National Human Genome Research Institute

CONGRESSIONAL JUSTIFICATION
FY 2022

Department of Health and Human Services
National Institutes of Health

NIH National Human Genome Research Institute

DEPARTMENT OF HEALTH AND HUMAN SERVICES

NATIONAL INSTITUTES OF HEALTH

National Human Genome Research Institute (NHGRI)

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Director's Overview

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The coming decade offers great promise for the field of genomics. Starting with the launch of the Human Genome Project (HGP) three decades ago, genomics has become increasingly woven into the fabric of biomedical research, medical practice, and society (Figure 1). Capitalizing on the momentum of the HGP's successful completion, genomics now regularly plays a central and catalytic role in basic and translational research, and studies increasingly demonstrate the vital role that genomic information can play in clinical care. Looking ahead, the anticipated advances in genomic technology development, biological insights, and clinical applications will lead to more widespread integration of genomics into virtually all areas of biomedical research, the adoption of genomics into mainstream medical and public-health practices, and an increasing relevance of genomics in everyday life with an emphasis on health applications. This overview articulates the highest-priority elements envisioned for the cutting edge of human genomics going forward.

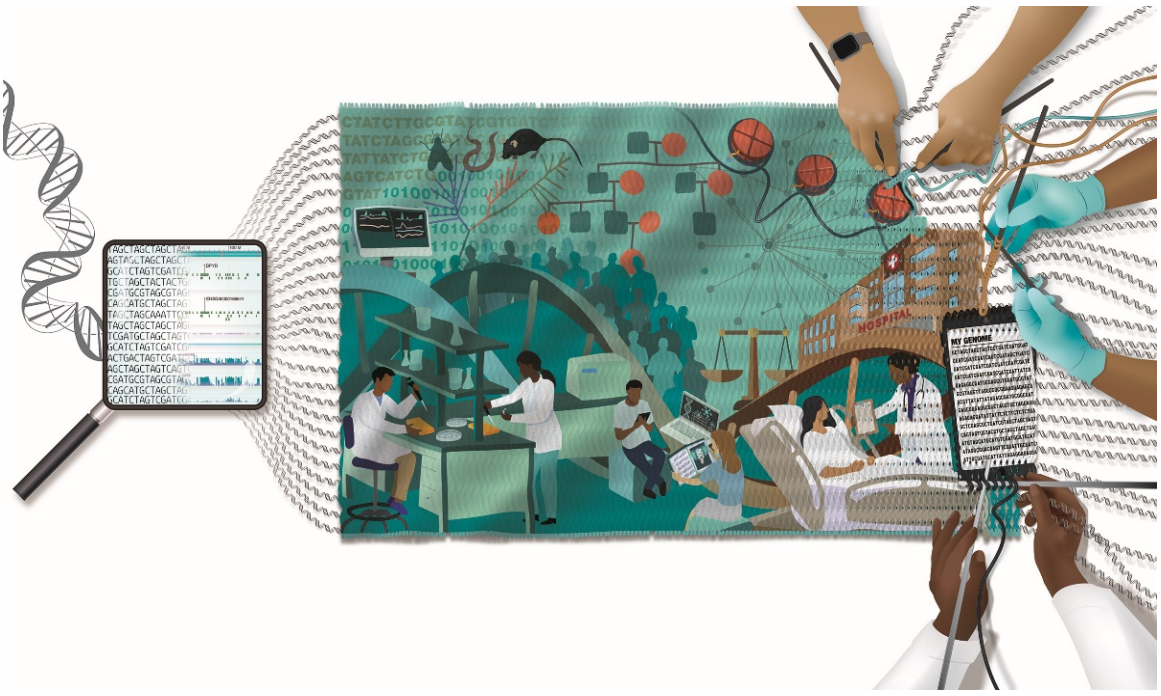


Figure 1: The increasing integration of genomics into research, medicine, and society. Beginning with the discovery of the double-helical structure of DNA and greatly catalyzed by the initial sequencing of the human genome by the Human Genome Project in conjunction with a growing understanding of its functional complexities, genomics has become increasingly woven into research, medicine, and society. This historic and ongoing progression is depicted from left to right.

Deliberately published in October 2020 to commemorate the 30th anniversary of the launch of the HGP, NHGRI's new strategic vision will guide human genomics in the coming decade. The 2020 NHGRI Strategic Vision is the product of the multi-year "Genomics2020" strategic planning process conducted by NHGRI that identified future research priorities and opportunities in human genomics. Published in the journal *Nature*, the 2020 NHGRI Strategic Vision describes how responsible stewardship is a central aspect of being at (and pushing forward) *The Forefront of Genomics*, specifically in the following four areas: (1) providing a socially responsible and highly ethical framework for conducting human genomics research by establishing and adhering to guiding principles and values; (2) facilitating genomic advances by sustaining and improving a robust foundation for genomics research; (3) breaking down barriers in genomics through advances that create new research opportunities and improve clinical care; and (4) defining and leading the pursuit of compelling genomics research projects focused on elucidating genome function, understanding human disease, studying the societal implications of genomics, and improving human health.

Figure 2: Four-area strategic framework at The Forefront of Genomics.

As genomics becomes increasingly integrated into clinical care, it is essential that NHGRI supports a broad and robust ethical, legal, and social implications (ELSI) research portfolio in order to ensure an appropriate ethical framework for genomics research and to fulfill the promise of science in service to society. NHGRI's ELSI Research Program has been in place since the HGP and continues to fund efforts to help answer challenging questions about legal boundaries, study governance, data control, privacy, and consent. This program continues to build on its efforts to develop a more synergistic and integrated ELSI research community, for example, through the recent establishment of the Center for ELSI Resources and Analysis (CERA) and the planned ELSI Research Congress in FY 2022.

The ELSI Research Program also supports ELSI research across NHGRI and across NIH. Phase II of the Clinical Sequencing Evidence-Generating Research (CSER) Program includes a special focus on engaging stakeholders (e.g., professional societies, payers, patients, clinicians, and family members) to responsibly integrate genomics into clinical care. ELSI research is also embedded in the Electronic Medical Records and Genomics (eMERGE) Network, which aims to responsibly utilize electronic medical records for genomics research and evaluate how multiple genes contribute to a person's risk for developing a disease. In its current phase, eMERGE is investigating how best to incorporate new and more complex data, such as polygenic risk scores (PRSs), into a patient's electronic medical record.

To ensure that all Americans benefit from the public's investment in genomics and genomic medicine, the scientific community must strive to maximize human diversity in all aspects of genomics research. Such efforts must reflect a full-throated and systematic commitment to including ancestrally diverse and underrepresented individuals in major genomic studies and to ensuring that genomics benefits all members of society, including the ability to access genomics in healthcare. The vast majority of the currently available genomic data has been derived from European populations, leaving the genomes of most of humanity poorly examined. A more in-depth understanding of human genomic variation across populations would benefit all. Biological and medical insights can be (and have been) gained from understanding the range and impact of genomic variation in diverse populations.

NHGRI is playing a key role in the ongoing effort to enhance the ancestral diversity of participants in all types of genomics research. For example, two NHGRI-funded research consortia, CSER and the Clinical Genome Resource (ClinGen), recently partnered to report on how race, ethnicity, and ancestry data are collected, used, and conceptualized in clinical genomics, calling for new standardization approaches for data collection to avoid misleading or inconclusive results. Such efforts will be aided by the Human Genome Reference Program, which continues to work toward developing a "pangenome" reference that captures and assimilates as much of the genomic variation in the global human population as possible.

The current phase of the eMERGE Network is focused on compiling diverse datasets that will be used for studying common diseases in all patient populations, with the results returned to a diverse group of ethnic minority populations, underserved populations, or populations who experience poorer medical outcomes through their electronic medical records (EMRs). These efforts will shape the conversations about implementing genomics-based risk estimates in clinical care as well as how and in what format to return genomics results to patients. Complementing these efforts is the recently launched Implementing Genomics in Practice (IGNITE) Pragmatic Trials Network (PTN), which is conducting two clinical trials of genomic medicine interventions at multi-site clinical groups involving diverse populations. Also, the Population Architecture using Genetics and Epidemiology (PAGE) Consortium is analyzing the relationship between genomic variants and a range of common diseases and traits, with a special focus on non-European Ancestry populations; a grant was awarded in 2019 that will allow a third phase of PAGE to continue through FY 2022.

