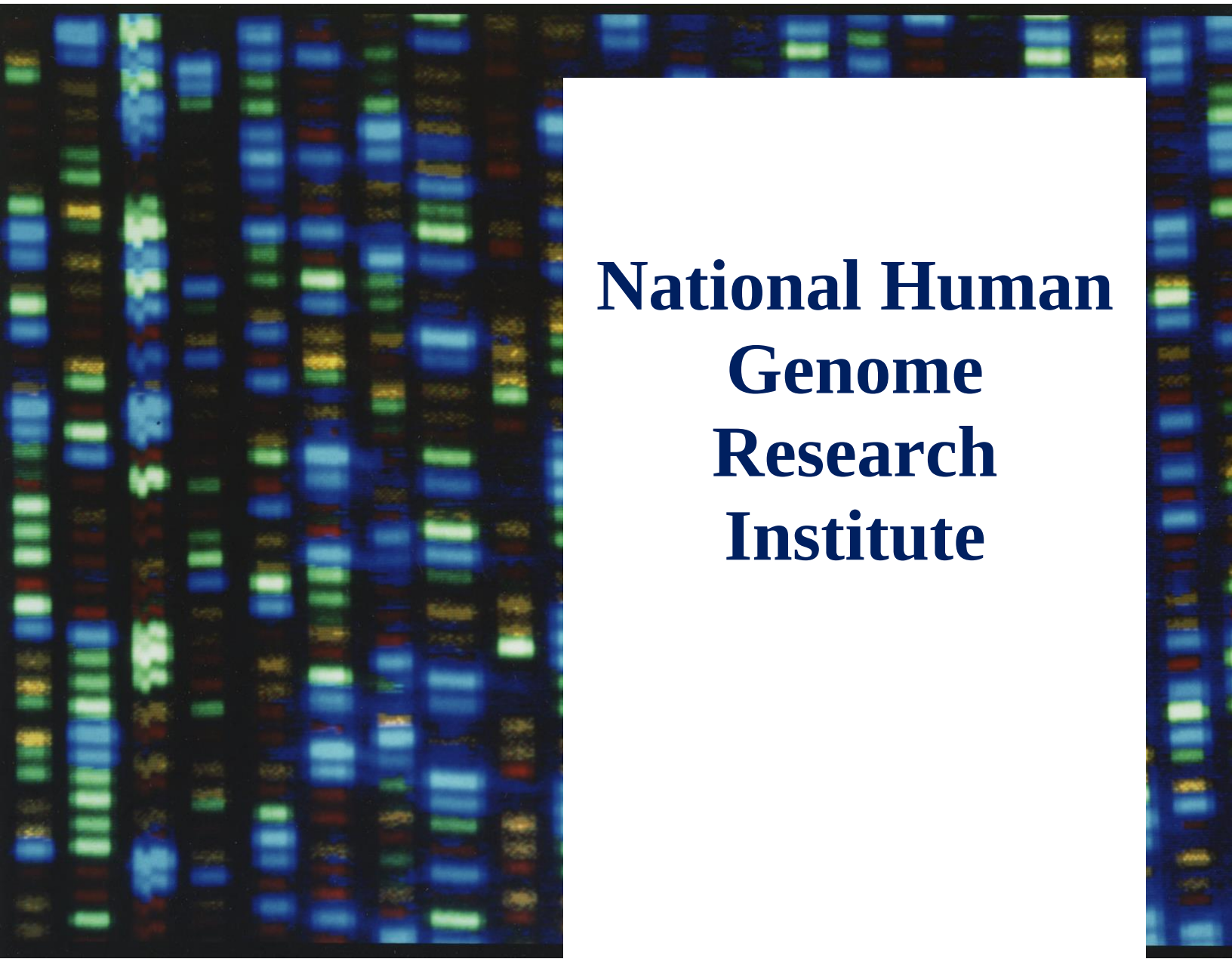


National Human Genome Research Institute

CONGRESSIONAL JUSTIFICATION
FY 2025

Department of Health and Human Services
National Institutes of Health

NIH National Human Genome Research Institute | The Forefront of Genomics

[THIS PAGE INTENTIONALLY LEFT BLANK]

DEPARTMENT OF HEALTH AND HUMAN SERVICES

NATIONAL INSTITUTES OF HEALTH

National Human Genome Research Institute

FY 2025 Budget Table of Contents

General Notes

1. FY 2024 funding levels cited in this document are based on the Continuing Resolution in effect at the time of the budget preparation (Public Law 118-35) and do not include HIV/AIDS transfers.
2. Detail in this document may not sum to the subtotals and totals due to rounding.

[THIS PAGE INTENTIONALLY LEFT BLANK]

Director's Overview

Eric D. Green, M.D., Ph.D.
Director, NHGRI

In April 2023, the National Human Genome Research Institute (NHGRI), part of the National Institutes of Health (NIH), and the genomics community celebrated the 70th anniversary of the discovery of DNA's double-helical structure and the 20th anniversary of the Human Genome Project's completion. The latter milestone was particularly relevant because the nature of the Institute's work greatly expanded 20 years ago, with NHGRI pivoting to take on greater roles in: (1) leading the development of new laboratory and computational technologies for use in the genomics research being conducted by the entire biomedical community; and (2) providing an incubator for applying genomics to medicine. As a result, numerous genomic discoveries have followed, contributing to key advances in all areas of biomedical research and the early implementation of genomic medicine.

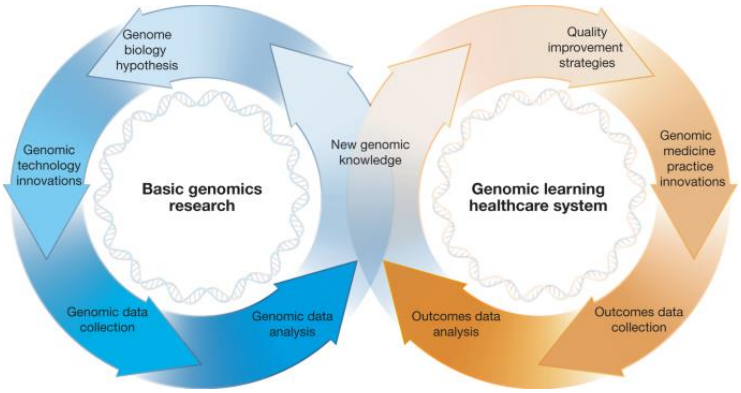
Developing and improving genomic technologies are essential for both making key discoveries about genome structure and function and translating innovations in genomics into clinical advances that have the potential to save lives. The NHGRI Genome Technology Program continues to fuel the study of the human genome by improving technologies to characterize genomic variation, mutation, and perturbation. In this program, NHGRI supports efforts in novel nucleic acid sequencing, single-molecule protein sequencing, and other cutting-edge technologies from across the breadth of genomic applications. Technological advances require improved data-analysis methods, and the NHGRI Computational Genomics and Data Science Program supports the development of computational and data science tools for the storage, management, analysis, and visualization of data, as well as improved statistical and analytical methods suited to extract meaningful information from genomic and clinical data. The program supports the development and application of clinical informatics tools that employ computational approaches to facilitate patients' understanding of their genomic information and to assist in using that information for healthcare decisions. NHGRI also supports the application of machine-learning methods in basic genomics research and genomic medicine. These efforts underscore the importance of novel approaches in technology development and supporting work that will move the field of genomics forward in highly influential ways.

NHGRI strives to expand understanding of the human genome through studies of genomic architecture and complex genetic traits. NHGRI has expanded knowledge of genome structure and function through efforts like the Human Genome Reference Program, which continuously maintains and improves the human genome reference sequence, an essential resource used by the global scientific community. Efforts to fully understand genomic architecture focus on characterizing the physical organization of human genomes from diverse populations and determining how genomic variation contributes to human traits and disease. This is particularly important for complex genetic traits and diseases, which are the result of many genomic variants working in concert – all influenced by physical and social environment.

NHGRI is also broadening knowledge of the human genome by supporting investigations on the genomes of diverse animal species. This approach is known as comparative genomics and can provide crucial insights into human health and disease by revealing how the human genome evolved over time. For example, NHGRI intramural investigators are using comparative genomics to tackle topics related to human health like the immune system, aging, healing, radiation resistance, and cancer. Additionally, NHGRI is supporting data resources that are critical for using common well-studied animals, known as model organisms, in biomedical research. Many scientific breakthroughs key to human health have involved model organisms, and the NHGRI-funded Model Organism Databases make information on these animals centralized and accessible, allowing more researchers to complete robust model organism studies.

In addition to supporting a range of genomics studies, NHGRI is committed to ensuring that genomic advances benefit the health of all humans by considering the ethical, legal, and social implications (ELSI) of genomics in all aspects of the Institute's work. NHGRI's ELSI Research Program was established in 1990 as an integral part of the Human Genome Project and remains a unique program among NIH Institutes, Centers, and Offices (ICOs). Through the ELSI Research Program, NHGRI-supported researchers explore topics such as communicating genomic findings to research participants and providers; addressing privacy concerns about genomic data; tactics for increasing participation of underrepresented populations in genomics research; and methods to engage with diverse communities to increase genomic literacy. ELSI researchers also work with policymakers to inform policy development and decisions that will prepare society for a future in which genomics is part of daily life. NHGRI's Center for ELSI Resources and Analysis is a multidisciplinary effort that is working to establish a more integrated ELSI research community, serving as a hub to organize the community to avoid duplicative efforts. NHGRI also supports Centers of Excellence in ELSI Research, which bring together investigators from multiple disciplines to address new and persistent genomics-relevant ELSI challenges and support the next generation of ELSI researchers. As more human genomes are sequenced and new medical applications of genomics emerge, such as gene therapy and polygenic risk scores (the estimated effect of many genetic variants on an individual's disease risk), new ELSI-related questions must be explored to ensure that everyone benefits from genomics research and that mistreatment, disparities, and inequities are avoided.

For genomic discoveries to be appropriately harnessed for advancing human health at all stages of life and for all people, diversity, equity, and inclusion must be foundational in genomics research. Many of the Institute's guiding principles and values for human genomics, articulated in the



2020 NHGRI Strategic Vision,[1] demonstrate a commitment to health equity and the prevention of disparities in genomics. Alongside building a more diverse genomics workforce, NHGRI's Training, Diversity, and Health Equity Office supports research to improve minority health, reduce health disparities, and foster health equity. NHGRI is also working tirelessly to enhance the diversity of people who participate in genomics research, thereby improving our knowledge of human genomic variation and genomic information for all populations.

