National Human Genome Research Institute

Department of Health and Human Services
National Institutes of Health

Fiscal Year 2016 Budget Request

Statement for the Record
Senate Subcommittee on Labor-HHS-Education Appropriations

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Mr. Chairman and Members of the Subcommittee:

I am pleased to present the President's Fiscal Year (FY) 2016 budget request for the National Human Genome Research Institute (NHGRI) of the National Institutes of Health (NIH). The FY 2016 budget request for NHGRI is $515,491,000, which is $16,814,000 more than the FY 2015 level.

Twenty-five years ago, scientists came together to chart the first plans for the Human Genome Project (HGP), the audacious scientific and technological endeavor that deciphered our DNA code and laid out the human blueprint. Today, a dozen years after the completion of the HGP and the sequencing of the first human genome, and to a great extent due to NHGRI's sustained investment in innovative technologies and research strategies leading to successive genomics advances, we are poised to pursue the ultimate promise of the HGP by transforming medicine and improving health through the Precision Medicine Initiative. NHGRI's research portfolio fuels the potential for precision medicine through basic science to understand the structure and function of the human and other genomes; health and disease research to apply that knowledge to decipher the mechanisms of both common and rare diseases; and pioneering applications of genomic medicine involving the use of genomic information for clinical care. Through comprehensive efforts to detect and understand the genomic variation - those places in our DNA sequence where the As, Ts, Cs, and Gs of one person's genome differ from other people's genome - that exists among the world's populations, we are learning a tremendous amount about the genomic underpinnings of human disease.

However, we need faster, cheaper, and more accurate DNA sequencing technologies, so that we can reliably generate individual-level genomic information with the degree of confidence needed for doctors, health insurers, and patients to rely on as part of their clinical care. Therefore, in FY 2016, NHGRI will continue to focus on improving genomic-based diagnostic methods through its Genome Technology Program. Already, this program, working in parallel and in collaboration with the private sector, has been responsible for a dramatic drop in the costs of genome sequencing over the past decade by providing research funds to develop innovative, high-risk DNA sequencing technologies. The fruits of these efforts have led to multiple examples of productive commercialization of new genome-sequencing technologies and a reduction in the cost of sequencing a human genome from hundreds of millions of dollars a decade ago to several thousand dollars today.

For many years, NHGRI's flagship has been its Genome Sequencing Program (GSP), components of which have sequenced thousands of human and other genomes, implemented the most cutting-edge genome sequencing methods, and investigated fundamental questions about the genomics of biology and disease. In FY 2016, NHGRI

is re-configuring the GSP to capitalize on the most compelling opportunities in research that aims to understand the genomic contributions to human disease. These diseases can be generally divided into two categories: common diseases (such as Alzheimer's disease, cardiovascular disease, and diabetes), which pose a significant burden to the health of the Nation; and rare diseases, those disorders for which cumulatively more than 25 million American suffer, a number greater than those afflicted with cancer. A new NHGRI Centers for Common Disease Genomics (CCDG) program will tackle the first disease category, where conditions typically result from variants in multiple parts of an individual's genome and researchers need to compare the genomes of tens of thousands of people to reveal the particular genomic variants involved in each disease.

Meanwhile, the Centers for Mendelian Genomics (CMGs) program will continue its focus on discovering the genomic alterations, most often in a single gene, that underlie thousands of rare diseases. There are an estimated 7,300 of these rare inherited - or Mendelian - diseases, with genomic bases established for only about half (most of those discoveries occurring since the end of the HGP). That leaves well over 3,000 rare diseases for which the genomic bases remain unknown. Learning more about these rare disorders helps patients via the availability of more rapid diagnoses and the identification of potential routes to identify new treatments; another benefit is the insight that can be gained, giving clues about the causes of more common diseases due to defects in similar biological pathways and processes. NHGRI's GSP is particularly interested in finding common genomic causes that underlie multiple conditions or that may be protective in one case and deleterious in another.