Ensuring diversity in genomics research goes hand in hand with championing a diverse genomics workforce. The promise of genomics cannot be fully achieved without attracting, developing, and retaining a diverse workforce, including individuals from groups currently underrepresented in the genomics enterprise. NHGRI has a strong record of funding diversity-enhancing programs, including the Diversity Action Plan (DAP) program, which has been in place since 2002. In addition, the Institute's Education and Community Involvement Branch leads science and education programs that facilitate the training of secondary school teachers, community college staff, and Tribal college faculty in genomics. Most recently, NHGRI developed a 10-year "*Building a Diverse Genomics Workforce: An NHGRI Action Agenda*." The objectives of this 'Action Agenda' include both reducing barriers to training opportunities in the field and supporting the development and career progression of researchers from underrepresented backgrounds.

Over the last three decades, genomics has grown from an emerging field to a well-established discipline. The tools of genomics are now routinely and broadly used throughout biomedical research. Consequently, there is widespread reliance on a robust foundation for using genomic approaches. One of NHGRI's key responsibilities is sustaining and improving that foundation. Various core technologies and analytical methods resulting from NHGRI funding form a base upon which new genomic advances will arise. These range from increasing our basic understanding of genome biology to unraveling the genomic bases of human disease to the use of genomic information in medicine.

One such transformative project is the Encyclopedia of DNA Elements (ENCODE). This project began in 2003 as an effort to identify the parts of the human genome that are functional. In addition to the nearly 900 publications produced by the ENCODE Consortium itself, ENCODE data has contributed to over 2,200 publications that advance our understanding of the human genome. In its current phase, ENCODE is expanding its efforts by establishing Functional Characterization Centers, which work to study the precise function of individual genomic elements identified by ENCODE Mapping Centers and their potential role in disease.

NHGRI efforts also include major programs that build upon the foundational understanding of genome biology by linking genomic variants to human disease. NHGRI has committed to provide support for three to five additional Centers for Mendelian Genomics over the next five years, using the latest sequencing technologies to discover genes underlying human Mendelian disorders. Some of these studies are also conducted within the Institute's Centers of Excellence in Genomic Science (CEGS) program, which supports the development of innovative genomic approaches in many different areas relevant to biomedical research. In FY 2020, $10 million was allocated to NHGRI to support "emerging Centers of Excellence in Genomic Science" (eCEGS). These new funds will be used to develop scientific infrastructure at institutions that have not previously received CEGS awards, continuing to expand and diversify the genomics enterprise.

Genomics has consistently benefited from the proactive identification of major obstacles impeding progress and the subsequent focused efforts to break down those barriers. Prototypic successes include the call for a "$1,000 Genome" following completion of the HGP and a

proposed set of actions to facilitate the early implementation of genomic medicine in 2011. In these cases, both the risks of failure and the benefits of success were high. Not unexpectedly, some prior barriers remain today, while some new ones have emerged. Once again, breaking down these barriers would accelerate progress and create new research and clinical opportunities. For example, genomics now faces major challenges and barriers related to analyzing all of the data being generated. As such, NHGRI's Computational Genomics and Data Science Program (CGDS) is focused on the development of improved computational approaches, innovative data analysis tools, and data resources that break down technological barriers to progress; the Institute's signature efforts in this area include support for the NHGRI Genomic Analysis, Visualization, and Informatics Lab-space (AnVIL), the Alliance of Genome Resources, and the Global Alliance for Genomics and Health (GA4GH), among other efforts.

NHGRI and genomics are poised to contribute to larger public health needs, such as fighting the COVID-19 pandemic. Indeed, genomics has rapidly assumed a critical role in COVID-19 research and clinical care. The rapid sequencing of the coronavirus (SARS-CoV-2) genome led to important insights about the virus and suggested lines of attack to prevent further spread. Meanwhile, understanding the mechanisms involved in the virus's transmission, invasion, and clearance, as well as the highly variable and at times disastrous physiologic responses to it, are active areas of genomics research. The growing adoption of genomic approaches and technologies into myriad aspects of the global response to the COVID-19 pandemic serves as yet another important and highly visible example of the integral and vital nature of genomics in modern research and medicine.

The field of genomics has routinely benefited from a willingness to articulate ambitious – often audacious – research efforts that aim to address questions and acquire knowledge that may seem out of reach. Such boldness has often served to stimulate interest in emerging opportunities, recruit new expertise for addressing difficult problems, galvanize international collaborations involving multiple funders, and propel the field forward. In the next 10 years, human genomics will be capable of feats – knowing the function of every human gene and the relevance of every genomic variant, mainstream incorporation of genomic information into clinical settings, curative gene therapies for dozens of genetic diseases – beyond the wildest dreams of the Human Genome Project. But to fulfill the full potential of genomics, researchers need to push the boundaries of science while every one of us—scientists and nonscientists alike—needs to continually examine what we know to be true and know to be possible.

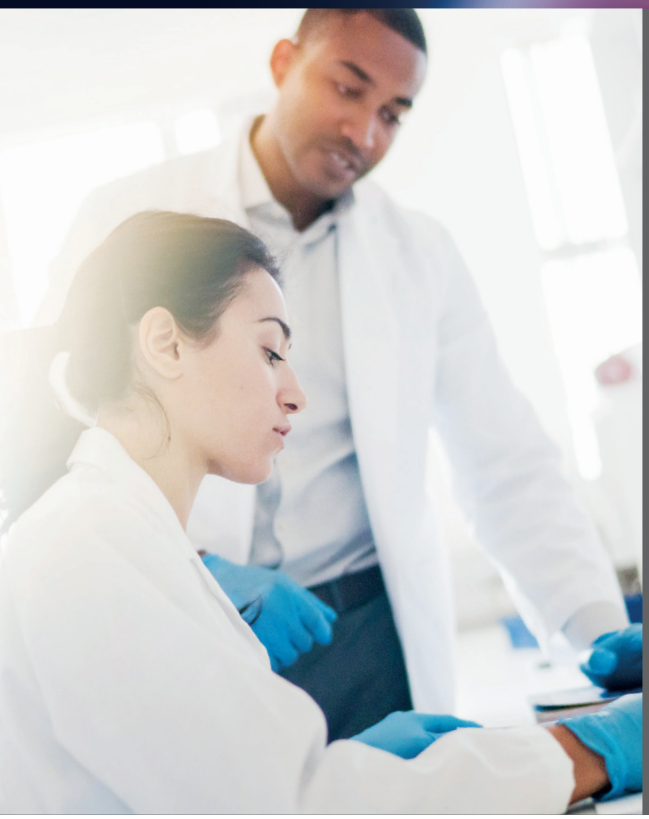
Overall Budget Policy: The FY 2022 President's Budget request is $633.0 million, an increase of $17.0 million compared with the FY 2021 Enacted level. This increase is distributed across all programmatic areas and basic, epidemiology, and clinical research.

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

351 FTEs
FY 2021

$616,012,000 FY 2021
Enacted Budget
(1.4% of the total NIH budget)

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 Fiscal Year 2021 President's 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 2022 President's Budget request for NHGRI, which is $633.0 million, an increase of $17.0 million from the FY 2021 Enacted level. Within this request level, NHGRI will pursue its highest research priorities through strategic investments and careful stewardship of appropriated funds.

Research Project Grants (RPGs) (+$15.3 million, total $326.6 million):
The NHGRI has been transitioning many of its programs out of the Research Centers mechanism as they come up for renewal or transition to new scientific approaches and technologies. These programs, along with the associated new programs, are categorized under the cooperative activity codes that fall within the RPG and Other Research budget mechanisms after a thorough review of the program announcements. This is not a change in the type of activities funded, but only a shift in the mechanism in which the activities are categorized. NHGRI will also continue to support new investigator-initiated research within the RPG pool.

Research Centers (-$12.0 million, total $17.0 million):
This decrease represents completion of and the movement of several ongoing NHGRI initiatives from the Research Centers budget mechanism line to the RPG mechanism. There is an offsetting increase in the funding for RPGs.