As genomics expands to include an increasing number of applications in medicine, genomic information must be effectively integrated into mainstream healthcare to fully realize its life-saving potential. NHGRI is facilitating that process by supporting work that is merging genomic information into learning healthcare systems, in which real-time data on outcomes of healthcare delivery are accessed and used to enhance clinical practice. This work enables the movement of genomic discoveries rapidly into clinical care, leveraging advances in electronic health records and information technology. NHGRI is also at the forefront of improving genomic data exchange and interoperability, ushering in the expansion of these efforts to enable integration of genomic data into health information exchanges.

These efforts have real-world impacts for studying both rare and common diseases. NHGRI is committed to reducing the diagnostic odyssey many patients endure by supporting systems that better identify undiagnosed rare-disease patients. The NHGRI-supported Genomics Research to Elucidate the Genetics of Rare Diseases Consortium aims to increase the proportion of Mendelian disorders with an identified genetic cause by developing and applying novel approaches to discover causal genomic variants. Through the Electronic Medical Records and Genomics Network and other efforts, NHGRI is supporting work seeking to improve the methods and application of polygenic risk scores for common diseases so that they may be integrated into routine clinical care. Not only do innovations generated by basic genomics research help inform clinical care, the implementation of new genomic medicine practice innovations also often yields new genomic knowledge, creating a productive and virtuous cycle in which research and medicine work together to propel the fields of genomics and medicine forward in a mutually beneficial way.

[1] genome.gov/2020SV

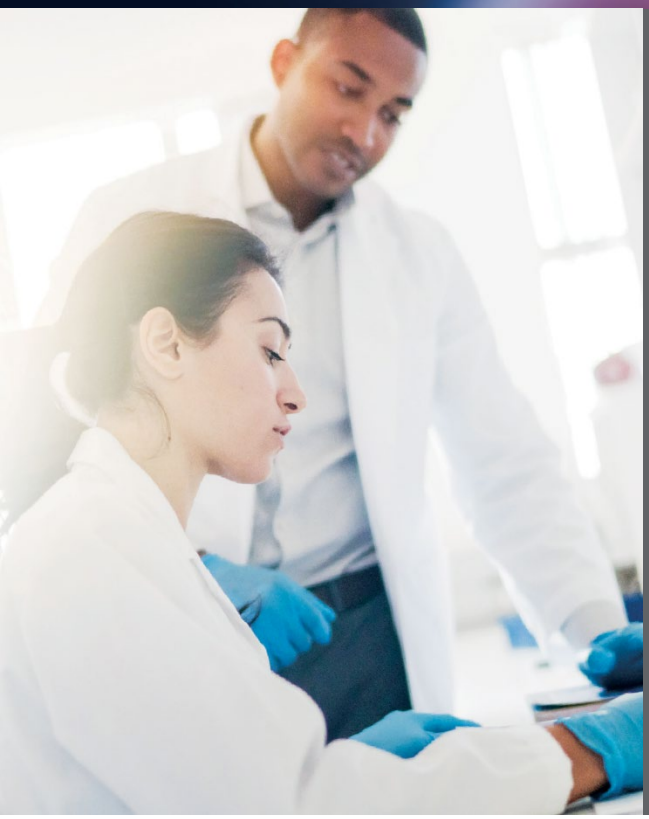
[THIS PAGE INTENTIONALLY LEFT BLANK]

The Forefront of Genomics®

genome.gov

National Human Genome Research Institute

NHGRI conducts and funds world-class genomics research, trains the next generation of genomics experts, and collaborates with diverse communities to improve human health.



Empowering the Biomedical Research Community

Building on our leadership role in sequencing the human genome, NHGRI uses a team science" approach to tackle increasingly complex biological problems. As one of the smaller institutes at the National Institutes of Health (NIH), we make every dollar we spend impactful. We assemble interdisciplinary research teams consisting of scientists, clinicians, ethicists, and other experts, and we ensure they have the funding and resources to advance genomics. This approach has stimulated a cultural change across biomedical research toward enhanced data sharing, increased collaboration in the scientific and medical communities, and a heightened appreciation for the impact of genomics on society.

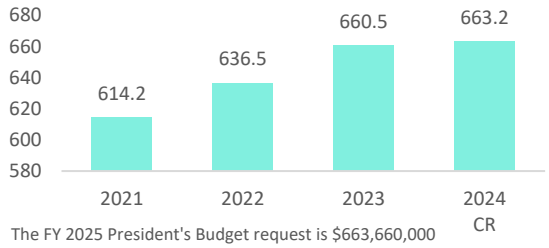
Research Funding Areas:

- Structure and Biology of the Genome
- Biology of Disease
- Genomic Medicine
- Data Science
- Early Career Training
- Ethical, Legal, and Social Implications of Genomics
- Small Business Innovation

Our Institute

385 FTEs
FY 2025 President's Budget

NHGRI Funding History by FY
($ in Millions)



The FY 2025 President's Budget request is $663,660,000

5% of NHGRI's research budget is dedicated to studying the ethical, legal, and social implications of genomics

From Bench to Bedside: Transforming Patient Care

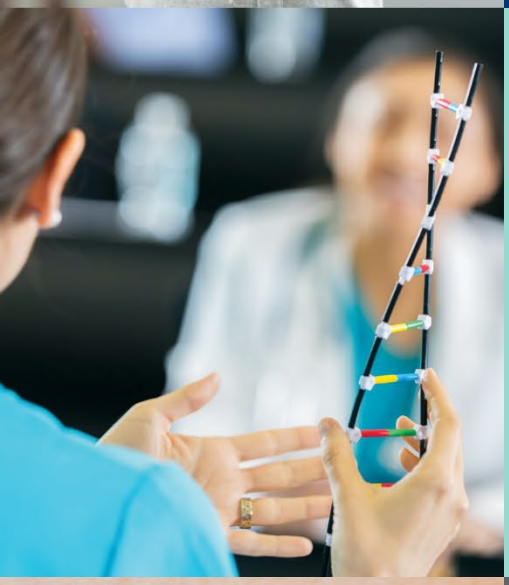
By catalyzing new technologies and building translational programs, our experts help understand, diagnose, and treat both rare and common diseases in sophisticated new ways.

Genomic Technologies

The research we fund paves the way for precision medicine and therapeutic interventions. NHGRI funded investigators and consortia are developing new genomic and data analysis tools to transform the study of human biology and disease. One such center, the Center for Genome Editing and Recording led by 2020 Nobel Prize winner Dr. Jennifer Doudna, employs CRISPR/Cas9 genome editing technology to understand how genomic variation contributes to disease and uncover new therapeutic targets.

Genomic Medicine

We are enabling healthcare professionals to use their patients genomic information for personalized care. NHGRI is implementing genomic medicine across different clinical settings and in diverse populations as part of the Implementing Genomics in Practice (IGNITE) Pragmatic Trials Network (PTN). By integrating genomic data into electronic medical records and clinical decision making, NHGRI is piloting new approaches for personalized treatments that will be available to everyone in the future.



Driving Responsible Use of Genomics

NHGRI is committed to advancing genomic knowledge and ensuring that genomics benefits the health of all humans. We consider the ethical, legal, and social implications (ELSI) of genomics in all aspects of our work. The ELSI Research Program supports transdisciplinary Centers of Excellence in ELSI Research (CEER) that examine cutting-edge questions in ELSI research and translate this scholarship into practice and policy.

Our teams:

- Explore privacy concerns and how to communicate study results to research participants and their providers.
- Strive to increase participation of underrepresented populations in research.
- Engage with diverse communities to increase genomic literacy.
- Work with policymakers to inform policy decisions for a future in which genomics is part of daily life.

A 2020 Vision for Genomics

In October 2020, NHGRI published a strategic vision for the next decade that aims to expand genomics into new frontiers and enable novel applications to human health and disease. Through a multi year process of strategic engagement, NHGRI collected input from diverse stakeholders at over 50 events. The anticipated advances in technology development, biological insights, and clinical applications will integrate genomics into virtually all areas of biomedical research, mainstream medical and public health practices, and everyday life. NHGRI's strategic vision highlights research opportunities and priorities that are at *The Forefront of Genomics*:

I. Providing a socially responsible and highly ethical framework for conducting human genomics research by establishing and adhering to guiding principles and values.

II. Facilitating genomic advances by sustaining and improving a robust foundation for genomics research.

III. Breaking down barriers in genomics through advances that create new research opportunities and improve clinical care.

IV. Defining and leading the pursuit of bold and compelling genomics research projects focused on elucidating genome function, understanding human disease, studying the societal implications of genomics, and improving human health.

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 mechanism and activity detail, and these highlights will not sum to the total change for the FY 2025 President's Budget request for the National Human Genome Research Institute (NHGRI) of $663.7 million, which is a 0.5 percent increase over the FY 2023 Final level of $660.5 million. Within this request level, NHGRI will pursue its highest research priorities through strategic investments and careful stewardship of appropriated funds.

Research Project Grants (RPGs) (-$9.5 million, total $314.8 million):
NHGRI will support a total of 424 Research Project Grant (RPG) awards in FY 2025, including SBIR/STTR awards. Costs for non-competing RPGs will increase by $5.1 million, supporting 4 more awards compared to the FY 2023 Final level. Funding for administrative supplements will decrease by $13.3 million compared to the FY 2023 Final level. Funding for competing RPGs will decrease by $1.1 million relative to the FY 2023 Final level, with 1 fewer award.

Intramural Research (+$6.6 million, total $141.2 million):
The increase of $6.6 million above the FY 2023 Final level will support critical NIH shared infrastructure and high priority intramural science that remains an important priority within the overall NHGRI research portfolio as well as pay increases and other inflationary costs. NHGRI will continue to support the data-science pursuits of the NIH Intramural Sequencing Center, which serves the entire NIH intramural research community by providing the infrastructure and expertise for bringing genome sequencing to the NIH Intramural Research Program. NHGRI will also continue to support resources, knowledgebases, and repositories that serve the entire genomics community.