As with the other clinically oriented research programs in NHGRI's portfolio, eMERGE is studying the ethical, legal, and social implications of integrating genomic technologies into medicine. Society must be comfortable with the use of genomic information for clinical care if genomic medicine (and ultimately precision medicine) is to be successful. Understanding the public's attitudes about genomics requires designing and examining safeguards for how and when an individual's genomic information may be used as well as promoting genomic literacy among healthcare professionals and the general public.

Finally, as evidence begins to accumulate that supports the use of specific genomic information for making clinical decisions, it is essential to have adequate mechanisms to disseminate knowledge and resources among healthcare practitioners. Towards that end, NHGRI developed the Clinical Genome Resource (ClinGen), co- funded by the National Cancer Institute and the National Center for Biotechnology Information, to assist clinicians in interpreting genomic test results. This program, which began in FY 2013 and will expand in FY 2016, aims to provide researchers and healthcare providers with clinically relevant information about demonstrated links between genomic variants and disease. Importantly, patients are involved in collecting this information for dissemination through the GenomeConnect web portal. This portal allows the upload of genomic test results and associated medical data, and connects patients with others with the same genomic variants and with researchers interested in their conditions.

Through these and other programs, NHGRI will continue to provide leadership to the genomics community as it works toward solving the remaining puzzles that lie in the Nation's path towards a future where genomic medicine improves the ways in which American's experience and direct their healthcare.

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Eric D. Green, M.D., Ph.D., is the Director of the National Human Genome Research Institute (NHGRI) of the National Institutes of Health (NIH), a position he has held since late 2009. NHGRI is the largest organization in the world solely dedicated to genomics research. Previously, he served as the NHGRI Scientific Director (2002- 2009), Chief of the NHGRI Genome Technology Branch (1996-2009), and Director of the NIH Intramural Sequencing Center (1997-2009).

Born and raised in St. Louis, Missouri, Dr. Green received his B.S. degree in Bacteriology from the University of Wisconsin-Madison in 1981, and his M.D. and Ph.D. degrees from Washington University in 1987. During residency training in clinical pathology (laboratory medicine), he worked in the laboratory of Dr. Maynard Olson, where he launched his career in genomics research. In 1992, he was appointed Assistant Professor of Pathology and Genetics as well as a Co-Investigator in the Human Genome Center at Washington University. In 1994, he joined the newly established Intramural Research Program of the National Center for Human Genome Research, later renamed the National Human Genome Research Institute.

While directing an independent research program for almost two decades, Dr. Green was at the forefront of efforts to map, sequence, and understand eukaryotic genomes. His work included significant, start-to-finish involvement in the Human Genome Project. These efforts eventually blossomed into a highly productive program in comparative genomics that provided important insights about genome structure, function, and evolution. His laboratory also identified and characterized several human disease genes, including those implicated in certain forms of hereditary deafness, vascular disease, and inherited peripheral neuropathy.

As Director of NHGRI, Dr. Green is responsible for providing overall leadership of the Institute's research portfolio and other initiatives. In 2011, Dr. Green led NHGRI to the completion of a strategic planning process that yielded a new vision for the future of genomics research, entitled *Charting a course for genomic medicine from base pairs to bedside (Nature 470:204-213, 2011).* Since that time, he has led the Institute in broadening its research mission; this has included designing and launching a number of major programs to accelerate the application of genomics to medical care. With the rapidly expanding scope of genomics, his leadership efforts have also involved significant coordination with multiple components of the NIH, as well as other agencies and organizations.

Beyond NHGRI-specific programs, Dr. Green has also played an instrumental leadership role in the development of a number of high-profile efforts relevant to genomics, including the Smithsonian-NHGRI exhibition *Genome: Unlocking Life's Code*, the NIH Big Data to Knowledge (BD2K) program, the NIH Genomic Data Sharing Policy, and the U.S. Precision Medicine Initiative.

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