Other Research (+$6.0 million, total $90.4 million):
This increase represents increases for several new NHGRI initiatives including funding for the Non-Human Primate Developmental Genotype-Tissue Expression (NHP dGTEx) Research Center. This research center is needed to further understanding of gene expression patterns across developmental timepoints by including comparable data from non-human primates. The NHP dGTEx research center will perform four major functions by creating a tissue resource of multiple reference tissues across developmental stages in non-human primates (NHPs); performing transcriptome sequencing and other genomic analysis of bulk tissues and single-cell populations; performing analysis of gene expression patterns in NHPs and compare them to human gene expression patterns; and making the tissue samples and data available and usable to the community.

NATIONAL INSTITUTES OF HEALTH
National Human Genome Research Institute

Budget Mechanism - Total[1]

(Dollars in Thousands)

MECHANISM	FY 2020 Final		FY 2021 Enacted		FY 2022 President's Budget		FY 2022 +/- FY 2021 Enacted	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount
Research Projects:								
Noncompeting	212	$160,100	206	$141,741	250	$197,222	44	$55,481
Administrative Supplements	*(45)*	69,759	*(50)*	63,580	*(46)*	48,876	*(-4)*	-14,704
Competing:								
Renewal	15	12,454	20	16,601	12	10,200	-8	-6,401
New	85	59,148	89	72,360	65	52,877	-24	-19,483
Supplements	3	1,395	0	0	0	0	0	0
Subtotal, Competing	103	$72,997	109	$88,961	77	$63,077	-32	-$25,884
Subtotal, RPGs	315	$302,857	315	$294,282	327	$309,175	12	$14,893
SBIR/STTR	26	16,160	27	17,000	27	17,445	0	445
Research Project Grants	341	$319,017	342	$311,282	354	$326,620	12	$15,338
Research Centers:								
Specialized/Comprehensive	2	$4,137	3	$3,717	1	$1,750	-2	-$1,967
Clinical Research	0	360	0	373	0	0	0	-373
Biotechnology	22	48,867	13	24,887	7	15,249	-6	-9,638
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	24	$53,364	16	$28,977	8	$16,999	-8	-$11,978
Other Research:								
Research Careers	28	$4,027	36	$5,896	35	$6,020	-1	$124
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	0	0	0	2	345	2	345
Other	52	41,849	70	78,483	78	84,018	8	5,535
Other Research	80	$45,877	106	$84,379	115	$90,383	9	$6,004
Total Research Grants	445	$418,257	464	$424,638	477	$434,002	13	$9,364
Ruth L Kirschstein Training Awards:	FTTPs		FTTPs		FTTPs		FTTPs	
Individual Awards	29	$1,211	29	$1,246	29	$1,322	0	$76
Institutional Awards	173	10,739	175	11,138	175	11,798	0	660
Total Research Training	202	$11,949	204	$12,384	204	$13,120	0	$736
Research & Develop. Contracts	9	$18,974	9	$20,866	9	$22,983	0	$2,117
(SBIR/STTR) (non-add)	*(0)*	*(171)*	*(0)*	*(171)*	*(0)*	*(183)*	*(0)*	*(12)*
Intramural Research	234	120,760	241	123,216	254	126,913	13	3,697
Res. Management & Support	100	34,177	110	34,908	116	35,955	6	1,047
SBIR Admin. (non-add)	*(0)*	*(0)*	*(0)*	*(0)*	*(0)*	*(0)*	*(0)*	*(0)*
Construction		0		0		0		0
Buildings and Facilities		0		0		0		0
Total, NHGRI	334	$604,118	351	$616,012	370	$632,973	19	$16,961

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

NATIONAL HUMAN GENOME RESEARCH INSTITUTE

For carrying out section 301 and title IV of the PHS Act with respect to human genome research, [$615,780,000]*$632,973,000*.

NATIONAL INSTITUTES OF HEALTH
National Human Genome Research Institute

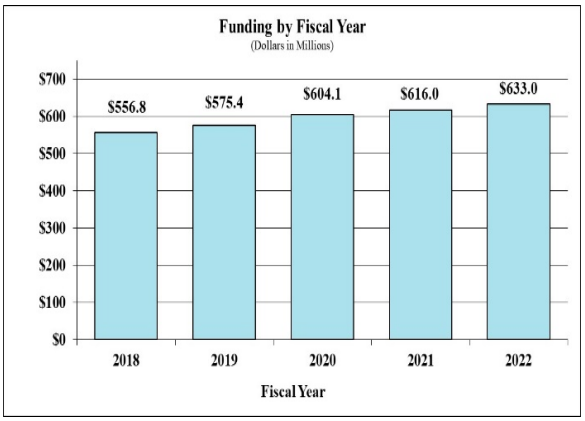
Summary of Changes
(Dollars in Thousands)

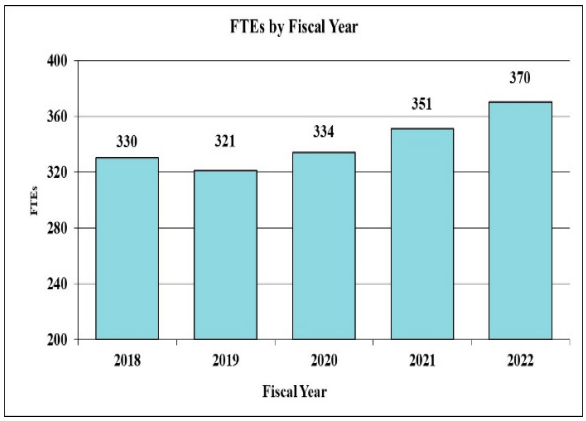
FY 2021 Enacted	$616,012
FY 2022 President's Budget	$632,973
Net change	$16,961

CHANGES	FY2021 Enacted		FY 2022 President's Budget		Change from FY 2021 Enacted	
	FTEs	Budget Authority	FTEs	Budget Authority	FTEs	Budget Authority
A. Built-in:						
1. Intramural Research:						
a. Annualization of January 2021 pay increase & benefits		$45,907		$49,294		$125
b. January FY 2022 pay increase & benefits		45,907		49,294		1,252
c. Paid days adjustment		45,907		49,294		0
d. Differences attributable to change in FTE		45,907		49,294		2,010
e. Payment for centrally furnished services		21,528		22,604		1,076
f. Cost of laboratory supplies, materials, other expenses, and non-recurring costs		55,781		55,014		1,332
Subtotal						$5,796
2. Research Management and Support:						
a. Annualization of January 2021 pay increase & benefits		$16,407		$17,704		$44
b. January FY 2022 pay increase & benefits		16,407		17,704		454
c. Paid days adjustment		16,407		17,704		0
d. Differences attributable to change in FTE		16,407		17,704		789
e. Payment for centrally furnished services		1,438		1,510		72
f. Cost of laboratory supplies, materials, other expenses, and non-recurring costs		17,062		16,741		361
Subtotal						$1,719
Subtotal, Built-in						$7,515