Research Management and Support (+$2.4 million, total $46.9 million):
This increase of +$2.4 million above the FY 2023 Final level will support increased costs for the management of NIH and NHGRI infrastructure as well as pay increases and other inflationary costs for existing RMS activities.

NATIONAL INSTITUTES OF HEALTH

National Human Genome Research Institute

Budget Mechanism *

(Dollars in Thousands)

Mechanism	FY 2023 Final		FY 2024 CR		FY 2025 President's Budget		FY 2025 +/- FY 2023	
	Number	Amount	Number	Amount	Number	Amount	Number	Amount
Research Projects:								
Noncompeting	295	$227,419	301	$228,752	299	$232,486	4	$5,067
Administrative Supplements	*(46)*	$14,268	*(20)*	$7,189	*(4)*	$1,000	*-(42)*	-$13,268
Competing:								
Renewal	14	$10,731	19	$14,300	19	$14,000	5	$3,269
New	82	$54,134	79	$51,415	76	$49,797	-6	-$4,337
Supplements	0	$0	0	$0	0	$0	0	$0
Subtotal, Competing	**96**	**$64,865**	**98**	**$65,715**	**95**	**$63,797**	**-1**	**-$1,068**
Subtotal, RPGs	391	$306,552	399	$301,656	394	$297,283	3	-$9,269
SBIR/STTR	30	$17,679	29	$17,468	30	$17,485	0	-$194
Research Project Grants	421	$324,231	428	$319,124	424	$314,768	3	-$9,463
Research Centers								
Specialized/Comprehensive	2	$4,931	3	$6,136	2	$6,200	0	$1,269
Clinical Research	0	$0	0	$0	0	$0	0	$0
Biotechnology	1	$2,741	2	$3,000	2	$3,000	1	$259
Comparative Medicine	0	$0	0	$0	0	$0	0	$0
Research Centers in Minority Institutions	0	$0	0	$0	0	$0	0	$0
Research Centers	**3**	**$7,672**	**5**	**$9,136**	**4**	**$9,200**	**1**	**$1,528**
Other Research:								
Research Careers	33	$5,473	34	$5,555	34	$5,555	1	$82
Cancer Education	0	$0	0	$0	0	$0	0	$0
Cooperative Clinical Research	0	$0	0	$0	0	$0	0	$0
Biomedical Research Support	0	$0	0	$0	0	$0	0	$0
Minority Biomedical Research Support	0	$494	0	$502	0	$120	0	-$374
Other	97	$107,708	115	$109,356	114	$108,879	17	$1,171
Other Research	**130**	**$113,674**	**149**	**$115,413**	**148**	**$114,554**	**18**	**$880**
Total Research Grants	554	$445,577	582	$443,673	576	$438,522	22	-$7,055
Ruth L Kirschstein Training Awards:	FTTPs		FTTPs		FTTPs		FTTPs	
Individual Awards	22	$1,043	22	$1,090	22	$1,105	0	$62
Institutional Awards	161	$8,255	161	$10,978	159	$10,993	-2	$2,738
Total Research Training	**183**	**$9,299**	**183**	**$12,068**	**181**	**$12,098**	**-2**	**$2,799**
Research & Develop. Contracts	13	$26,445	9	$24,500	10	$24,900	-3	-$1,545
SBIR/STTR (non-add)	*(0)*	*($189)*	*(0)*	*($189)*	*(0)*	*($189)*	*(0)*	*($1)*
Intramural Research	230	$134,684	258	$137,296	258	$141,238	28	$6,554
Res. Management & Support	126	$44,506	127	$45,663	127	$46,902	1	$2,396
SBIR Admin. (non-add)		*($0)*		*($0)*		*($0)*		*($0)*
Construction		$0		$0		$0		$0
Buildings and Facilities		$0		$0		$0		$0
Total, NHGRI	**356**	**$660,510**	**385**	**$663,200**	**385**	**$663,660**	**29**	**$3,150**

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

NATIONAL INSTITUTES OF HEALTH

NATIONAL HUMAN GENOME RESEARCH INSTITUTE

For carrying out section 301 and title IV of the PHS Act with respect to human genome research, $663,660,000.

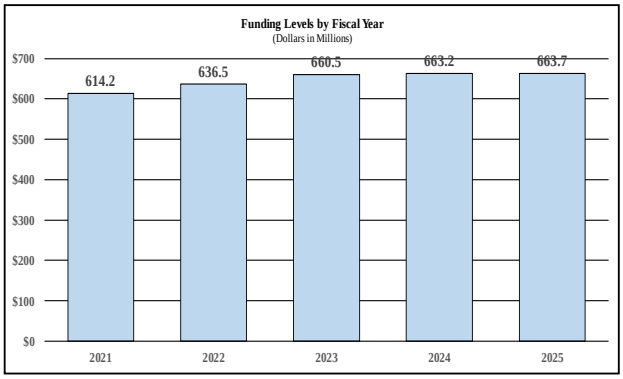
NATIONAL INSTITUTES OF HEALTH
National Human Genome Research Institute

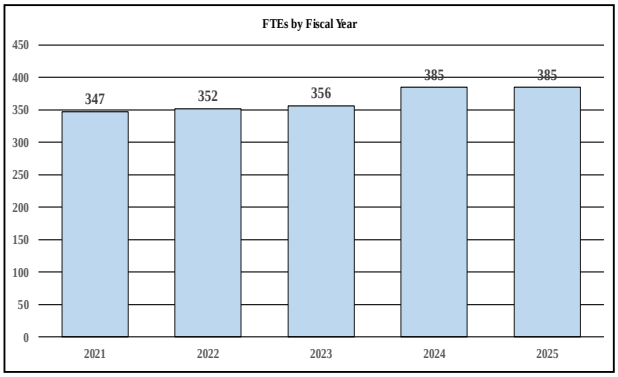
Summary of Changes
(Dollars in Thousands)

CHANGES	FY 2023 Final FTEs	FY 2023 Final Budget Authority	FY 2025 President's Budget FTEs	FY 2025 President's Budget Budget Authority	Built-In Change from FY 2023 Final FTEs	Built-In Change from FY 2023 Final Budget Authority
1. Intramural Research:						
A. Built-in cost changes:						
a. FY 2024 effect of FY 2023 pay & benefits increase		$49,715		$55,008		$586
b. FY 2024 effect of FY 2024 pay & benefits increase		$49,715		$55,008		$1,935
c. FY 2024 paid days adjustment		$49,715		$55,008		$191
d. Differences attributable to FY 2024 change in FTE		$49,715		$55,008		$6,088
e. FY 2025 effect of FY 2024 pay & benefits increase		$49,715		$55,008		$669
f. FY 2025 effect of FY 2025 pay & benefits increase		$49,715		$55,008		$902
g. FY 2025 paid days adjustment		$49,715		$55,008		$0
h. Differences attributable to FY 2025 change in FTE		$49,715		$55,008		$0
i. Payment for centrally furnished services		$20,862		$22,370		$1,507
j. Cost of laboratory supplies, materials, other expenses, and non-recurring costs		$64,069		$63,860		$5,167
Subtotal, IR built-in cost changes						$17,046
2. Research Management and Support:						
A. Built-in cost changes:						
a. FY 2024 effect of FY 2023 pay & benefits increase		$21,376		$23,212		$253
b. FY 2024 effect of FY 2024 pay & benefits increase		$21,376		$23,212		$832
c. FY 2024 paid days adjustment		$21,376		$23,212		$82
d. Differences attributable to FY 2024 change in FTE		$21,376		$23,212		$174
e. FY 2025 effect of FY 2024 pay & benefits increase		$21,376		$23,212		$281
f. FY 2025 effect of FY 2025 pay & benefits increase		$21,376		$23,212		$385
g. FY 2025 paid days adjustment		$21,376		$23,212		$0
h. Differences attributable to FY 2025 change in FTE		$21,376		$23,212		$0
i. Payment for centrally furnished services		$1,082		$1,160		$78
j. Cost of laboratory supplies, materials, other expenses, and non-recurring costs		$22,048		$22,529		$1,260
Subtotal, RMS built-in cost changes						$3,345

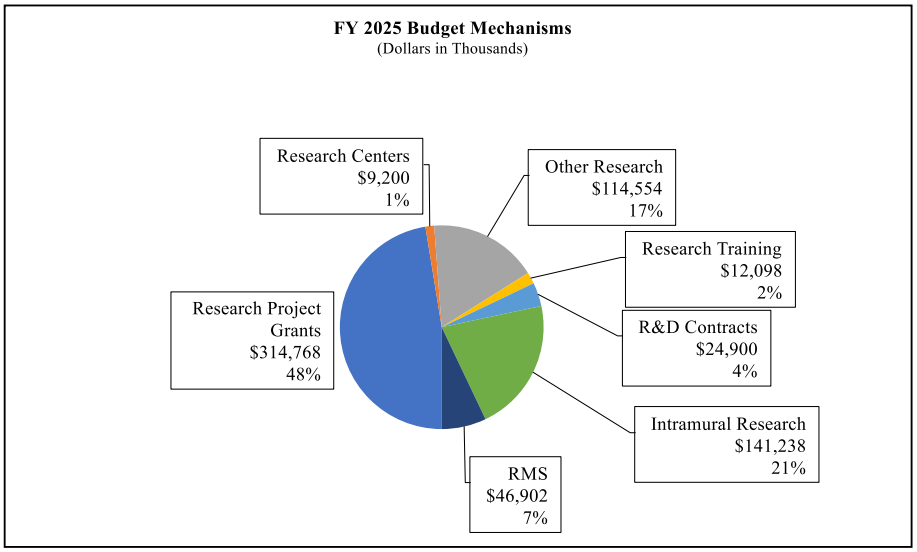
CHANGES	FY 2023 Final No.	FY 2023 Final Amount	FY 2025 President's Budget No.	FY 2025 President's Budget Amount	Program Change from FY 2023 Final No.	Program Change from FY 2023 Final Amount
B. Program:						
1. Research Project Grants:						
a. Noncompeting	295	$241,687	299	$233,486	4	-$8,201
b. Competing	96	$64,865	95	$63,797	-1	-$1,068
c. SBIR/STTR	30	$17,679	30	$17,485	0	-$194
Subtotal, RPGs	421	$324,231	424	$314,768	3	-$9,463
2. Research Centers	3	$7,672	4	$9,200	1	$1,528
3. Other Research	130	$113,674	148	$114,554	18	$880
4. Research Training	183	$9,299	181	$12,098	-2	$2,799
5. Research and development contracts	13	$26,445	10	$24,900	-3	-$1,545
Subtotal, Extramural		$481,320		$475,520		-$5,800
6. Intramural Research	230	$134,684	258	$141,238	28	-$10,492
7. Research Management and Support	126	$44,506	127	$46,902	1	-$948
8. Construction		$0		$0		$0
9. Buildings and Facilities		$0		$0		$0
Subtotal, program changes						-$17,240
Total built-in and program changes	356	$660,510	385	$663,660	29	$3,150

