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# Proposed NHGRI Reorganization

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



- I. Background on NHGRI
- II. Proposed Reorganization
- III. Process for Implementation



# Historical Context: 'The Genome Institute'



**Office for Human Genome Research**

***1988-1989***

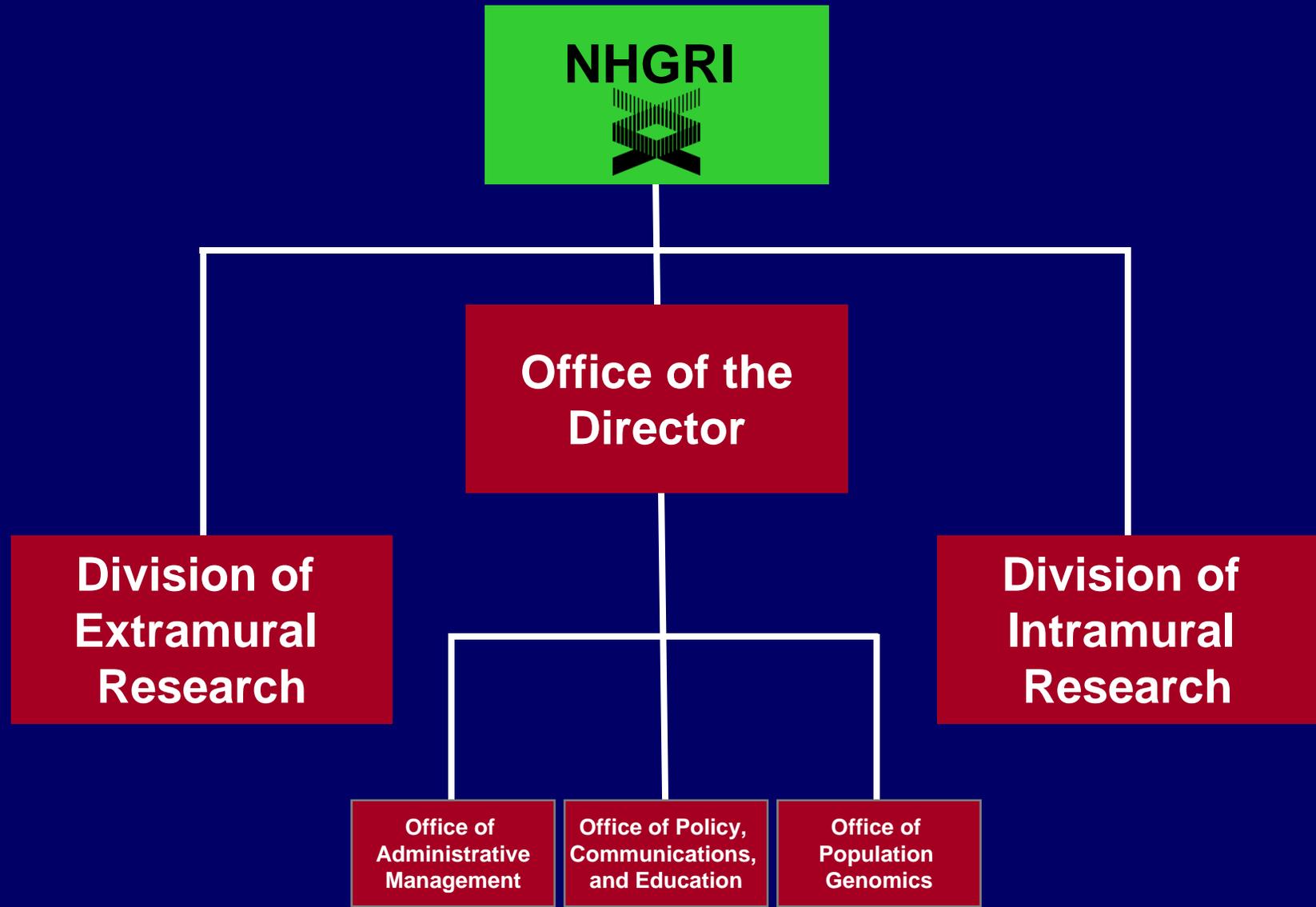
**National Center for Human Genome Research**