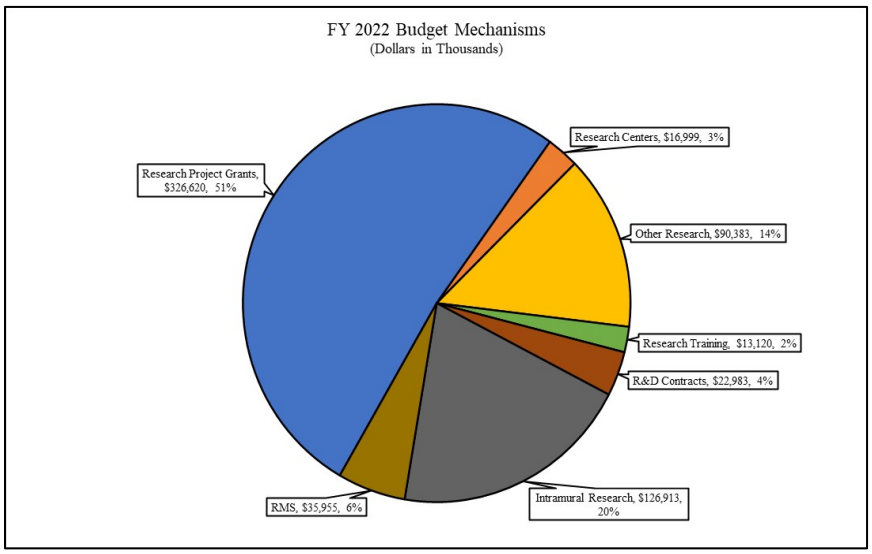
CHANGES	FY2021 Enacted		FY 2022 President's Budget		Change from FY 2021 Enacted	
	No.	Amount	No.	Amount	No.	Amount
B. Program:						
1. Research Project Grants:						
a. Noncompeting	206	$205,321	250	$246,098	44	$40,777
b. Competing	109	88,961	77	63,077	-32	-25,884
c. SBIR/STTR	27	17,000	27	17,445	0	445
Subtotal, RPGs	342	$311,282	354	$326,620	12	$15,338
2. Research Centers	16	$28,977	8	$16,999	-8	-$11,978
3. Other Research	106	84,379	115	90,383	9	6,004
4. Research Training	204	12,384	204	13,120	0	736
5. Research and development contracts	9	20,866	9	22,983	0	2,117
Subtotal, Extramural		$457,888		$470,105		$12,217
	FTEs		FTEs		FTEs	
6. Intramural Research	241	$123,216	254	$126,913	13	-$2,099
7. Research Management and Support	110	34,908	116	35,955	6	-672
8. Construction		0		0		0
9. Buildings and Facilities		0		0		0
Subtotal, Program	351	$616,012	370	$632,973	19	$9,446
Total built-in and program changes						$16,961

History of Budget Authority and FTEs:

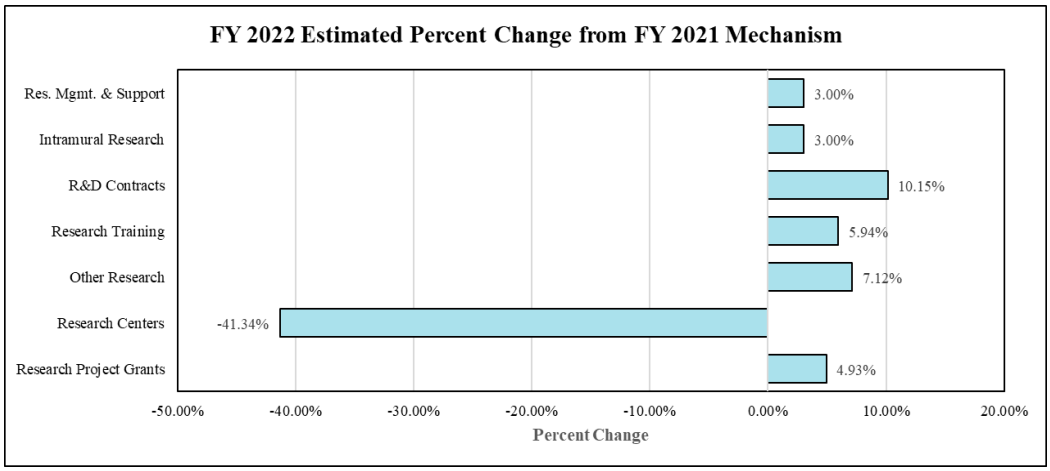




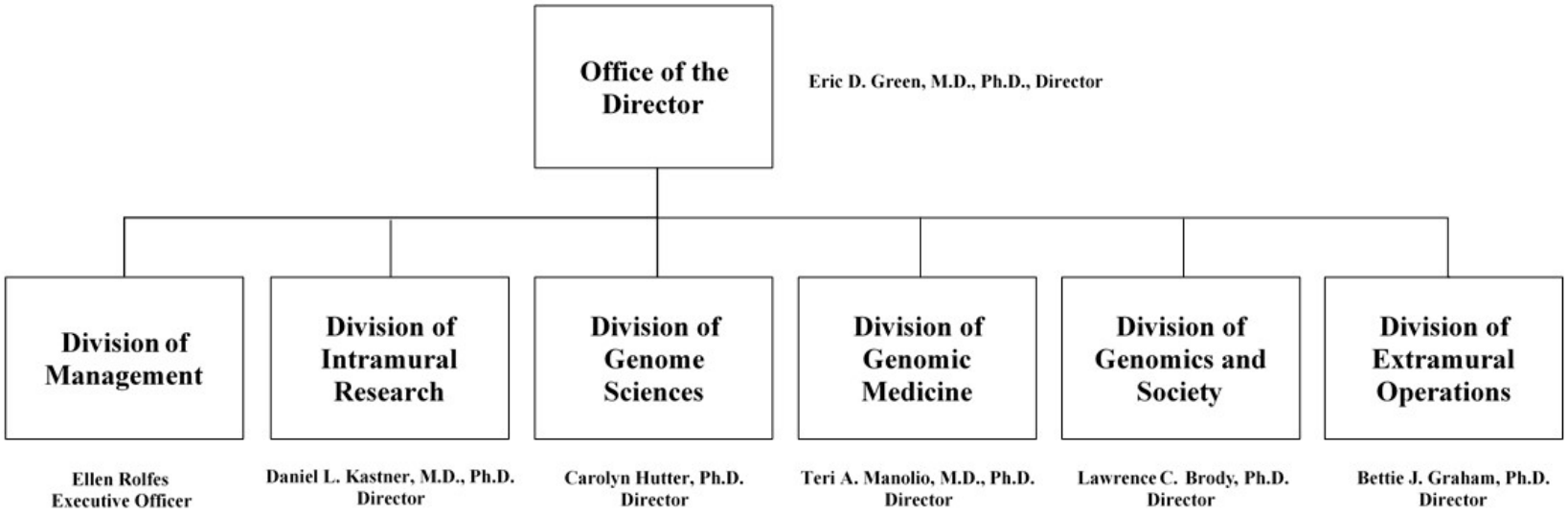
Distribution by Mechanism:



Change by Selected Mechanism:



NATIONAL HUMAN GENOME RESEARCH INSTITUTE
Organizational Structure



NATIONAL INSTITUTES OF HEALTH
National Human Genome Research Institute

Budget Authority by Activity[1]

(Dollars in Thousands)

Program Activity	FY 2020 Final FTE	FY 2020 Final Amount	FY 2021 Enacted FTE	FY 2021 Enacted Amount	FY 2022 President's Budget FTE	FY 2022 President's Budget Amount	FY 2022 +/- FY 2021 Enacted FTE	FY 2022 +/- FY 2021 Enacted Amount
Detail								
Understanding the Structure of Genomes		$38,514		$39,263		$40,321		$1,058
Understanding the Biology of Genomes		92,373		94,179		96,747		2,568
Using Genomics to Understand the Biology of Disease		140,985		143,758		147,739		3,981
Using Genomics to Advance Medical Science		23,332		23,802		24,500		699
Using Genomics to Improve the Effectiveness of Healthcare		13,917		14,193		14,597		403
Bioinformatics, Computational Biology, and Data Science		177,342		180,793		185,666		4,873
Education and Training		27,995		28,548		29,346		799
Genomics and Society		55,485		56,568		58,101		1,534
Subtotal, Program Activity*		**$569,941**		**$581,104**		**$597,018**		**$15,914**
Extramural Research (non-add)		*(449,181)*		*(457,888)*		*(470,105)*		*(12,217)*
Intramural Research (non-add)	**234**	*(120,760)*	**241**	*(123,216)*	**254**	*(126,913)*	**13**	*(3,697)*
Research Management & Support	**100**	**$34,177**	**110**	**$34,908**	**116**	**$35,955**	**6**	**$1,047**
TOTAL	**334**	**$604,118**	**351**	**$616,012**	**370**	**$632,973**	**19**	**$16,961**

[1] Includes FTEs whose payroll obligations are supported by the NIH Common Fund.
* The detail programs listed above include both Extramural and Intramural funding.

Justification of Budget Request

National Human Genome Research Institute

Authorizing Legislation: For carrying out section 301 and title IV of the PHS Act.