History of Budget Authority and FTEs:

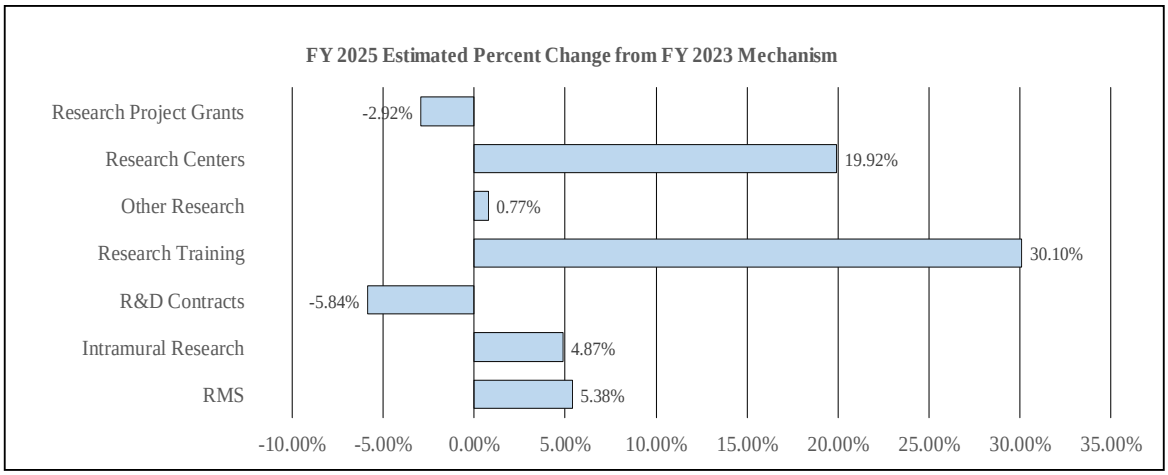




Distribution by Mechanism:

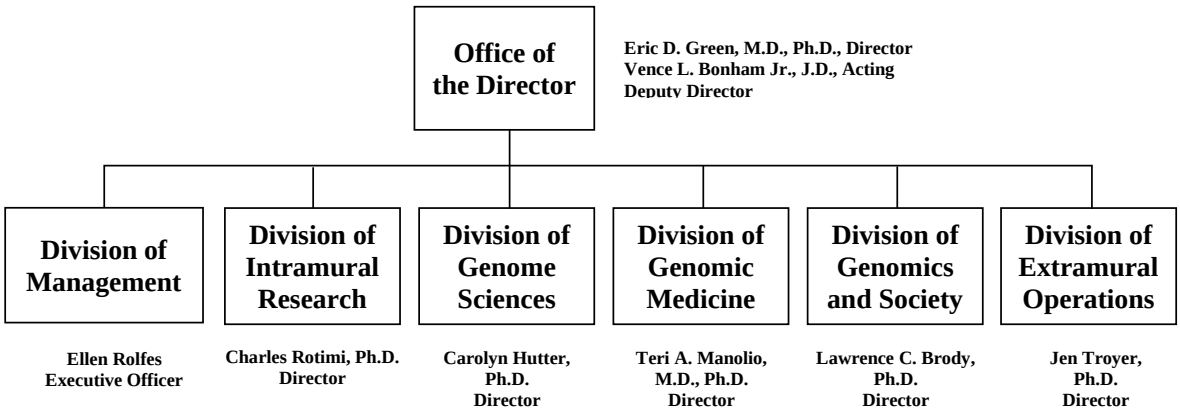


Change by Selected Mechanisms:



NATIONAL HUMAN GENOME RESEARCH INSTITUTE

Organizational Structure



NATIONAL INSTITUTES OF HEALTH
National Human Genome Research Institute

Budget Authority by Activity *
(Dollars in Thousands)

	FY 2023 Final		FY 2024 CR		FY 2025 President's Budget		FY 2025 +/- FY 2023 Final	
Extramural Research	**FTE**	**Amount**	**FTE**	**Amount**	**FTE**	**Amount**	**FTE**	**Amount**
Detail								
Genome Biology and Technology		$195,391		$195,484		$194,526		-$865
Genomics and Disease		$158,937		$159,504		$159,613		$677
Genomics and Medicine		$105,072		$105,438		$105,492		$420
Genomic Data Science		$93,940		$94,157		$94,008		$69
Genomics Workforce		$28,220		$28,378		$28,501		$281
Genomics and Society		$34,444		$34,576		$34,617		$172
(Extramural Research (non-add))		*($481,320)*		*($480,241)*		*($475,520)*		*-($5,800)*
(Intramural Research (non-add))	**230**	*($134,684)*	**258**	*($137,296)*	**258**	*($141,238)*	**28**	*($6,554)*
Subtotal, Program Activity [1]		**$616,004**		**$617,537**		**$616,758**		**$754**
Research Management & Support	**126**	**$44,506**	**127**	**$45,663**	**127**	**$46,902**	**1**	**$2,396**
TOTAL	**356**	**$660,510**	**385**	**$663,200**	**385**	**$663,660**	**29**	**$3,150**

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

[1] The detail programs listed above include both Extramural and Intramural funding.

National Human Genome Research Institute

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

Budget Authority (BA):

	FY 2023 Final	FY 2024 CR	FY 2025 President's Budget	FY 2025 +/- FY 2023
BA	$660,510,000	$663,200,000	$663,660,000	$3,150,000
FTE	356	385	385	29

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

Overall Budget Policy: The FY 2025 President's Budget request for the National Human Genome Research Institute (NHGRI) is $663.7 million, an increase of $3.2 million compared with the FY 2023 Final level. This funding level will support cutting edge human genomics research at the Forefront of Genomics, including advances in technology development, biological insights, and clinical applications that will lead to more widespread integration of genomics into almost all areas of biomedical research, the adoption of genomics into mainstream medical and public-health practices, and an increasing relevance of genomics for everyday life.

Program Descriptions

Genome Biology and Technology: Since the inception and subsequent completion of the Human Genome Project, seismic innovations in genomic technologies have catalyzed significant advances in gaining knowledge about the human genome. The NHGRI-funded Telomere-to-Telomere (T2T) Consortium recently completed the first gapless sequence of a human Y chromosome, publishing their findings in August 2023.[2] This accomplishment means that we now have complete sequences of all human chromosomes. The Y chromosome was the last human chromosome to be completely sequenced end-to-end, as truly complete sequences for the other 23 human chromosomes were completed by the T2T Consortium in 2022. Successes such as these are only now possible because of the new DNA sequencing technologies and analysis methods, many of which were developed and spearheaded with NHGRI funding.

Sustained investment in technology development has allowed the Human Genome Reference Program (HGRP) to continue its commitment to maintaining and advancing the reference human genome sequence. The goal of the program is to ensure the reference human genome sequence, which is essential for all studies involving human DNA, is representative of human diversity.

[2] nature.com/articles/s41586-023-06457-y

Specifically, the program aims to generate at least 350 high-quality reference human genome sequences and incorporate them into a "pangenome" reference that captures the breadth of human genomic diversity. The HGRP has already sequenced the genomes of 150 individuals and made these data available in multiple repositories. The HGRP was renewed in FY 2023 and has released three new funding announcements, including one focused on the development of informatics tools for the pangenome that will benefit the genomics community in FY 2025 and beyond.

NHGRI's Genome Technology Program fuels the study of the human genome. The program recently diversified its portfolio, expanding from a strong focus on nucleic acid (e.g., DNA) sequencing to supporting efforts in other types of genomic technologies, including technologies for synthesizing nucleic acids and sequencing proteins at single-molecule resolution. In FY 2025, the Genome Technology Program plans to continue to support a coordinating center, which enhances integration among the program's more than 50 active grants in order to coordinate efforts from across the breadth of genomic technology development efforts. To ensure that investigators throughout the research community have access to technologies that allow for robust genomic analyses, NHGRI continues to support the Center for Inherited Disease Research (CIDR). In FY 2025, CIDR will continue its mission to provide cutting-edge genomic services to NIH-funded investigators, including large research consortia.

In order to unlock the potential for scientific discovery that comes with the generation of new technologies and high-quality genome sequences, it is critically important to invest in efforts to characterize the influence of genomic variation within functional elements of the human genome. NHGRI continues to be a leader in this key area of genomics. NHGRI's Impact of Genomic Variation on Genome Function (IGVF) Consortium is working to systematically understand the effects of genomic variation on genome function and how these effects shape phenotypes (i.e., observable characteristics). IGVF has completed its first two years and is now scaling up with the goal of creating a map of genomic variant effects. IGVF has also been working with other consortia to ensure clinical utility of the data, as well as engaging in collaborative work within the consortium to expand the program's reach. In FY 2025 and beyond, IGVF will continue to develop a catalog of the effects of genomic variants, which will serve as an important resource for the scientific and clinical communities to enhance understanding of how genomic variation influences human health and disease.

One way to glean insights into the functional landscape of the human genome is to perform comparative studies between human genomes and those of various non-human animal species. NHGRI has been instrumental in the initial genome-sequencing efforts for many different species, mostly through funding provided to its Large-Scale Sequencing and Analysis Centers. Other prior work in comparative genomics and model organisms includes the Comparative Genomics Research Program, participation in the NIH Common Fund Knock-Out Mouse Phenotyping Program, the ENCyclopedia Of DNA Elements 4 (ENCODE4), and the Model Organism ENCyclopedia Of DNA Elements (modENCODE) projects, which together seek to better understand the genomes of humans, mice, and other fundamentally important research organisms. Currently, NHGRI funds the Model Organism Databases, the Alliance of Genome Resources, and the NIH-funded final phase of the Knock-out Mouse Phenotyping Program.