***1989-1997***

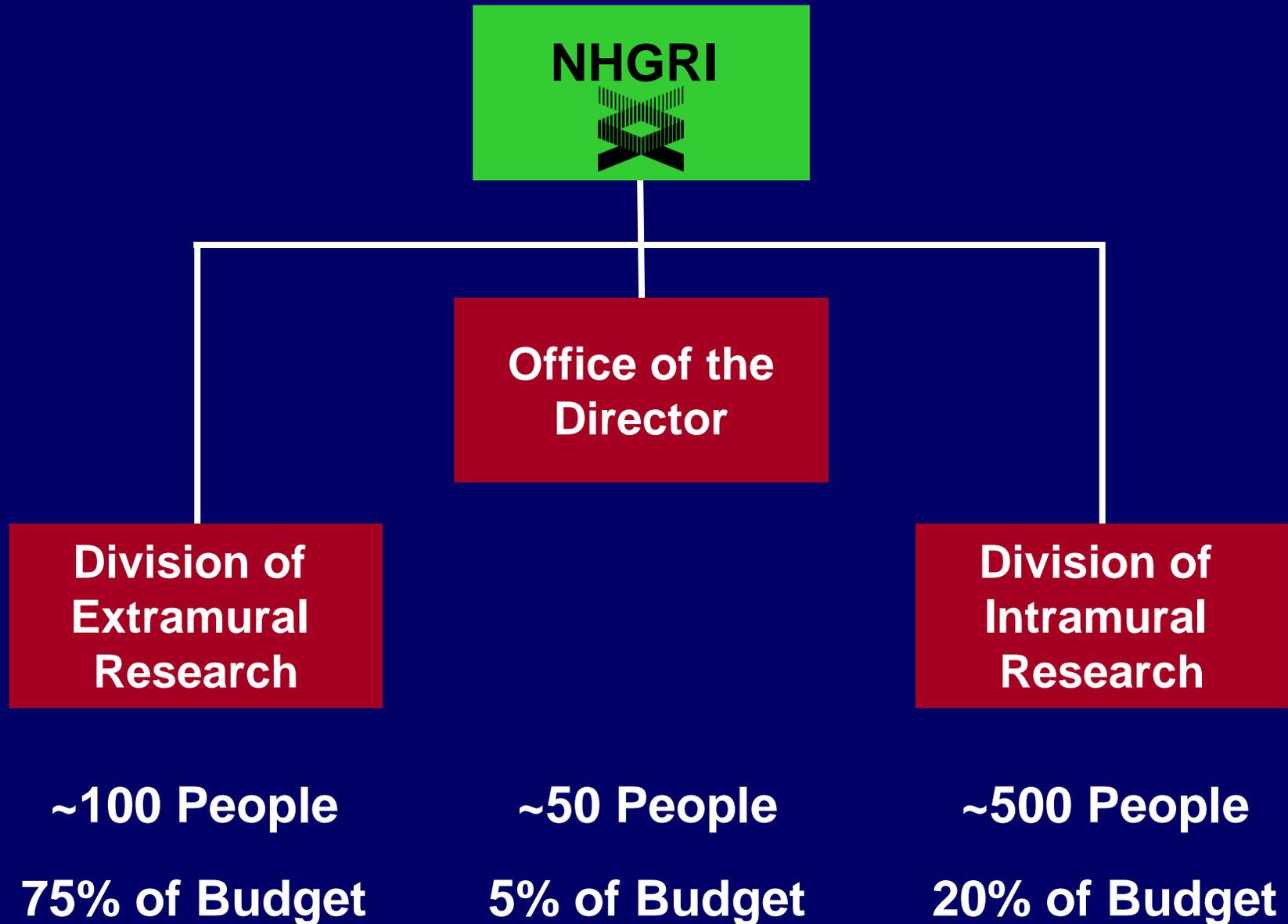
**National Human Genome Research Institute**