Budget Authority (BA):

	FY 2020 Final	FY 2021 Enacted	FY 2022 President's Budget	FY 2022 +/- FY 2021
BA	$604,118,000	$616,012,000	$632,973,000	+$16,961,000
FTE	334	351	370	19

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

Program Descriptions and Accomplishments

Understanding the Structure of Genomes: The last decade was associated with reaching the audacious goal of the "$1,000 human genome sequence," an explosion in technologies for functional genomics and insights about how genomic elements contribute to biological processes, and unparalleled genomics-based advances across numerous areas of life sciences research and medicine. As genome sequencing and subsequent sequence analyses become faster, cheaper, and more accurate, new opportunities arise to answer even more complex questions. The recent generation of a complete sequence of the human X chromosome represents the start of a new era in which truly comprehensive views of genomes will be acquired. The Telomere-to-Telomere Consortium, which aims to generate the first complete assembly of the human genome, is partially funded by NHGRI and will fill in the gaps in our understanding of the human genome sequence, laying a foundation for future research efforts in genomic medicine.

NHGRI's Genome Technology Program continues to support research to develop the new methods and technologies that will make the routine generation of complete human genome sequences possible. Recent awards funded by the program continue to aid in the development of novel investigator-initiated technologies for genomics, nucleic acid sequencing, and nucleic acid synthesis, and this work will continue in FY 2022.

Technology advances will not only allow for rapid sequencing of human genomes, but also the study of the genomes of other species, which can illuminate unique features of human biology. To this end, via the Comparative Genomics Research Program (co-funded with the U.S.

Department of Agriculture), NHGRI is supporting research that examines genomic variation across species with different physical traits and different susceptibilities to disease, which in turn will help maximize understanding of genome function and provide insights into human disease. Genome-sequencing centers supported by NHGRI have sequenced the genomes of the chicken, dog, honey bee, gorilla, chimpanzee, sea urchin, and fungi (among other organisms) to expand our understanding of genome structure and function across the tree of life.

Budget Policy: The FY 2022 President's Budget request for Understanding the Structure of Genomes is $40.3 million, a increase of $1.1 million or 2.7 percent from the FY 2021 Enacted level. With these funds, the Institute's Genome Technology Program will continue to support the development of novel genome-sequencing and data-analyses methods to increase the field's capabilities. NHGRI will also continue to fund the efforts of the Human Genome Reference Program to produce a "pangenome" that is more representative of human genomic variation across humanity.

Understanding the Biology of Genomes: In order to unlock the potential for scientific discovery that resides within genome-sequence data, the systematic detection and study of the functional elements of the human genome are needed. NHGRI continues to lead these efforts through the Encyclopedia of DNA Elements (ENCODE) project, launched in 2003 (see Program Portrait nearby). In FY 2022, the ENCODE project will remain committed to characterizing the functional elements of the human genome and sharing its data (via the ENCODE Portal) widely with the research community in an accessible way. With assistance from NIH's Common Fund, the Genotype-Tissue Expression Project (GTEx) established a widely-used data resource in the

Expanding the Usefulness of the Vast Data Generated by Genomics Research

After the human genome was sequenced by the HGP, scientists were faced with the daunting task of deciphering its meaning. To address this challenge, NHGRI launched the Encyclopedia of DNA Elements (ENCODE), an ambitious project spanning FY 2003 to FY 2022 that systematically catalogued the functional elements in the human genome. Most of these biologically active elements identified by ENCODE, such as non-protein-coding genes and regulatory regions that control gene expression, were previously unidentified. In its fourth and final phase, ENCODE began characterizing the biological roles of regulatory elements mapped in earlier phases, greatly enhancing the research community's ability to investigate biological phenomena and disease. ENCODE has operated as an open consortium of investigators with varied backgrounds and expertise, who collectively produced and analyzed the data and produced almost 900 publications. ENCODE data have been compiled into a free online "Encyclopedia" of genomic annotations, and this has led to over 2,200 more publications produced by researchers without ENCODE funding – convincingly documenting the utility of NHGRI's investment in ENCODE.

Building upon ENCODE's success, NHGRI launched the Impact of Genomic Variation on Function Consortium (IGVF) in FY 2021 to investigate how genomic differences influence human health and disease. Genomic variants are rapidly being identified, but causal relationships between variants and disease risk remain poorly understood. Advances in single-cell genomic technologies enables IGVF to characterize functional elements in different cell types and biological contexts, providing a new level of resolution. Continuing in FY 2022, IGVF will utilize a combination of high-throughput experimental assays, integrative data analyses, and predictive modeling to map genomic variants and their biological effects. IGVF has adopted a similar consortium model to ENCODE in order to generate a rich resource of data, tools, and models for the broader research community.

Centers of Excellence in Genomic Science (CEGS) Program

As scientists' capacity to interrogate the human genome continues to expand, researchers must develop innovative approaches to interpret the increased volume of genomic data and translate those insights into medical advances. Since FY 2001, NHGRI has funded the Centers of Excellence in Genomic Science (CEGS) Program to develop transformative genomic approaches that address important biological and biomedical research problems and advance genomic science. Each CEGS engages a team of interdisciplinary scientists, ranging from basic and clinical scientists to engineers and ethicists, to develop novel approaches and concepts that improve the ability of the broader biomedical community to produce, analyze, integrate, and use genomic data.

Each CEGS also includes an education and outreach component that leverages the strengths of the CEGS consortium and its investigators to add value to the genomics capabilities of the host institution and region. To further develop this scientific infrastructure, in FY 2020 and FY 2021 Congress allocated $10 million to fund CEGS at institutions that have not previously received a CEGS award. NHGRI will continue to support these "emerging Centers of Excellence in Genomic Science" (eCEGS) in FY 2022.

To date, 15 CEGS have completed their funding after 5-10 years of support, while 10 CEGS have ongoing funding. In FY 2022, several active CEGS are focused on developing genome-editing technologies with the goal of deploying these tools for a variety of applications, including genomic medicine and biotechnology. Some of these projects are generating synthetic gene networks to manipulate and assess how gene expression is regulated, developing a high-throughput pipeline for identification of genomic variants influencing human disease, and engineering improved models of complex tissues to expedite progress in early-stage biomedical research.

community focused on how changes in DNA sequence affect gene expression (how genes are turned on and off). The GTEx Portal, launched in 2013, was recently updated to version 8, which was released on NHGRI's Genomic Data Science Analysis, Visualization, and Informatics Lab-space (AnVIL). The GTEx project served as a foundation for a new initiative, dGTEx (developmental GTEx), which is co-funded by NHGRI and aims to study gene-expression patterns at multiple stages in human development. GTEx resources are also valuable tools for examining how changes in gene expression contribute to human disease.

In order to ensure that investigators throughout the research community have access to the technologies that allow for such genomic analyses, NHGRI continues to support, in partnership with other institutes, the Center for Inherited Disease Research (CIDR), which was established in 1996 and remains a valuable resource for the research community. To date, CIDR has supported almost 500 completed research projects, over 30 of which are affiliated with NHGRI. In FY 2022, CIDR will continue its successful mission to provide cutting-edge genomic services to NIH-funded investigators, including those involved in large-scale efforts such as the OncoArray Network, Population Architecture Using Genomics and Epidemiology (PAGE), and Human Heredity and Health in Africa (H3Africa).

Budget Policy: The FY 2022 President's Budget request for Understanding the Biology of Genomes is $96.7 million, a increase of $2.6 million or 2.7 percent from the FY 2021 Enacted level. NHGRI will continue to fund programs that seek to understand the biology of genomes and their relation to human health. CIDR will continue to support investigators in pursuing their genomics-based research objectives.

Using Genomics to Understand the Biology of Disease: The path to realizing the promise of genomic medicine requires understanding not only which DNA change genome function, but how these effects eventually contribute to human disease. NHGRI continues to support pioneering efforts to identify genomic variants that play a role in human health and disease. In FY 2019, NHGRI hosted the workshop "From Genome to Phenotype: Genomic Variation Identification, Association, and Function in Human Health and Disease." From the workshop's recommendations, the Impact of Genomic Variation on Function (IGVF) Consortium was launched to examine how genomic variants influence genome function and contribute to human health. In FY 2022, the IGVF Consortium will continue to build a catalog describing how genomic variants influence genome function.

The Centers of Excellence in Genomic Science (CEGS) program supports the development of innovative approaches to critical problems in genomics. In FY 2020, $10 million was provided to NHGRI to support "emerging Centers of Excellence in Genomic Science" (eCEGS); NHGRI received a robust response to the resulting funding opportunity announcement. These funds were used to develop scientific infrastructure at two institutions that have not previously received CEGS awards.