NHGRI-funded investigators also explore the connections between genome structure, function, and health using comparative genomics approaches.

Comparative genomics can also contribute to better understanding the roles of genes in the development and function of different organs. This is the focus of the Non-Human Primate Developmental Genotype-Tissue Expression Project, which is being conducted in collaboration with the National Institute of Mental Health (NIMH) and the Office of Research Infrastructure Programs within the NIH Office of the Director. In FY 2025, this project will continue working to establish a resource database and associated tissue bank with data and samples from old world and new world primates at developmental stages corresponding to those studied in humans as well as pre-natal stages. This will complement the Developmental Genotype-Tissue Expression Project, which is co-funded by NHGRI, the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, the National Institute of Neurological Disorders and Stroke, and NIMH.

Gaining a fundamental understanding of genome biology at different life stages will be important for using genomic information in the clinic. The Developmental Genotype-Tissue Expression Project studies gene expression patterns in the first 18 years of life by analyzing tissues from recently deceased pediatric donors. The project's main goal is to establish a molecular and data-analysis resource, as well as a tissue bank to aid researchers working to elucidate gene-expression patterns during development and early human life. This will help understand developmental disorders and childhood diseases, which are so devastating to patients and families. NHGRI is also a key contributor to NIH Common Fund efforts in this area, such as the Human BioMolecular Atlas Program and the 4D Nucleome Program, both of which seek to understand how genomes operate across time and space. The former was recently featured in a special cross-journal collection that included 11 papers in *Nature*, along with companion papers in other journals. These papers highlighted the progress made by the more than 400 researchers across 60 sites since the program's inception in 2018. The Human BioMolecular Atlas Program data portal[3] contains over 2,000 datasets obtained from more than 30 organs, while the 4D Nucleome Program portal[4] includes nearly 2,000 datasets from hundreds of experiments. Both of these portals are publicly available and will continue to grow in FY 2025 and beyond.

Budget Policy: The FY 2025 President's Budget request for Genome Biology and Technology is $194.5 million, a decrease of $0.9 million or 0.4 percent from the FY 2023 Final level. With these funds, NHGRI will continue to support the development of novel nucleic acid sequencing technologies and data-analysis methods. NHGRI will also continue to fund the efforts of the Human Genome Reference Program to produce reference human genome sequences that are more representative of humanity.

Genomics and Disease: The path to realizing the promise of genomic medicine requires an ever-growing understanding of both how genomic variation influences biological function and how these effects contribute to human disease. The set of Bold Predictions for Human Genomics by 2030 listed in the 2020 NHGRI Strategic Vision included that: "The biological function(s) of

[3] portal.hubmapconsortium.org/
[4] data.4dnucleome.org/

Multi-Omics for Health and Disease Consortium

Recent advances in high-throughput laboratory technologies have increased the generation of different 'omic data types, such as genomic, proteomic, and metabolomic data. Each of these data types provides distinct information about a biological system, such as the sequence of genes and the levels of proteins and metabolites. The integration and subsequent analysis of multiple data types from a single participant's biological sample can provide a more holistic view of the molecular factors and cellular processes involved in human health and disease. The use of multi-omics approaches offers great promise for applications such as defining disease subtypes and discovering drug targets.

The Multi-Omics for Health and Disease Consortium is a collaborative initiative established in FY 2023. The consortium aims to advance the application of multi-omic technologies to study health and disease in ancestrally diverse populations. This program emanated from the 2020 NHGRI Strategic Vision and is co-funded by the National Cancer Institute and the National Institute of Environmental Health Sciences. The consortium includes three components: six Disease Study Sites, an 'Omics Production Center, and a Data Analysis and Coordination Center. The sites will enroll research participants – at least 75 percent of whom will be from ancestral backgrounds underrepresented in genomics research – using meaningful community engagement strategies. This will include maximizing benefits from participation by investigating health issues relevant to participants' communities and creating opportunities for community input throughout the program. The sites will also collect data on participants' environments and social determinants of health, which will be used in conjunction with the multi-omics data. Collected specimens will be analyzed using high-throughput molecular assays to generate multi-omics data. These data will then be incorporated into large, organized datasets that will be widely available to the broader research community. These datasets will be made interoperable with existing resources, such as the National Heart, Lung, and Blood Institute's Trans-Omics for Precision Medicine (TOPMed) Program and the NIH *All of Us* Research Program.

While the consortium will likely provide new insights into the underlying causes of individual diseases, the program's primary goal is to develop scalable and generalizable multi-omics research strategies. The program is also prioritizing the generation of multi-omic and phenotypic data from ancestrally diverse participants, which is essential for achieving equitable benefits from multi-omics research advances. These strategies will ultimately be adopted by other groups, ensuring the consortium's work will have broad and long-lasting impacts for clinical research.

every human gene will be known; for elements in the human genome that do not code for proteins, such knowledge will be the rule, rather than the exception." A powerful way to understand the function of a gene is to study what happens when it is inactivated – or "knocked out." Conceived to address this bold prediction, the Molecular Phenotypes of Null Alleles in Cells (MorPhiC) Program aims to develop a catalog of molecular and cellular phenotypes that result from inactivating each human gene. Currently in its first five-year phase, MorPhiC consists of four Data Production Research and Development Centers, three Data Analysis and Validation Centers, and a Data Resource and Administrative Coordinating Center; these centers work together to leverage cell culture models that mimic human tissues and organs and offer clues about gene function at scale. MorPhiC will begin its second phase in FY 2026.

While single "omic" analyses are valuable, recent studies have shown that "multi-omic" approaches – which integrate many data types beyond the DNA sequence (e.g., proteomics, the study of the interactions, function, composition, and structures of proteins) – can provide a more complete view of the underpinnings of human health and disease. These findings can improve the classification of diseases into clinically relevant subgroups and potentially identify biomarkers and drug targets for future testing and treatments. The Multi-Omics for Health and Disease Consortium, co-funded by NHGRI, the National Cancer Institute (NCI), and the National Institute of Environmental Health Sciences, is a collaborative initiative that will advance the application of multi-omic technologies to study health and disease in ancestrally diverse populations (see Program Portrait).

NHGRI's investments into understanding the impacts of genomic variation on disease and human health have borne fruit in both rare and common disease. The Genomics Research to Elucidate the Genetics of Rare Diseases (GREGoR) Consortium aims to increase the proportion of Mendelian disorders with an identified genetic cause. Past

efforts in discovering the genetic causes of rare diseases have primarily focused on whole-exome sequencing, which only samples genes that code for proteins, but not other regions of the human genome. While this has generally been successful, the causes of many rare disease cases have not been elucidated, even following the use of this approach. GREGoR is developing new ways to tackle the more difficult cases and to create a new paradigm for approaching rare disease gene discovery in order to increase diagnostic yield and make rare disease diagnosis accessible to all. In FY 2025 and beyond, the GREGoR Consortium is prioritizing making the program's data more useful to the research community; examining the value of using different reference genome sequences for genomic-based diagnoses; effectively applying long-read DNA sequencing, RNA sequencing, and other -omic technologies for rare disease diagnoses; and sharing information about candidate genes and genomic variants with the broader genomics community.

Although rare monogenic disorders (i.e., those involving a single gene) collectively represent a significant public health burden, the most common diseases afflicting the United States and worldwide populations (e.g., heart disease and diabetes) are caused by complex interactions that involve many genomic variants in conjunction with influences of physical and social environments. NHGRI's Centers for Common Disease Genomics (CCDG) program was designed to study common, complex diseases to understand common disease architecture and find genomic variants that increase or decrease risk for disease. Continued funding and investment in the CCDG program has allowed for an unprecedented degree and depth of genome sequencing in cardiovascular and neuropsychiatric disease, thanks to collaborations with the National Heart, Lung, and Blood Institute and the National Institute on Aging (NIA), respectively.

Budget Policy: The FY 2025 President's Budget request for Genomics and Disease is $159.6 million, an increase of $0.7 million or 0.4 percent from the FY 2023 Final level. These funds will support the efforts of MorPhiC, the Multi-Omics for Health and Disease Consortium, GREGoR, and the CCDG program, as well as the maintenance and expanded capacity of critical genomic databases, catalogs, and knowledgebases that facilitate the use of genomics for studying human disease.

Genomics and Medicine: While a foundational understanding of how genomic variation contributes to human disease is essential for realizing the promise of genomic medicine, successful implementation of genomic medicine will only occur following the robust study of how best to integrate genomics into the healthcare ecosystem. NHGRI provides support for essential clinician resources and initiatives designed to bring innovations in genomic medicine implementation to many different real-world clinical settings.

In order to fully integrate knowledge about genomic variation into clinical care, it is necessary to aggregate phenotypic and clinical information on genes and variants across the genome. In the midst of a five-year renewal co-funded by NCI and with annual funding of approximately $14.5 million, the Clinical Genome Resource (ClinGen) is an essential resource that provides information about the clinical relevance of genes and genomic variants for use in medicine and research. ClinGen celebrated its tenth anniversary in 2023 and among its ranks are over 2,000

disease experts, laboratory directors, genetic counselors, and other research members from over 50 countries – all contributing to ClinGen data sharing and curation efforts. During this renewal phase, ClinGen is focusing on three themes: (1) engaging patients, healthcare systems, scientific experts, and genetics professionals; (2) increasing the scale of the consortium's work and its applications to a broader set of clinical specialties; and (3) embracing diversity in all regards – from diversity of the genomics workforce to the diversity of the patients and population databases.

Realizing the promise of genomic medicine for complex common diseases requires improved methods for genomic risk prediction that can be used in all populations. A polygenic risk score (PRS) is calculated based on the total number of disease-associated genomic variants that a person harbors, and it can be used to assess a person's risk for developing certain diseases. However, at present, these risk scores are less applicable to non-European individuals due to the lack of sufficient genomic data from these populations. The Polygenic RIsk MEthods in Diverse populations (PRIMED) Consortium, supported by NHGRI and NCI, is working to improve PRS usage by studying larger numbers of non-European individuals. Multiple PRIMED sites are developing and evaluating PRS models for various common diseases, including cardiovascular disease, diabetes, and cancer. These efforts demonstrate the benefit of using data from diverse populations to build models with better predictive capability across populations. In FY 2025 and beyond, PRIMED will continue to publish collaborative research; develop tools, pipelines, and reference panels; and disseminate recommendations to ensure PRS research and implementation are inclusive and generalizable and do not contribute to health disparities.