***1997-present***

# Current NHGRI Organizational Structure



# Current NHGRI Organizational Structure

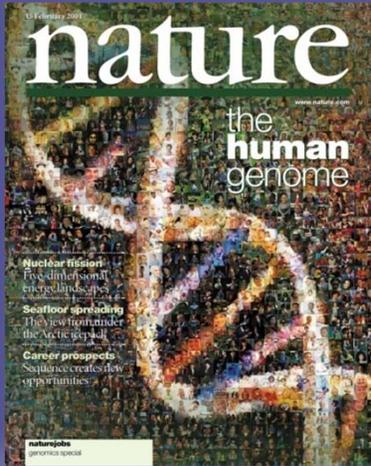


# **Additional Background**

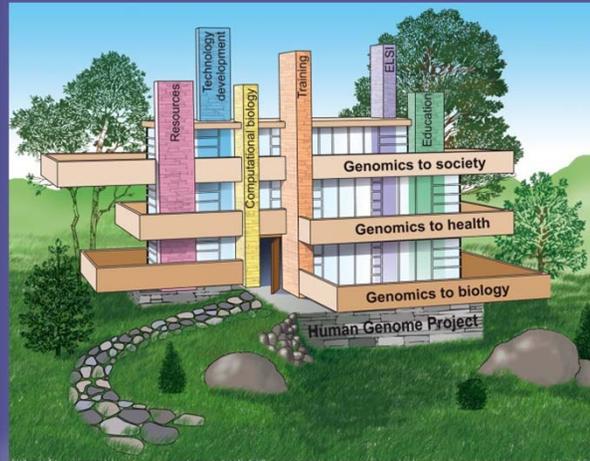
- **Organizational structure of the Extramural Research Program has been essentially unchanged since the Human Genome Project—largely a ‘flat’ (non-hierarchical) structure**
- **The Office of the Director has grown in mission, complexity, and scale in recent years, commensurate with the Institute’s expanding research portfolio**

# The Different Eras of NHGRI

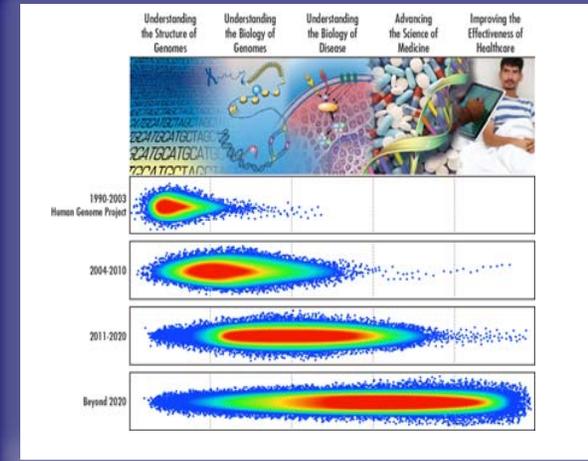
1990-2003



2003-2010



2011-??



**POICY**  
**A New H**

**Understand Our Gen Inheritance: The U.S. Human Project: The First Five Year FY 1991**

**GENOMICS**

**New Goals for the U.S. Human Genome Project: 1998-2003**

**Research S. Collins, Ad Patil, Eric Green, Kenneth Chakravarti, Raymond G. Cook-Deegan, Larry Watson, and the members of the DNA and HBB planning group**

**GENOMICS**

**GENOMICS**

**A vision for the future of genomics research**

**A blueprint for the genomics era**

**GENOMICS**

**GENOMICS**

**PERSPECTIVE**

**Charting a course for genomic medicine from base pairs to bedside**

**Paul D. Cincot, Mark D. Cuperl, & National Human Genome Research Institute**

**GENOMICS**

**GENOMICS**

# ~11 Months Ago



## PERSPECTIVE

doi:10.1038/nature09764

### Charting a course for genomic medicine from base pairs to bedside

Eric D. Green<sup>1</sup>, Mark S. Guyer<sup>1</sup> & National Human Genome Research Institute\*

There has been much progress in genomics in the ten years since a draft sequence of the human genome was published. Opportunities for understanding health and disease are now unprecedented, as advances in genomics are harnessed to obtain robust foundational knowledge about the structure and function of the human genome and about the genetic contributions to human health and disease. Here we articulate a 2011 vision for the future of genomics research and describe the path towards an era of genomic medicine.

Since the end of the Human Genome Project (HGP) in 2003 and the publication of a reference human genome sequence<sup>1,2</sup>, genomics has become a mainstay of biomedical research. The scientific community's foresight in launching this ambitious project<sup>3</sup> is evident in the broad range of scientific advances that the HGP has enabled, as shown in Fig. 1 (see rollfold). Optimism about the potential contributions of genomics for improving human health has been fuelled by new insights about cancer<sup>4,5</sup>, the molecular basis of inherited diseases (http://www.ncbi.nlm.nih.gov/omim and http://www.genome.gov/GWAStudies) and the role of structural variation in disease<sup>6</sup>, some of which have already led to new therapies<sup>7,8</sup>. Other advances have already changed medical practice (for example, microarrays are now used for clinical detection of genomic imbalances<sup>9</sup> and pharmacogenomic testing is routinely performed before administration of certain medications<sup>10</sup>). Together, these achievements (see accompanying paper<sup>11</sup>) document that genomics is contributing to a better understanding of human biology and to improving human health.