Progress in genomics is, by necessity, a nationwide – and global – effort. NHGRI has always embraced the core value of open access to shared data and resources. The Institute is constantly working to expand the capacity of these shared resources, increase their utilization, and ensure they are representative of and beneficial to everyone. NHGRI is spearheading the ongoing effort to enhance the diversity of participants in genomics research and the genomic data housed in community resources. NHGRI-funded research consortia are working toward standardization in the collection of race, ethnicity, and ancestry data. The Human Genome Reference Program continues to work toward developing a "pangenome" reference that captures as much of the genomic variation in the global human population as possible. In FY 2022, NHGRI will continue to support efforts to ensure that shared genomic databases and resources meet the needs of the research community and realize the promise of genomics for all populations and communities.

Budget Policy: The FY 2022 President's Budget request for Using Genomics to Understand the Biology of Disease is $147.7 million, an increase of $4.0 million or 2.8 percent from the FY 2021 Enacted level. These funds will support the IGVF program's efforts to discern which genomic variants play a role in human health and disease as well as the CEGS/eCEGS program's efforts in human genomics. NHGRI will also use these funds to continue to support the maintenance and expanded capacity of critical genomic databases and knowledge-bases.

Using Genomics to Advance Medical Science: NHGRI remains committed to the responsible and effective integration of genomics into clinical care. The CSER Consortium, now in the final year of its second phase, continues to leverage the nation's genomic expertise to establish best practices and conduct essential ELSI research to implement genomic medicine. CSER also emphasizes a focus on the recruitment of diverse study participants. For example, the CSER Consortium recently published work on incorporating stakeholder feedback into study design in an effort to reduce health disparities and – in conjunction with the Clinical Genome Resource

(ClinGen) – standardization in the collection of race, ethnicity, and ancestry data. In addition to the over 340 papers already produced by investigators at individual sites and across CSER, 32 CSER-wide manuscripts are currently in progress. In FY 2022, CSER will foster new partnerships with other NHGRI consortia and NIH's *All of Us* Research Program to identify new research and learning opportunities.

To achieve effective integration of genomics into clinical care, clinicians and researchers must have access to curated information about the relationship between genomic variants and human disease. ClinGen aims to collect that information, develop consensus approaches to genomic variant interpretation and classification, and disseminate the resulting information to the genomics community. ClinGen and ClinVar – a freely accessibly public database of information about genomic variation, funded by the Intramural Research Program of the National Library of Medicine – partner to spearhead data-sharing efforts amongst patients, clinicians, laboratories, and researchers in order to build an unrestricted genomic knowledge-base that informs research and benefits patients. In December 2018, the U.S. Food and Drug Administration (FDA) recognized ClinGen as the first authoritative source of valid scientific evidence for germline genomic variants that can be used to support clinical validity in premarket FDA submissions. ClinGen recruits experts in specific disease areas to assist with curation and develops training resources for genomic variant interpretation that are used in laboratories and clinical settings all around the world. In FY 2022, ClinGen will continue to broaden its curation efforts to include examination of complex diseases and ensure ancestry and diversity are adequately addressed – a key theme of ClinGen's Phase 3 vision.

Budget Policy: The FY 2022 President's Budget request for Using Genomics to Advance Medical Science is $24.5 million, an increase of $0.7 million or 2.9 percent from the FY 2021 Enacted level. In FY 2022, CSER and ClinGen will utilize these funds to continue to advance the genomic medicine by supporting the successful integration of genomics into clinical decision making and care.

Using Genomics to Improve the Effectiveness of Healthcare: The Implementing Genomics in Practice (IGNITE) Pragmatic Trials Network (PTN) works to actively implement genomic medicine in many clinical settings with diverse populations. Building on the success of its initial phase, the current phase of IGNITE began in 2018 and is comprised of five multi-site clinical groups and one coordinating center. Two clinical trials, GUARDD-US and ADOPT-PGx, began enrollment in 2020. GUARDD-US aims to study the effect of returning genomic risk information to hypertensive patients of African ancestry and their primary care providers, while ADOPT-PGx aims to compare traditional methods of treating acute post-surgical pain, chronic pain, and depression to genotype-guided therapies. Funds have been allocated to the IGNITE PTN through FY 2022, which will enable the program to assess the clinical utility and cost-effectiveness of genomic medicine interventions in diverse clinical settings.

In order for genomics to inform the development of solutions for some of the greatest public health needs that the nation faces related to common diseases (e.g., heart disease, diabetes, dementia, and autism), complex information about the interactions between many genomic variants contributing to disease risk must be synthesized in a patient's medical record. Polygenic

risk scores (PRSs) are a new way of assessing genomic risk and account for contributions of multiple genomic variants. The Electronic Medical Records and Genomics (eMERGE) Network is working to incorporate PRSs into patients' EMR and combine genomic information with existing EMR data to inform clinical care strategies. In July 2020, NHGRI announced $75 million in funding over five years for the eMERGE Genomic Risk Assessment and Management Network to support a coordinating center, four clinical, and six enhanced diversity clinical sites specifically focusing on recruiting participants from diverse ancestries. In FY 2022, the Network will focus on compiling data from an ethnically diverse set of participants to ensure PRSs are validated in all populations as well as studying the impact of returning genomic information to a diverse set of patients in order to inform best practices. The Network continues to look for ways to be at the forefront of genomics using the EMR to ensure that everyone benefits from the public's investment in genomic medicine.

Budget Policy: The FY 2022 President's Budget request for Using Genomics to Improve the Effectiveness of Healthcare is $14.6 million, an increase of $0.4 million or 2.8 percent from the FY 2021 Enacted level. Using FY 2022 funds, eMERGE and IGNITE will continue to pioneer and study real-world applications of genomics in healthcare to improve patient outcomes.

Bioinformatics, Computational Biology, and Data Science: Since the beginning of the Human Genome Project, bioinformatics, computational biology, and data have been an integral part of NHGRI's mission. The Institute's Computational Genomics and Data Science (CGDS) Program supports investigator-initiated research focused on new computational approaches, innovative data-analysis tools, and data resources – with all of this aligning nicely with the NIH Strategic Plan for Data Science. The CGDS Program has elicited a robust response from the research community, receiving 170 applications in FY 2020. Recent budget increases allowed for 14 of these applications to be funded. In FY 2022, the CGDS Program will continue to support innovate approaches to leveraging big data to propel the field of genomics forward.

The Genomic Data Science Analysis, Visualization, and Informatics Lab-space (AnVIL) is a resource created and supported by NHGRI that is working toward integrating tools that will be useful for the clinical genomics community. One of the four platforms involved in the NIH Cloud Platforms Interoperability Effort, AnVIL uses cloud-based infrastructure to democratize data access, sharing, and computing across large genomic and genomic-related datasets. Since its soft launch in June 2019, AnVIL has publicly released high-value datasets, such as GTEx version 8 and the high-coverage 1000 Genomes data, and currently holds data from the NHGRI Genome Sequencing Program and eMERGE for access by consortia members. During the COVID-19 pandemic, AnVIL has been used as the genomics data repository for various NIH COVID-19 host genetics studies and for the international COVID-19 Host Genetics Initiative, a consortium studying the genomic determinants of COVID-19 susceptibility, severity, and outcomes. In FY 2022, AnVIL will continue the process of onboarding NHGRI consortia datasets to allow researchers to access all of the data they need in one place, regardless of its origin.

Promoting a Diverse Genomics Workforce

A diverse workforce is critical to increasing innovation as well as creativity in order to fully realize the potential of genomics. In FY 2021 NHGRI unveiled its Diversity Strategic Plan articulating the institute's commitment to attracting, developing, and retaining a well-rounded genomics workforce. The goals of this plan are to develop and fund programs that support individuals from varied backgrounds at three key steps in their pursuit of a genomics career: pre-college education, graduate training, and career transitions.