The efforts of ClinGen, PRIMED, and several other NHGRI programs that work to ensure all

Health Equity in Genomics

Although basic discoveries and technological advances have fueled the application of genomics to better understand human health and disease, not all populations have benefitted equally. Without equity in research, resource allocation, and clinical practice, disparities in the benefits of genomics research and its applications will persist and possibly increase. Many of the guiding principles and values for human genomics articulated in the 2020 NHGRI Strategic Vision demonstrate NHGRI's unwavering commitment to health equity and the prevention of disparities in genomics research and genomic medicine.

NHGRI's Training, Diversity, and Health Equity (TiDHE) Office is leading initiatives aimed at reducing health disparities and fostering health equity in genomics. In partnership with the National Institute on Aging, the National Cancer Institute, and the NIH Office of Research on Women's Health, the TiDHE Office recently released two funding opportunities for investigator-initiated research in genomics and health equity. The goals of these opportunities are to develop approaches, generate and disseminate data, and implement metrics and interventions that will advance the equitable use of genomics to improve health for everyone. Community engagement efforts, as relevant to the research questions being addressed, will be highly encouraged.

Community engagement enables researchers to build authentic partnerships, cultivate public trust, and empower individuals traditionally underrepresented in genomics research. Recognizing the critical role that community engagement plays in working towards health equity in genomics, NHGRI's Clinical Genome Resource (ClinGen) developed a Justice, Equity, Diversity, and Inclusion Action Plan as a roadmap for taking action in those areas. The accessibility of ClinGen's patient registry (GenomeConnect) was recently expanded by providing a Spanish-language version of the website and enrollment materials. The latter are also now provided in accessible formats for those with visual and hearing impairments. ClinGen has convened three international workshops on gene and genomic variant curation that involved attendees primarily from low- and middle-income countries. In FY 2023, NHGRI created the Diversity Centers for Genome Research Program, which is establishing Genomic Research Centers at Minority Serving Institutions to perform innovative genomics research and increase the pool of diverse genomic scientists. Additionally, each Center includes a Community Engagement Core. Finally, NHGRI recently started a collaboration with the NIH Community Engagement Alliance to support the development and assessment of practices for community-engaged genomics research and strategies to increase participation of individuals historically underrepresented in genomics research.

people benefit from genomic medicine demonstrate NHGRI's commitment to health equity. In collaboration with NIA, NCI, the *All of Us* Research Program, and the NIH Office of Research on Women's Health, NHGRI recently published two funding opportunities to support investigator-initiated genomics research in health equity (see Program Portrait).

In order to effectively implement genomic medicine, healthcare providers and systems as well as patients themselves must be able to incorporate genomic information into healthcare. A new initiative, the Network of Genomics-Enabled Learning Health Systems recently released two funding opportunities. The program aims to establish a network of institutions, including resource-limited institutions, that are using learning health system approaches. In FY 2025, these institutions will identify and create learning health system tools and resources to improve approaches for the adoption of genomics into clinical practice.

NHGRI's Small Business Program also uses congressionally mandated set-aside funds to support projects for commercial genomics activities, including in genomic medicine. A Notice of Special Interest, [5] issued by the Small Business Program and continuing through FY 2025, encourages applications to develop and implement patient-facing genomic-based clinical informatics tools that incorporate genomic information.

Budget Policy: The FY 2025 President's Budget request for Genomics and Medicine is $105.5 million, an increase of $0.4 million or 0.4 percent from the FY 2023 Final level. In FY 2025, ClinGen will continue to advance the implementation of genomic medicine by supporting the successful integration of genomics into clinical decision making and care. Using FY 2025 funds, PRIMED will work to improve the predictive ability and responsible use of PRSs to assess disease risk in diverse populations.

Genomic Data Science: Progress in genomic data science is enabling researchers to use powerful computational and statistical methods to decode the fundamental information within DNA sequences and apply that information to better understand genome function and implement genomic medicine. NHGRI is a leader in robust and coordinated genomic data science efforts. Effectively aligning with the 2020 NHGRI Strategic Vision and the NIH Strategic Plan for Data Science, the Office of Genomic Data Science (OGDS) was established in 2021 to develop, promote, and support NHGRI's genomic data science activities. The potential of genomic data science cannot be fully realized without effective data sharing, which is vital for scientific rigor and provides a broad foundation for new discoveries. The work of OGDS has enabled NHGRI to be a leader in data sharing, including implementation of the NIH Data Management and Sharing (DMS) Policy,[6] by providing relevant information and resources to the genomics community (e.g., including a library of sample DMS plans on the Institute's website, genome.gov).

The NHGRI Genomic Data Science Analysis, Visualization, and Informatics Lab-Space (AnVIL) inverts the traditional model of genomic data sharing, providing a cloud environment for the analysis of large genomic and genomics-related datasets. AnVIL facilitates integration and computing across large datasets generated by NHGRI-funded programs, as well as other

[5] grants.nih.gov/grants/guide/notice-files/NOT-HG-22-011.html
[6] sharing.nih.gov/data-management-and-sharing-policy

initiatives funded by NIH and other agencies that support human genomics research. AnVIL is a component of the emerging federated data ecosystem and actively collaborates and integrates with other genomic data resources through the adoption of the Findable, Accessible, Interoperable, and Reusable (FAIR) principles.[7] AnVIL provides a collaborative environment and interface for researchers and consortia. AnVIL also offers training and functionality for both users who have limited computational expertise and those with strong data science backgrounds. AnVIL was renewed in FY 2023, marking the launch of its second phase, during which the AnVIL platform will continue to expand by adding analysis tools and workflows, improving interoperability with other cloud-based resources, and providing more educational offerings. In FY 2025, AnVIL will continue to work toward its goal of creating a multi-functional platform for genomic data science.

NHGRI also demonstrates its commitment to genomic data science and responsible data sharing via partnerships within the Institute, across NIH, and beyond. The NHGRI Genomic Data Science Working Group – a working group of the National Advisory Council for Human Genome Research – will continue to advise the institute leadership in FY 2025, addressing broad challenges such as data management, data analysis, biocomputing, and data science policy. NHGRI also plays a leading role in the NIH Data Science Policy Council, which aims to address the growing policy challenges and opportunities associated with "big data" and data science in biomedical research and to promote the maximum public benefit from data used in a responsible manner. In FY 2025, NHGRI will continue to support the data-science pursuits of the NIH Intramural Sequencing Center, which serves the entire NIH intramural research community by providing the infrastructure and expertise for bringing genome sequencing to the NIH Intramural Research Program. NHGRI will also continue to support resources, knowledgebases, and repositories that serve the entire genomics community.

Budget Policy: The FY 2025 President's Budget request for Genomic Data Science is $94.0 million, an increase of $0.1 million or 0.1 percent from the FY 2023 Final level. With FY 2025 funds, NHGRI will continue to push the frontiers of data-analyses technologies. AnVIL will continue to provide a cutting-edge resource for the storage, analysis, and sharing of genomic data.

Genomics Workforce: Attracting, developing, and retaining a diverse and talented genomics workforce is a top priority for NHGRI and will be necessary to ensure that genomics-based breakthroughs improve human health for all. Part of the charge of NHGRI's Training, Diversity, and Health Equity (TiDHE) Office is to support initiatives that expand opportunities for genomics education, training programs, career access, and other workforce development for individuals underrepresented in biomedical research. To that end, TiDHE supports many programs that cultivate these opportunities, and it has launched the annual Outstanding Award for Enhancing Diversity, Equity, Inclusion, and Accessibility (DEIA) in the Genomics Workforce to honor professionals who have made significant impacts on enhancing DEIA. Through TiDHE's efforts, NHGRI will continue to be a leader in fostering a diverse and talented genomics workforce in FY 2025 and beyond.

[7] go-fair.org/fair-principles/

NHGRI has issued a series of funding opportunities focused on genomics workforce diversity that will remain active in FY 2025. The Genome Research Experiences to Attract Talented Undergraduates into the Genomic Field to Promote Diversity program supports collaborations between minority-serving institutions or Institutional Development Awards (IDeA)-eligible Institutions and research-intensive institutions with a prominent genomics research training environment. The Entry-Level Modules for training the genomics research workforce program are intended to: (1) develop, implement, and evaluate modules of genomics-related curriculum for the entry-level genomics research workforce by supporting lead sites teamed with partner sites, such as community, technical, and tribal colleges; and (2) enhance diversity in the genomics workforce by supporting and facilitating training and career opportunities for the entry-level workforce. The Educational Hub for Enhancing Diversity in Computational Genomics and Data Science, launched in FY 2023, aims to enhance diversity in cloud-based genomic data science education and support educational opportunities for undergraduate and masters' degree students who are enrolled in institutions currently underrepresented in genomics and data science.

The Genomic Science and Health Equity Postdoctoral Fellowship is a joint training program established by NHGRI and the Food and Drug Administration's Office of Minority Health and Health Equity. The program prepares fellows to use genetic, genomic, and pharmacogenomic approaches to advance minority health and health equity, while developing skills to better understand the delivery of drugs, biologics, and medical devices from the bench to the bedside. The second Genomic Science and Health Equity Postdoctoral Fellow began in FY 2023. NHGRI also continues to fund the Genomic Innovator Awards and – in partnership with the American Society of Human Genetics – the Human Genetics Scholars Initiative (HGI) to support early-career researchers. The HGI Initiative was developed to advance diversity and inclusion in the human genetics and genomics research workforce and recently announced its 2023-2025 cohort of scholars.

In addition to supporting summer interns, post-baccalaureate fellows, graduate students, and postdoctoral fellows of all backgrounds, the NHGRI Intramural Research Program participates in the NIH Office of Intramural Training and Education's High School Scientific Training and Enrichment Program 2.0, which is offered to high school seniors who have limited research experience, providing them the opportunity to perform biomedical research at NIH. NHGRI's Education and Community Involvement Branch provides genomics education and training resources for healthcare providers, tribal colleges, high school teachers, and other professionals. NHGRI remains committed to supporting the training of the next generation of genomics professionals in FY 2025 and beyond.