As it did eight years ago<sup>3</sup>, the National Human Genome Research Institute (NHGRI) has engaged the scientific community (http://www.genome.gov/Planning) to reflect on the key attributes of genomics (Box 1) and explore future directions and challenges for the field. These discussions have led to an updated vision that focuses on understanding human biology and the diagnosis, prevention and treatment of human disease, including consideration of the implications of those advances for society (but these discussions, intentionally did not address the role of genomics in agriculture, energy and other areas). Like the HGP, achieving this vision is broader than what any single organization or country can achieve—realizing the full benefits of genomics will be a global effort.

This 2011 vision for genomics is organized around five domains extending from basic research to health applications (Fig. 2). It reflects the view that, over time, the most effective way to improve human health is to understand normal biology (in this case, genome biology) as a basis for understanding disease biology, which then becomes the basis for improving health. At the same time, there are other connections among these domains. Genomics offers opportunities for improving health without a thorough understanding of disease (for example, cancer therapies can be selected based on genomic profiles that identify tumour subtypes<sup>12,13</sup>), and clinical discoveries can lead back to understanding disease or even basic biology.

The past decade has seen genomics contribute fundamental knowledge about biology and its perturbation in disease. Further deepening this understanding will accelerate the transition to genomic medicine (clinical care based on genomic information). But significant change rarely comes

quickly. Although genomics has already begun to improve diagnostics and treatments in a few circumstances, profound improvements in the effectiveness of healthcare cannot realistically be expected for many years (Fig. 2). Achieving such progress will depend not only on research, but also on new policies, practices and other developments. We have illustrated the kinds of achievements that can be anticipated with a few examples (Box 2) where a confluence of need and opportunities should lead to major accomplishments in genomic medicine in the coming decade. Similarly, we note three cross-cutting areas that are broadly relevant and fundamental across the entire spectrum of genomics and genomic medicine: bioinformatics and computational biology (Box 3), education and training (Box 4), and genomics and society (Box 5).

#### Understanding the biology of genomes

Substantial progress in understanding the structure of genomes has revealed much about the complexity of genome biology. Continued acquisition of basic knowledge about genome structure and function will be needed to illuminate further those complexities (Fig. 2). The contribution of genomics will include more comprehensive sets (catalogues) of data and new research tools, which will enhance the capabilities of all researchers to reveal fundamental principles of biology.

#### Comprehensive catalogues of genomic data

Comprehensive genomic catalogues have been uniquely valuable and widely used. There is a compelling need to improve existing catalogues and to generate new ones, such as complete collections of genetic variation, functional genomic elements, RNAs, proteins, and other biological molecules, for both human and model organisms.

Genomic studies of the genes and pathways associated with disease-related traits require comprehensive catalogues of genetic variation, which provide both genetic markers for association studies and variants for identifying candidate genes. Developing a detailed catalogue of variation in the human genome has been an international effort that began with The SNP Consortium<sup>14</sup> and the International HapMap Project<sup>15</sup> (http://hapmap.ncbi.nlm.nih.gov), and is ongoing with the 1000 Genomes Project<sup>16</sup> (http://www.1000genomes.org).

Over the past decade, these catalogues have been critical in the discovery of the specific genes for roughly 3,000 Mendelian (monogenic) diseases

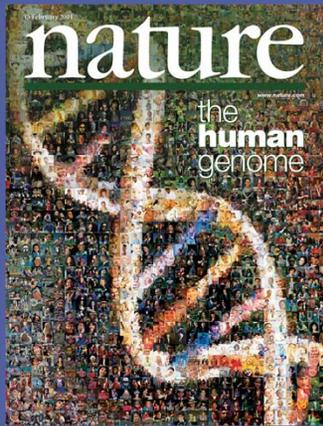
Figure 1 | Genomic achievements since the Human Genome Project (see accompanying rollfold). ►

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†List of participants and their affiliations appear at the end of the paper.