At the pre-college level, exposing students to genomics generates interest in and lays the groundwork for a career in the field of genomics. One program that captures this pre-college audience is the NHGRI Short Course in Genomics. Started in FY 2003, the Short Course educates educators from across the United States in the fundamentals of genomics. To date, there have been over 250 course participants, many from Tribal Colleges. In FY 2022, NHGRI will continue to support this and other programs that provide underserved communities with early exposure to genomics. At the graduate level, NHGRI will encourage the development of graduate genomics training programs that provide mentorship and communities for diverse cohorts of students that work to retain those most at risk of leaving the scientific pipeline.

Early and mid-career transitions are common exit points from the scientific pipeline. In FY 2022, NHGRI will start transition awards to help retain underrepresented scientists in genomics research careers. NHGRI provides short-term funding to career investigators seeking genomics training or genomics researchers searching for preparation in another discipline, enabling these investigators to enrich their genomics research programs. One of the final pieces of the Diversity Strategic Plan is NHGRI's dedication to evaluating the progress of its initiatives to ensure they substantially increase the diversity of the genomics workforce by the end of the decade.

Budget Policy: The FY 2022 President's Budget request for Bioinformatics, Computational Biology, and Data Science is $185.7 million, an increase of $4.9 million or 2.7 percent from the FY 2021 Enacted level. With FY 2022 funds, NHGRI will continue to push the frontiers of genome-sequencing and data-analyses technologies. AnVIL will continue to provide a cutting-edge resource for the storage, analysis, and sharing of such data.

Education and Training: Among the challenges of implementing genomic medicine will be the need to ensure that the genomics workforce is diverse and that diversity is present at all career stages. To that end, NHGRI supports the Initiative to Maximize Research Education in Genomics: Diversity Action Plan (DAP). The DAP has been in place since 2002 and has included over 1,400 participants across 20 projects, increasing the pool of scientists from underrepresented backgrounds trained and poised to enter the genomics workforce. In FY 2020, NHGRI supported 14 DAP grants that developed students' preparedness for graduate school and beyond.

In April 2019, NHGRI partnered with the American Society of Human Genetics to launch the Human Genetics Scholars Initiative (HGI), a program dedicated to achieving diversity and inclusion in the field of human genetics and genomics. The program provides crucial mentorship and funds to early-career scientists from underrepresented backgrounds. In FY 2022, the second class of eight HGI scholars will begin their second year of the program and the third class will begin the program.

NHGRI's Genomic Innovator Award is another demonstration of the Institute's commitment to supporting early-career researchers. Initiated in FY 2018, this program rewards early-career

scientists who have made significant contributions to consortia and other team science efforts by providing crucial funds to support their own independent research careers. In its second year, the initiative awarded 12 researchers doing innovative and inspiring work in all areas of genomics. Recent budget increases will allow this program to expand even further in FY 2022, giving more early-stage researchers the chance to transform their careers.

Budget Policy: The FY 2022 President's Budget request for Education and Training is $29.3 million, an increase of $0.8 million or 2.8 percent from the FY 2021 Enacted level. These funds will be used by NHGRI to continue to support diverse trainees in genomics at all stages of their careers and aid in the development of early-stage investigators.

Genomics and Society: Ethical, legal, and social implications (ELSI) research has been an integral part of NHGRI's research portfolio since the founding of the HGP. The ELSI Research Program funds research studies, training opportunities and workshops, and develops and supports research consortia and conferences. The Program funds projects in the following broad areas: issues with the design and conduct of genetic and genomic research, issues in incorporating genomics into clinical care, and broader legal, and policy and bioethical and societal issues raised by the use of genetic and genomic technologies.

Since 2004, the ELSI Research Program has supported a Centers of Excellence in ELSI Research (CEER) program, designed to create academic centers pursuing trans-disciplinary research and training that explore cutting-edge ELSI issues and translate ELSI scholarship into practices and policies that guide genomics research and genomic medicine. The CEER program currently supports five research centers at universities across the country. To provide a platform for the coordination and synthesis of ELSI research and research products, NHGRI established a Center for ELSI Resources and Analysis in 2019. To better integrate the ELSI research community, the ELSI Research Program holds a biennial ELSI Research Congress; the next ELSI Research Congress is expected to be held in FY 2022.

In addition to the efforts directly supported by the ELSI Research Program, ELSI research is a vital component of many other NHGRI's programs and projects (e.g., CSER, eMERGE, and dGTEX), as the Institute continues to work toward the responsible integration of genomics into research and clinical care. In FY 2022, NHGRI's ELSI Research Program will continue to perform research that will inform the future of genetics and genomics. The program is working to expand its focus to include more diverse disciplines, particularly in analytical and conceptual approaches to issues raised by emerging technologies. The ELSI Research Program is also working to coordinate ELSI research across the NIH to better address scientific and public need.

Budget Policy: The FY 2022 President's Budget request for Genomics and Society is $58.1 million, an increase of $1.5 million or 2.7 percent from the FY 2021 Enacted level. In FY 2022, NHGRI will continue to fund ELSI research that is critical for ethical and successful advances in genomics.

Research Management and Support (RMS): 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 RMS funds to

support NHGRI's mission of furthering genetics and genomics research by engaging with policymakers, stakeholders, educators, researchers, and clinicians.

PPAB assists in promoting policies that facilitate the uptake of genomic technologies into the clinic and broader society, the protection of research participants in genomic studies, and the integration of genomic knowledge into healthcare. Additionally, PPAB conducts portfolio analysis for long-range planning and evaluation of institute research. In FY 2022, PPAB will continue to focus its portfolio to address emerging policy issues in genomics, such as data sharing, direct-to-consumer genetic testing, and privacy.

ECIB's education programs include those that inform the public of the latest advances in genomics as well as those that support the dissemination of information to teachers, students, consumers, and clinicians. ECIB acts as a liaison between NHGRI and community-based organizations and leads programs and initiatives to promote the engagement of diverse communities in understanding genomics and its translation to health and society. ECIB continues to disseminate the *Genome: Unlocking Life's Code* newsletter in partnership with the Smithsonian Museum of Natural History, which provides vital resources for educators, students, and parents. In FY 2020, ECIB offered its annual NHGRI Short Course in Genomics for middle and high school teachers, community college instructors, and Tribal college faculty that teach science, technology, engineering, and math (STEM) courses.

NHGRI's Communications and Public Liaison Branch (CPLB), within the Office of the Director, creates media in the form of written articles, videos, graphics, and social media posts to provide high-quality and timely genomics information to the general public. For the 30th anniversary of the HGP's launch at the end of FY 2020, CPLB created materials that celebrated the impact and legacy of the HGP, including 30 oral histories with prominent genomicists and a social media video campaign.

In FY 2022, PPAB, ECIB, and CPLB will continue to work in concert to promote sound policy, perform outreach and stakeholder engagement, and keep the general public informed about the latest in genomics and genomic medicine.

Budget Policy: The FY 2022 President's Budget request for Research Management and Support is $36.0 million, an increase of $1.0 million or 3.0 percent from the FY 2021 Enacted level. These funds will be used to support a number of outreach, education, and stakeholder-engagement initiatives in FY 2022.

NATIONAL INSTITUTES OF HEALTH
National Human Genome Research Institute

Appropriations History

Fiscal Year	Budget Estimate to Congress	House Allowance	Senate Allowance	Appropriation
2013	$511,370,000		$512,920,000	$512,872,835
Rescission				$1,025,746
Sequestration				($25,742,690)
2014	$517,319,000		$513,881,000	$497,813,000
Rescission				$0
2015	$498,451,000			$499,356,000
Rescission				$0
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			

[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	2021 Amount Authorized	FY 2021 Enacted	2022 Amount Authorized	FY 2022 President's Budget
Research and Investigation	Section 301	42§241	Indefinite	$616,012,000	Indefinite	$632,973,000
National Human Genome Research Institute	Section 401(a)	42§281	Indefinite		Indefinite	
Total, Budget Authority				$616,012,000		$632,973,000

NATIONAL INSTITUTES OF HEALTH
National Human Genome Research Institute

Amounts Available for Obligation[1]

(Dollars in Thousands)

