
	Total compensable workyears:			
-	Full-time equivalent	966	966	0
-	Full-time equivalent of overtime and holiday hours	1	1	0
-	Average ES salary	$211	$223	$11
-	Average GM/GS grade	12.8	12.8	0.0
-	Average GM/GS salary	$131	$138	$7
-	Average salary, Commissioned Corps (42 U.S.C. 207)	$124	$131	$7
-	Average salary of ungraded positions	$157	$166	$9
-	Personnel Compensation	-	-	-
11.1	Full-Time Permanent	$75,858	$79,896	$4,038
11.3	Other Than Full-Time Permanent	$41,880	$44,011	$2,131
11.5	Other Personnel Compensation	$6,313	$6,646	$333
11.7	Military Personnel	$3,075	$3,232	$157
11.8	Special Personnel Services Payments	$11,551	$12,134	$583
11.9	**Subtotal Personnel Compensation**	**$138,676**	**$145,918**	**$7,242**
12.1	Civilian Personnel Benefits	$45,449	$47,625	$2,176
12.2	Military Personnel Benefits	$616	$647	$31
13.0	Benefits to Former Personnel	$0	$0	$0
-	**Subtotal Pay Costs**	**$184,741**	**$194,190**	**$9,449**
21.0	Travel & Transportation of Persons	$2,017	$2,024	$7
22.0	Transportation of Things	$378	$378	$0
23.1	Rental Payments to GSA	$0	$0	$0
23.2	Rental Payments to Others	$0	$0	$0
23.3	Communications, Utilities & Misc. Charges	$292	$292	$0
24.0	Printing & Reproduction	$2	$2	$0
25.1	Consulting Services	$102,780	$104,033	$1,254
25.2	Other Services	$70,116	$70,972	$856
25.3	Purchase of Goods and Services from Government Accounts	$260,882	$261,818	$936
25.4	Operation & Maintenance of Facilities	$122	$122	$1
25.5	R&D Contracts	$139,859	$143,126	$3,267
25.6	Medical Care	$2,075	$2,075	$0
25.7	Operation & Maintenance of Equipment	$14,676	$14,691	$15
25.8	Subsistence & Support of Persons	$0	$0	$0
25.0	**Subtotal Other Contractual Services**	**$590,509**	**$596,837**	**$6,328**
26.0	Supplies & Materials	$15,398	$15,394	-$4
31.0	Equipment	$8,664	$8,701	$37
32.0	Land and Structures	$4,474	$4,488	$14
33.0	Investments & Loans	$0	$0	$0
41.0	Grants, Subsidies & Contributions	$3,178,661	$3,162,829	-$15,833
42.0	Insurance Claims & Indemnities	$0	$0	$0
43.0	Interest & Dividends	$22	$22	$0
44.0	Refunds	$0	$0	$0
-	**Subtotal Non-Pay Costs**	**$3,800,417**	**$3,790,968**	**-$9,449**
-	**Total Budget Authority by Object Class**	**$3,985,158**	**$3,985,158**	**$0**

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

NATIONAL INSTITUTES OF HEALTH
National Heart, Lungs, and Blood Institute

Salaries and Expenses
(Dollars in Thousands)

Object Classes	FY 2023 Enacted	FY 2024 President's Budget	FY 2024 +/- FY 2023
Personnel Compensation			
Full-Time Permanent (11.1)	$75,858	$79,896	$4,038
Other Than Full-Time Permanent (11.3)	$41,880	$44,011	$2,131
Other Personnel Compensation (11.5)	$6,313	$6,646	$333
Military Personnel (11.7)	$3,075	$3,232	$157
Special Personnel Services Payments (11.8)	$11,551	$12,134	$583
Subtotal, Personnel Compensation (11.9)	**$138,676**	**$145,918**	**$7,242**
Civilian Personnel Benefits (12.1)	$45,449	$47,625	$2,176
Military Personnel Benefits (12.2)	$616	$647	$31
Benefits to Former Personnel (13.0)	$0	$0	$0
Subtotal Pay Costs	**$184,741**	**$194,190**	**$9,449**
Travel & Transportation of Persons (21.0)	$2,017	$2,024	$7
Transportation of Things (22.0)	$378	$378	$0
Rental Payments to Others (23.2)	$0	$0	$0
Communications, Utilities & Misc. Charges (23.3)	$292	$292	$0
Printing & Reproduction (24.0)	$2	$2	$0
Other Contractual Services	-	-	-
Consultant Services (25.1)	$102,780	$104,033	$1,254
Other Services (25.2)	$70,116	$70,972	$856
Purchase of Goods and Services from Government Accounts (25.3)	$159,760	$160,695	$936
Operation & Maintenance of Facilities (25.4)	$122	$122	$1
Operation & Maintenance of Equipment (25.7)	$14,676	$14,691	$15
Subsistence & Support of Persons (25.8)	$0	$0	$0
Subtotal Other Contractual Services	**$347,453**	**$350,514**	**$3,061**
Supplies & Materials (26.0)	$15,398	$15,394	-$4
Subtotal Non-Pay Costs	**$365,540**	**$368,605**	**$3,065**
Total Administrative Costs	**$550,280**	**$562,795**	**$12,515**