Budget Policy: The FY 2025 President's Budget request for Genomics Workforce is $28.5 million, an increase of $0.3 million or 1.0 percent from the FY 2023 Final level. These funds will be used by NHGRI to continue supporting diverse trainees in genomics at all stages of their careers and to aid in the support of early-stage investigators.

Genomics and Society: The 2020 NHGRI Strategic Vision outlined a set of principles and values for human genomics, and these were extensively informed by a lengthy history of ethical, legal, and social implications (ELSI) research. NHGRI dedicates at least five percent of its

Center for ELSI Resources and Analysis (CERA)

When the Human Genome Project began, concerns were raised about how genomic information would be used and how individuals and society could be protected from possible harm due to genomic advances. In response, NHGRI established the Ethical, Legal, and Social Implications (ELSI) Research Program in 1990 to support studies that anticipate, analyze, and address the societal impact of genomics. Currently, five percent of NHGRI's research budget is dedicated to ELSI research. Ongoing advances in genomic technologies and data science, in conjunction with continued reductions in the cost of DNA sequencing, have rapidly increased the number of human genomes being sequenced. The ready availability of genomic data has transformed biomedical research and is having a large impact on healthcare and other aspects of society, continually yielding new questions for ELSI research.

Ensuring that the results of ELSI research are broadly accessible will be important to help mitigate harms and maximize benefits of advancing genomic knowledge, data, and technologies. Because ELSI research is highly interdisciplinary and heterogeneous, it can be difficult to locate and summarize. In FY 2019, the Center for ELSI Resources and Analysis (CERA) was established to address these concerns, with an overarching aim of fostering a more integrated and connected ELSI research community. In FY 2021, CERA launched ELSIhub, an online web-based platform that aims to enhance the production and use of scholarship materials associated with genomics-focused ELSI research. ELSIhub offers many features to facilitate resource sharing and community building among ELSI scholars, clinicians, educators, trainees, the wider genomics community, and beyond. ELSIhub Collections assemble materials on fundamental and emerging ELSI topics from the cross-disciplinary literature to make key information accessible. ELSIhub TraineeHub provides a central location for networking and resources for trainees and early-career ELSI scholars; this space is operated by and designed for trainees, with ELSIhub staff providing assistance in organizing webinars, workshops, and other events on topics chosen by the TraineeHub community. Open to all trainees, this resource aims to equalize access to some of the resources and discussions necessary for success in ELSI research.

In FY 2024, CERA will be renewed to continue and build upon key functions while also innovating content and expanding the resource's reach. CERA will increase the availability and visibility of ELSI research products and resources for use by NHGRI- and NIH-funded programs as well as by other domestic and international genomics efforts. It will also continue to serve as a source of expertise for the larger research and policy communities.

research budget to ELSI research, making the Institute unique at NIH. While the origins of ELSI research in genomics date back to the beginning of the Human Genome Project, this area of research has grown to include a large portfolio of studies that examine the intersection of genomics, law, ethics, philosophy, and society.

The NHGRI ELSI Research Program funds research studies, training opportunities, and workshops. It also develops and supports research consortia and conferences in four broad areas: (1) Genomics and Sociocultural Structures and Values; (2) Genomics at the Institutional and System Level; (3) Genomic Research Design and Implementation; and (4) Genomic Healthcare. The ELSI Research Program has a particular focus on studies that explore these issues in relation to communities that have been underrepresented, underserved, and/or mistreated by biomedical research and healthcare.

In addition to its three active program announcements, the ELSI Research Program supports the Centers of Excellence in ELSI Research program, which funds four research centers at universities across the country, and the Center for ELSI Resources and Analysis (CERA), which assists in establishing a more integrated ELSI research community. The latter was renewed in FY 2024. In FY 2025, CERA plans to build on work completed during the initial funding period, prioritizing the following goals: (1) provide ELSI researchers with an online platform to share ELSI research products; (2) curate and synthesize ELSI research studies and results; and (3) facilitate new research collaborations and uptake of ELSI research (see Program Portrait). The ELSI Research Program also supports ELSI research that is embedded within other NHGRI programs and projects, such as Developmental Genotype-Tissue Expression (dGTEx), the PRIMED Consortium, and the Human Pangenome Reference Consortium. Looking forward, key areas of focus for the ELSI Research Program include transdisciplinary

scholarship, community engagement, and investigation of timely ELSI issues, such as gene-environment interactions, use of population descriptors, artificial intelligence, and data privacy and accessibility. The ELSI Research Program is also strengthening partnerships with other NIH ICOs to address these goals and to better coordinate ELSI research across the NIH.

Intramural investigators in NHGRI's Social and Behavioral Research Branch approach research using a social genomics lens. In FY 2025 and beyond, NHGRI researchers in this Branch will continue to explore how genomic discoveries intersect with society.

Budget Policy: The FY 2025 President's Budget request for Genomics and Society is $34.6 million, an increase of $0.2 million or 0.5 percent from the FY 2023 Final level. In FY 2025, NHGRI will continue to fund ELSI research that is critical for ensuring ethical and successful advances in genomics.

Research Management and Support: Within NHGRI's Division of Genomics and Society and alongside the ELSI Research Program, the Policy and Program Analysis Branch (PPAB) and the Education and Community Involvement Branch (ECIB) use Research Management and Support funds to enhance NHGRI's mission of furthering genetics and genomics research by engaging with policymakers, community partners, educators, researchers, clinicians, and the public.

PPAB supports NHGRI in a broad range of activities, including Congressional relations; program and portfolio analysis; policy tracking, dissemination, analysis, and development; community engagement; and resource development for both scientific and lay audiences. Recently, PPAB prepared briefs on patent eligibility, laboratory-developed tests, and coverage and reimbursement for genetic testing. PPAB also participated in an NHGRI-wide effort to develop an explainer on the use of population descriptors in genomics, which is now publicly available on the institute's website, genome.gov. PPAB also continues to maintain the Genome Statute and Legislation Database,[8] which is comprised of state statutes and bills relevant to genetics and genomics and serves as a resource for the genomics and policy communities. In FY 2025, PPAB will continue to focus its portfolio on addressing emerging policy issues in genomics, such as data sharing; coverage and reimbursement for genetic testing; laboratory-developed tests; foreign involvement in genomics research; genomics in law enforcement; costs of genomic medicine; and other salient issues.

ECIB works with a range of audiences to provide educational resources about the ever-changing landscape of genetics and genomics. Led by ECIB, National DNA Day is an annual community-driven initiative that provides resources to students at all levels, educators, and the general public to inspire everyone to learn about genomics. In FY 2023, DNA Day commemorated the 70th anniversary of the discovery of DNA's double-helical structure and the 20th anniversary of the Human Genome Project's completion. ECIB hosts the annual NHGRI Short Course in Genomics, which enables high school and community college science educators to listen to lectures and receive teaching resources from leading researchers, clinicians, and NIH staff. In FY 2023, 22 teachers participated in the Short Course, which over the years has provided over 200 educators with professional development opportunities in genomics. In FY 2023, ECIB also collaborated with the National Science Teaching Association (NSTA) to develop a new set of

[8] genome.gov/about-genomics/policy-issues/Genome-Statute-Legislation-Database

eight lesson plans and an abbreviated "playlist" of four lesson plans, all designed for high school biology teachers to explore the concepts of genomic variation and gene-environment interactions using phenomenon-based inquiry practices.

ECIB also hosts the Inter-Society Coordinating Committee for Practitioner Education in Genomics (ISCC-PEG) to create resources for and promote collaborations among healthcare professionals. Among ISCC-PEG initiatives is the Scholars Program, which pairs trainees with ISCC-PEG member mentors to research and create products in genomics education. Three new educational resources created by members of ISCC-PEG were released during Healthcare Professionals' Genomics Education Week in FY 2023. These included Nursing Genomics Frequently Asked Questions, the Pharmacogenomics Learning Series, and a new interactive, simulated patient module, "Autism Spectrum Disorder and Vaccines," which provides factual information to help healthcare providers effectively communicate with patients.[9] In FY 2025, ECIB will continue to lead programs and initiatives to promote the engagement of diverse communities in understanding genomics and its translation to health and society.

NHGRI's Office of Communications (OC) creates media in the form of written articles, videos, graphics, and social media posts to provide high-quality and timely genomics information to the public. OC also serves as the point of contact for all news media requests, inquiries from the scientific community, and questions from the public. In FY 2023, OC launched a refreshed homepage for genome.gov, the Institute's website, which included more user-friendly navigation, improved accessibility options, and increased responsiveness and performance. The efforts of NHGRI's OC garnered significant media attention for the complete human Y chromosome sequence published by the Telomere-to-Telomere Consortium in FY 2023. This coverage pointed to how the complete human Y chromosome sequence may aid in future studies about human health, fertility, evolution, and genealogy. Notable news outlets reporting on this development included *Science*, *CNN*, *New Scientist*, and *Reuters*, among others.

In FY 2023, the NHGRI History of Genomics Program, a component of OC, launched a new website powered by the open-sourced application called ArchivesSpace.[10] This application is used by academic and research institutions around the world, including the National Library of Medicine, for managing and sharing archival collections with researchers and the public. NHGRI's new ArchivesSpace site now provides public access to vast amounts of highly significant historical materials preserved by the Institute. The site's first two featured collections are the Francis Collins Collection and the Elke Jordan Collection. Together, these two collections include digitized files of more than 125 boxes of paper documents amassed by both Drs. Collins and Jordan during their tenures at NHGRI, which spanned from 1990 to 2006. The History of Genomics Program staff has meticulously assembled digital finding aids for these collections with extensive metadata that allow users to fully search through these important historical materials.

In FY 2025, NHGRI's PPAB, ECIB, and OC will continue to work in concert to promote sound policies, perform outreach and stakeholder engagement, and keep the public informed about the latest developments in genomics and genomic medicine.

[9] genome.gov/For-Health-Professionals/Provider-Genomics-Education-Resources
[10] genome.gov/history-of-genomics-archive

Budget Policy: The FY 2025 President's Budget request for Research Management and Support is $46.9 million, an increase of $2.4 million or 5.4 percent from the FY 2023 Final level. These funds will be used to support a number of outreach, education, and stakeholder-engagement initiatives in FY 2025.