## February 2011

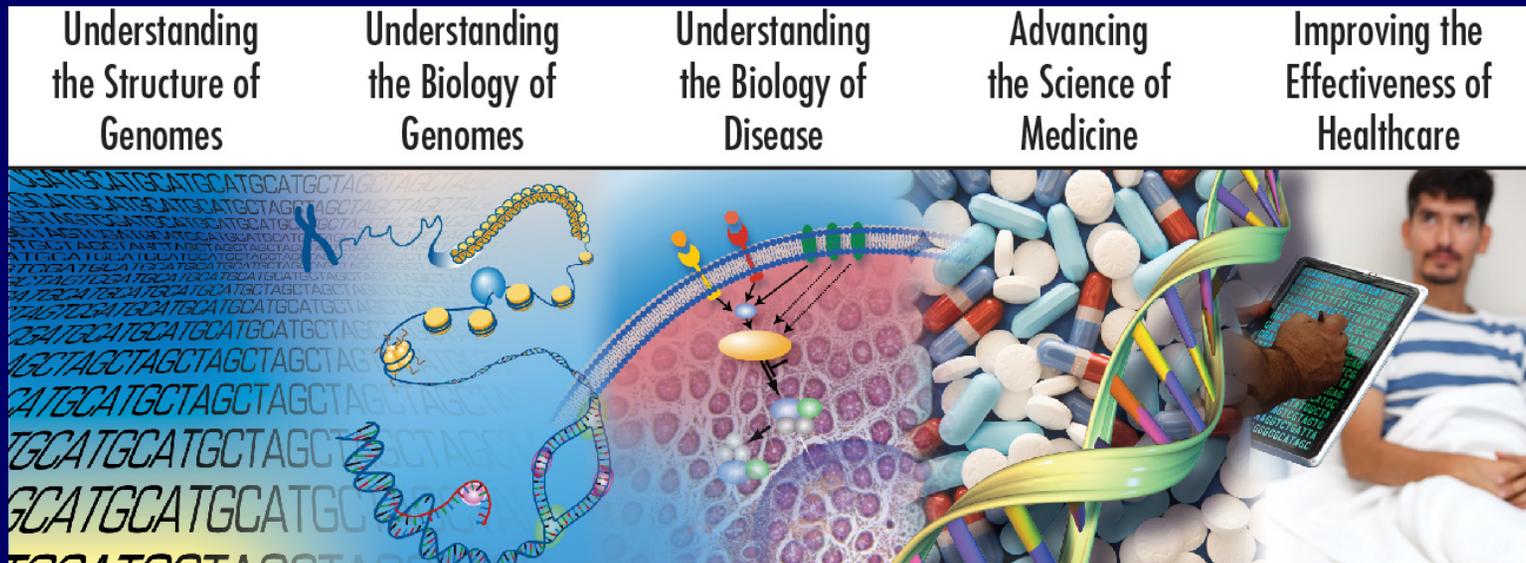
# NHGRI Published New Vision for Genomics

# The Path to Genomic Medicine



**Human  
Genome  
Project**

**Realization of  
Genomic  
Medicine**



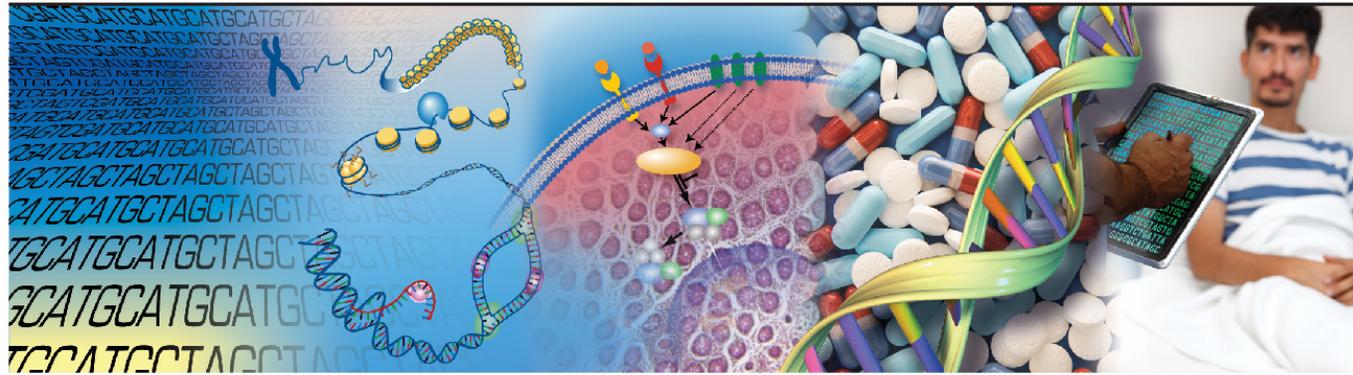
Understanding  
the Structure of  
Genomes