Source of Funding	FY 2020 Final	FY 2021 Enacted	FY 2022 President's Budget
Appropriation	$606,349	$615,780	$632,973
Secretary's Transfer	0	0	0
OAR HIV/AIDS Transfers	-2,231	232	0
HEAL Transfer from NINDS	0	0	0
Subtotal, adjusted budget authority	$604,118	$616,012	$632,973
Unobligated balance, start of year	0	0	0
Unobligated balance, end of year	0	0	0
Subtotal, adjusted budget authority	$604,118	$616,012	$632,973
Unobligated balance lapsing	-35	0	0
Total obligations	$604,083	$616,012	$632,973

[1] Excludes the following amounts (in thousands) for reimbursable activities carried out by this account:
FY 2020 - $25,912 FY 2021 - $26,430 FY 2022 - $27,708

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National Human Genome Research Institute

Budget Authority by Object Class[1]

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2022 +/- FY 2021 Enacted
Total compensable workyears:			
Full-time equivalent	351	370	19
Full-time equivalent of overtime and holiday hours	0	0	0
Average ES salary	$199	$204	$5
Average GM/GS grade	12.6	12.6	0.0
Average GM/GS salary	$122	$125	$3
Average salary, Commissioned Corps (42 U.S.C. 207)	$133	$136	$4
Average salary of ungraded positions	$160	$163	$4

	OBJECT CLASSES	FY 2021 Enacted	FY 2022 President's Budget	FY 2022 +/- FY 2021
	Personnel Compensation			
11.1	Full-Time Permanent	21,331	23,004	1,673
11.3	Other Than Full-Time Permanent	19,529	20,810	1,281
11.5	Other Personnel Compensation	967	989	22
11.7	Military Personnel	444	456	12
11.8	Special Personnel Services Payments	4,671	4,778	106
11.9	**Subtotal Personnel Compensation**	**$46,942**	**$50,036**	**$3,094**
12.1	Civilian Personnel Benefits	14,919	16,497	1,578
12.2	Military Personnel Benefits	453	465	13
13.0	Benefits to Former Personnel	0	0	0
	Subtotal Pay Costs	**$62,314**	**$66,998**	**$4,684**
21.0	Travel & Transportation of Persons	577	588	10
22.0	Transportation of Things	155	158	3
23.1	Rental Payments to GSA	0	0	0
23.2	Rental Payments to Others	2	2	0
23.3	Communications, Utilities & Misc. Charges	225	229	4
24.0	Printing & Reproduction	11	11	0
25.1	Consulting Services	24,799	25,953	1,154
25.2	Other Services	21,718	19,532	-2,186
25.3	Purchase of goods and services from government accounts	55,119	58,225	3,106
25.4	Operation & Maintenance of Facilities	139	139	0
25.5	R&D Contracts	940	957	17
25.6	Medical Care	638	649	12
25.7	Operation & Maintenance of Equipment	2,422	2,466	44
25.8	Subsistence & Support of Persons	0	0	0
25.0	**Subtotal Other Contractual Services**	**$105,776**	**$107,922**	**$2,145**
26.0	Supplies & Materials	5,874	5,879	6
31.0	Equipment	4,056	4,065	8
32.0	Land and Structures	0	0	0
33.0	Investments & Loans	0	0	0
41.0	Grants, Subsidies & Contributions	437,022	447,122	10,100
42.0	Insurance Claims & Indemnities	0	0	0
43.0	Interest & Dividends	0	0	0
44.0	Refunds	0	0	0
	Subtotal Non-Pay Costs	**$553,698**	**$565,975**	**$12,277**
	Total Budget Authority by Object Class	**$616,012**	**$632,973**	**$16,961**

[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 2021 Enacted	FY 2022 President's Budget	FY 2022 +/- FY 2021
Personnel Compensation			
Full-Time Permanent (11.1)	$21,331	$23,004	$1,673
Other Than Full-Time Permanent (11.3)	19,529	20,810	1,281
Other Personnel Compensation (11.5)	967	989	22
Military Personnel (11.7)	444	456	12
Special Personnel Services Payments (11.8)	4,671	4,778	106
Subtotal Personnel Compensation (11.9)	**$46,942**	**$50,036**	**$3,094**
Civilian Personnel Benefits (12.1)	$14,919	$16,497	$1,578
Military Personnel Benefits (12.2)	453	465	13
Benefits to Former Personnel (13.0)	0	0	0
Subtotal Pay Costs	**$62,314**	**$66,998**	**$4,684**
Travel & Transportation of Persons (21.0)	$577	$588	$10
Transportation of Things (22.0)	155	158	3
Rental Payments to Others (23.2)	2	2	0
Communications, Utilities & Misc. Charges (23.3)	225	229	4
Printing & Reproduction (24.0)	11	11	0
Other Contractual Services:			
Consultant Services (25.1)	24,799	25,953	1,154
Other Services (25.2)	21,718	19,532	-2,186
Purchases from government accounts (25.3)	38,447	41,075	2,627
Operation & Maintenance of Facilities (25.4)	139	139	0
Operation & Maintenance of Equipment (25.7)	2,422	2,466	44
Subsistence & Support of Persons (25.8)	0	0	0
Subtotal Other Contractual Services	**$87,526**	**$89,165**	**$1,639**
Supplies & Materials (26.0)	$5,874	$5,879	$6
Subtotal Non-Pay Costs	**$94,370**	**$96,032**	**$1,662**
Total Administrative Costs	**$156,684**	**$163,030**	**$6,346**

NATIONAL INSTITUTES OF HEALTH
National Human Genome Research Institute

Detail of Full-Time Equivalent Employment (FTE)

OFFICE/DIVISION	FY 2020 Final			FY 2021 Enacted			FY 2022 President's Budget		
	Civilian	Military	Total	Civilian	Military	Total	Civilian	Military	Total
Division of Extramural Operations									
Direct:	14	-	14	16	-	16	16	-	16
Reimbursable:	1	-	1	1	-	1	2	-	2
Total:	15	-	15	17	-	17	18	-	18
Division of Genome Sciences									
Direct:	11	-	11	13	-	13	14	-	14
Reimbursable:	3	-	3	3	-	3	3	-	3
Total:	14	-	14	16	-	16	17	-	17
Division of Genomic Medicine									
Direct:	11	-	11	13	-	13	14	-	14
Reimbursable:	2	-	2	2	-	2	2	-	2
Total:	13	-	13	15	-	15	16	-	16
Division of Genomics and Society									
Direct:	6	-	6	7	-	7	8	-	8
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	6	-	6	7	-	7	8	-	8
Division of Intramural Research									
Direct:	199	3	202	206	3	209	217	3	220
Reimbursable:	29	3	32	29	3	32	31	3	34
Total:	228	6	234	235	6	241	248	6	254
Division of Management									
Direct:	40	-	40	41	-	41	43	-	43
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	40	-	40	41	-	41	43	-	43
Office of the Director									
Direct:	12	-	12	14	-	14	14	-	14
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	12	-	12	14	-	14	14	-	14
Total	328	6	334	345	6	351	364	6	370
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
2018	12.6
2019	12.7
2020	12.6
2021	12.6
2022	12.6

NATIONAL INSTITUTES OF HEALTH
National Human Genome Research Institute

Detail of Positions[1]

GRADE	FY 2020 Final	FY 2021 Enacted	FY 2022 President's Budget
Total, ES Positions	2	2	2
Total, ES Salary	394,600	398,546	407,713
General Schedule			
GM/GS-15	35	36	37
GM/GS-14	31	33	35
GM/GS-13	66	68	69
GS-12	36	37	37
GS-11	19	21	22
GS-10	1	1	1
GS-9	4	4	4
GS-8	10	12	12
GS-7	2	1	1
GS-6	0	0	0
GS-5	0	0	0
GS-4	0	0	0
GS-3	2	2	2
GS-2	0	0	0
GS-1	0	0	0
Subtotal	206	215	220
Commissioned Corps (42 U.S.C. 207)			
Assistant Surgeon General	0	0	0
Director Grade	3	3	3
Senior Grade	2	3	3
Full Grade	0	0	0
Senior Assistant Grade	0	0	0
Assistant Grade	0	0	0
Subtotal	5	6	6
Ungraded	147	167	174
Total permanent positions	213	223	228
Total positions, end of year	360	390	402
Total full-time equivalent (FTE) employment, end of year	334	351	370
Average ES salary	197,300	199,273	203,856
Average GM/GS grade	12.6	12.6	12.6
Average GM/GS salary	120,816	121,945	124,750

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