NATIONAL INSTITUTES OF HEALTH
National Human Genome Research Institute

Appropriations History

Fiscal Year	Budget Estimate to Congress	House Allowance	Senate Allowance	Appropriation
2016	$515,491,000	$505,551,000	$526,166,000	$518,956,000
Rescission				$0
2017 [1]	$513,227,000	$531,438,000	$534,516,000	$528,566,000
Rescission				$0
2018	$399,622,000	$536,774,000	$546,934,000	$556,881,000
Rescission				$0
2019	$512,979,000	$563,531,000	$575,882,000	$575,579,000
Rescission				$0
2020	$495,448,000	$603,710,000	$607,999,000	$606,349,000
Rescission				$0
2021	$550,116,000	$611,564,000	$623,862,000	$615,780,000
Rescission				$0
2022	$632,973,000	$646,295,000	$634,598,000	$639,062,000
Rescission				$0
2023	$629,154,000	$659,233,000	$658,873,000	$663,200,000
Rescission				$0
2024	$660,510,000	$663,200,000	$663,200,000	$663,200,000
Rescission				$0
2025	$663,660,000			

[1] Budget Estimate to Congress includes mandatory financing.

NATIONAL INSTITUTES OF HEALTH
National Human Genome Research Institute

Authorizing Legislation

	PHS Act/ Other Citation	U.S. Code Citation	2024 Amount Authorized	FY 2024 CR	2025 Amount Authorized	FY 2025 President's Budget
Research and Investigation	Section 301	42§241	Indefinite	$663,200,000	Indefinite	$663,660,000
National Human Genome Research Institute	Section 401(a)	42§281	Indefinite		Indefinite	
Total, Budget Authority				$663,200,000		$663,660,000

NATIONAL INSTITUTES OF HEALTH

National Human Genome Research Institute

Amounts Available for Obligation [1]

(Dollars in Thousands)

Source of Funding	FY 2023 Final	FY 2024 CR	FY 2025 President's Budget
Appropriation	$663,200	$663,200	$663,660
Mandatory Appropriation: (non-add)			
Type 1 Diabetes	*($0)*	*($0)*	*($0)*
Other Mandatory financing	*($0)*	*($0)*	*($0)*
Subtotal, adjusted appropriation	$663,200	$663,200	$663,660
OAR HIV/AIDS Transfers	-$2,690	$0	$0
Subtotal, adjusted budget authority	$660,510	$663,200	$663,660
Unobligated balance, start of year	$0	$0	$0
Unobligated balance, end of year (carryover)	$0	$0	$0
Subtotal, adjusted budget authority	**$660,510**	**$663,200**	**$663,660**
Unobligated balance lapsing	-$38	$0	$0
Total obligations	$660,472	$663,200	$663,660

[1] Excludes the following amounts (in thousands) for reimbursable activities carried out by this account: FY 2023 - $26,972 FY 2024 - $28,813 FY 2025 - $29,541

NATIONAL INSTITUTES OF HEALTH
National Human Genome Research Institute

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

		FY 2024 CR	FY 2025 President's Budget
Total compensable workyears:			
	Full-time equivalent	385	385
	Full-time equivalent of overtime and holiday hours	385	385
	Average ES salary	$224	$230
	Average GM/GS grade	12.6	12.6
	Average GM/GS salary	$135	$139
	Average salary, Commissioned Corps (42 U.S.C. 207)	$141	$148
	Average salary of ungraded positions	$181	$186
OBJECT CLASSES		**FY 2024 CR**	**FY 2025 President's Budget**
	Personnel Compensation		
11.1	Full-Time Permanent	$27,015	$27,771
11.3	Other Than Full-Time Permanent	$21,165	$21,758
11.5	Other Personnel Compensation	$1,676	$1,723
11.7	Military Personnel	$355	$372
11.8	Special Personnel Services Payments	$7,245	$7,448
11.9	**Subtotal Personnel Compensation**	**$57,456**	**$59,072**
12.1	Civilian Personnel Benefits	$18,450	$19,067
12.2	Military Personnel Benefits	$78	$81
13.0	Benefits to Former Personnel	$0	$0
	Subtotal Pay Costs	**$75,984**	**$78,221**
21.0	Travel & Transportation of Persons	$1,400	$1,430
22.0	Transportation of Things	$162	$166
23.1	Rental Payments to GSA	$0	$0
23.2	Rental Payments to Others	$6	$6
23.3	Communications, Utilities & Misc. Charges	$225	$230
24.0	Printing & Reproduction	$17	$18
25.1	Consulting Services	$22,778	$23,530
25.2	Other Services	$30,781	$31,509
25.3	Purchase of Goods and Services from Government Accounts	$64,271	$65,728
25.4	Operation & Maintenance of Facilities	$261	$265
25.5	R&D Contracts	$1,385	$1,515
25.6	Medical Care	$612	$636
25.7	Operation & Maintenance of Equipment	$2,700	$2,759
25.8	Subsistence & Support of Persons	$0	$0
25.0	**Subtotal Other Contractual Services**	**$122,789**	**$125,942**
26.0	Supplies & Materials	$4,581	$4,682
31.0	Equipment	$2,254	$2,303
32.0	Land and Structures	$36	$37
33.0	Investments & Loans	$0	$0
41.0	Grants, Subsidies & Contributions	$455,741	$450,620
42.0	Insurance Claims & Indemnities	$0	$0
43.0	Interest & Dividends	$5	$5
44.0	Refunds	$0	$0
	Subtotal Non-Pay Costs	**$587,216**	**$585,439**
	Total Budget Authority by Object Class	**$663,200**	**$663,660**

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

NATIONAL INSTITUTES OF HEALTH
National Human Genome Research Institute

Salaries and Expenses
(Dollars in Thousands)

Object Classes	FY 2024 CR	FY 2025 President's Budget
Personnel Compensation		
Full-Time Permanent (11.1)	$27,015	$27,771
Other Than Full-Time Permanent (11.3)	$21,165	$21,758
Other Personnel Compensation (11.5)	$1,676	$1,723
Military Personnel (11.7)	$355	$372
Special Personnel Services Payments (11.8)	$7,245	$7,448
Subtotal, Personnel Compensation (11.9)	**$57,456**	**$59,072**
Civilian Personnel Benefits (12.1)	$18,450	$19,067
Military Personnel Benefits (12.2)	$78	$81
Benefits to Former Personnel (13.0)	$0	$0
Subtotal Pay Costs	**$75,984**	**$78,221**
Travel & Transportation of Persons (21.0)	$1,400	$1,430
Transportation of Things (22.0)	$162	$166
Rental Payments to Others (23.2)	$6	$6
Communications, Utilities & Misc. Charges (23.3)	$225	$230
Printing & Reproduction (24.0)	$17	$18
Other Contractual Services		
Consultant Services (25.1)	$22,778	$23,530
Other Services (25.2)	$30,781	$31,509
Purchase of Goods and Services from Government Accounts (25.3)	$46,153	$47,534
Operation & Maintenance of Facilities (25.4)	$261	$265
Operation & Maintenance of Equipment (25.7)	$2,700	$2,759
Subsistence & Support of Persons (25.8)	$0	$0
Subtotal Other Contractual Services	**$102,673**	**$105,597**
Supplies & Materials (26.0)	$4,581	$4,682
Subtotal Non-Pay Costs	**$109,065**	**$112,129**
Total Administrative Costs	**$185,049**	**$190,349**

NATIONAL INSTITUTES OF HEALTH
National Human Genome Research Institute

Detail of Full-Time Equivalent Employment (FTE)

Office	FY 2023 Final			FY 2024 CR			FY 2025 President's		
	Civilian	Military	Total	Civilian	Military	Total	Civilian	Military	Total
Division of Intramural Research									
Direct:	195	1	196	219	1	220	219	1	220
Reimbursable:	31	3	34	37	1	38	37	1	38
Total:	226	4	230	256	2	258	256	2	258
Office of the Director									
Direct:	24	-	24	24	-	24	24	-	24
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	24	-	24	24	-	24	24	-	24
Division of Management									
Direct:	48	-	48	49	-	49	49	-	49
Total:	48	-	48	49	-	49	49	-	49
Division of Genome Sciences									
Direct:	11	-	11	11	-	11	11	-	11
Reimbursable:	2	-	2	2	-	2	2	-	2
Total:	13	-	13	13	-	13	13	-	13
Division of Genomic Medicine									
Direct:	11	1	12	11	1	12	11	1	12
Reimbursable:	1	-	1	1	-	1	1	-	1
Total:	12	1	13	12	1	13	12	1	13
Division of Genomics and Society									
Direct:	8	-	8	8	-	8	8	-	8
Total:	8	-	8	8	-	8	8	-	8
Division of Extramural Operations									
Direct:	20	-	20	20	-	20	20	-	20
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	20	-	20	20	-	20	20	-	20
Total	351	5	356	382	3	385	382	3	385
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**								
2021	12.7								
2022	12.8								
2023	12.7								
2024	12.6								
2025	12.6								

NATIONAL INSTITUTES OF HEALTH
National Human Genome Research Institute

Detail of Positions [1]

GRADE	FY 2023 Final	FY 2024 CR	FY 2025 President's Budget
Total, ES Positions	1	1	1
Total, ES Salary	$212,100	$223,628	$229,890
General Schedule			
GM/GS-15	37	38	38
GM/GS-14	33	34	34
GM/GS-13	85	92	92
GS-12	40	41	41
GS-11	13	16	16
GS-10	0	0	0
GS-9	12	13	13
GS-8	5	5	5
GS-7	5	5	5
GS-6	0	0	0
GS-5	0	0	0
GS-4	1	1	1
GS-3	1	1	1
GS-2	0	0	0
GS-1	0	0	0
Subtotal	232	246	246
Commissioned Corps (42 U.S.C. 207)			
Assistant Surgeon General	0	0	0
Director Grade	2	2	2
Senior Grade	1	1	1
Full Grade	0	0	0
Senior Assistant Grade	0	0	0
Assistant Grade	0	0	0
Junior Assistant	0	0	0
Subtotal	3	3	3
Ungraded	138	153	153
Total permanent positions	236	250	250
Total positions, end of year	374	403	403
Total full-time equivalent (FTE) employment, end of year	356	385	385
Average ES salary	$212,100	$223,628	$229,890
Average GM/GS grade	12.7	12.6	12.6
Average GM/GS salary	$128,450	$135,305	$139,093

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