Understanding  
the Biology of  
Genomes

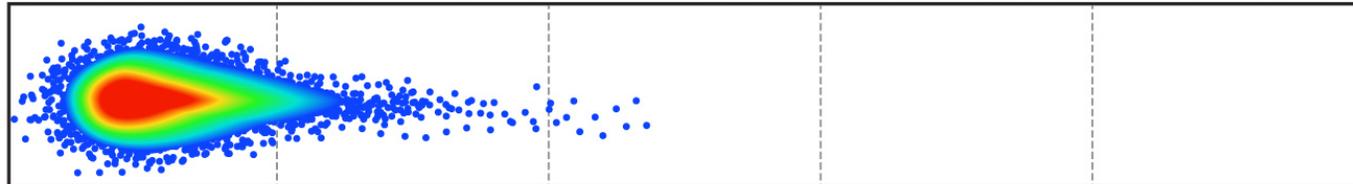
Understanding  
the Biology of  
Disease

Advancing  
the Science of  
Medicine

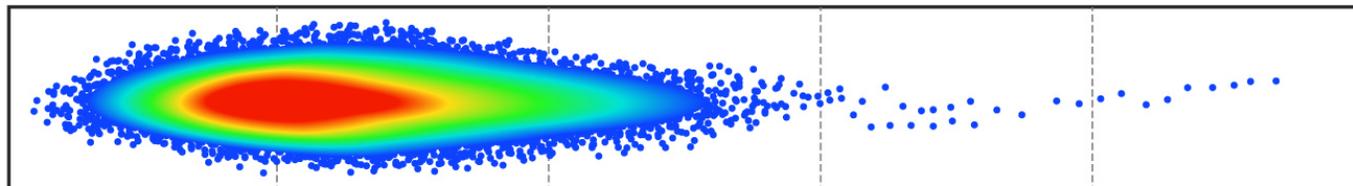
Improving the  
Effectiveness of  
Healthcare