NATIONAL INSTITUTES OF HEALTH
National Heart, Lungs, and Blood Institute

Detail of Full-Time Equivalent Employment (FTE)

Office	FY 2022 Final			FY2023 Enacted			FY 2024 President's Budget		
	Civilian	Military	Total	Civilian	Military	Total	Civilian	Military	Total
Division of Intramural Research									
Direct:	467	15	482	469	15	484	469	15	484
Reimbursable:	18	-	18	18	-	18	18	-	18
Total:	485	15	500	487	15	502	487	15	502
Office of the Director									
Direct:	112	1	113	156	1	157	156	1	157
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	112	1	113	156	1	157	156	1	157
Division of Blood and Resources									
Direct:	25	2	27	27	2	29	27	2	29
Total:	25	2	27	27	2	29	27	2	29
Division of Lung Diseases									
Direct:	37	-	37	39	-	39	39	-	39
Total:	37	-	37	39	-	39	39	-	39
Center for Translation Research and Implementation Science									
Direct:	13	-	13	15	-	15	15	-	15
Total:	13	-	13	15	-	15	15	-	15
Division of Cardiovascular Sciences									
Direct:	114	-	114	119	-	119	119	-	119
Total:	114	-	114	119	-	119	119	-	119
Division of Extramural Research Activities									
Direct:	95	-	95	105	-	105	105	-	105
Total:	95	-	95	105	-	105	105	-	105
Total	881	18	899	948	18	966	948	18	966
Includes FTEs whose payroll obligations are supported by the NIH Common Fund									
FTEs supported by funds from Cooperative Research and Development Agreements.	0	0	0	0	0	0	0	0	0
FISCAL YEAR	**Average GS Grade**								
2020	12.7								
2021	12.7								
2022	12.7								
2023	12.8								
2024	12.8								

NATIONAL INSTITUTES OF HEALTH
National Heart, Lungs, and Blood Institute

Detail of Positions[1]

GRADE	FY 2022 Final	FY 2023 Enacted	FY 2024 President's Budget
Total, ES Positions	2	2	2
Total, ES Salary	$407,400	$422,644	$445,616
General Schedule			
GM/GS-15	85	89	89
GM/GS-14	154	167	167
GM/GS-13	195	210	210
GS-12	73	78	78
GS-11	36	38	38
GS-10	0	0	0
GS-9	34	36	36
GS-8	1	2	2
GS-7	2	3	3
GS-6	3	4	4
GS-5	3	4	4
GS-4	5	6	6
GS-3	3	3	3
GS-2	3	3	3
GS-1	0	0	0
Subtotal	597	643	643
Commissioned Corps (42 U.S.C. 207)			
Assistant Surgeon General	1	1	1
Director Grade	6	6	6
Senior Grade	4	4	4
Full Grade	7	7	7
Senior Assistant Grade	0	0	0
Assistant Grade	0	0	0
Subtotal	18	18	18
Ungraded	282	303	303
Total permanent positions	617	617	617
Total positions, end of year	899	966	966
Total full-time equivalent (FTE) employment, end of year	899	966	966
Average ES salary	$203,700	$211,322	$222,808
Average GM/GS grade	12.7	12.8	12.8
Average GM/GS salary	$127,592	$130,745	$137,852

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