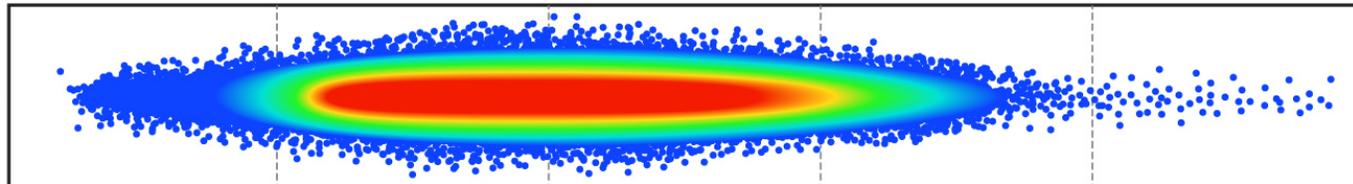
1990-2003  
Human Genome Project



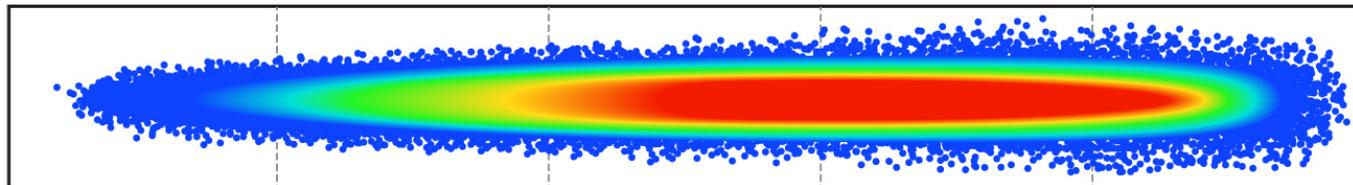
2004-2010



2011-2020

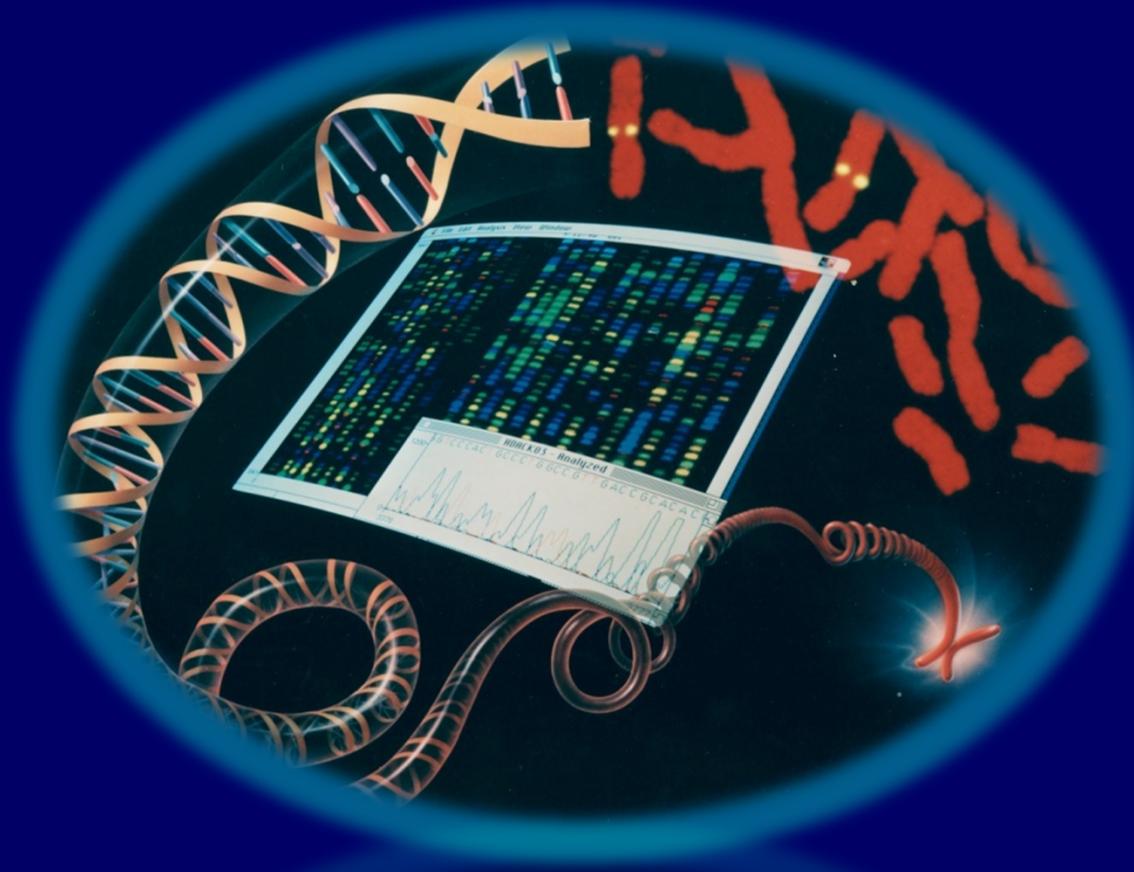


Beyond 2020



Green et al. (2011)

# NHGRI Extramural Research Program: *Circa 'Then'*



# NHGRI Extramural Research Program: Circa 'Now'

**\$1000 Genome**  
Technology Development  
Program

**TCGA**  
The Cancer Genome  
Atlas

**KOMP**  
Knockout Mouse  
Project

**PAGE**  
Population Architecture using  
Genomics and Epidemiology

**1000  
Genomes**

**ENCODE**  
Encyclopedia of DNA  
Elements Project

**modENCODE**  
Model Organism  
ENCODE

**Clinical  
Sequencing**

**Mendelian Disorders  
Sequencing**

**Large-Scale  
Sequencing Program**

**eMERGE**  
Electronic Medical  
Records and Genomics

**PhenX**  
Consensus Measures for  
Phenotypes and eXposures

**GENEVA**  
Gene Environment  
Association Studies

**CEGS**  
Centers of Excellence in  
Genomic Science

**ELSI**  
Ethical Legal Social  
Implications Program

**GARNET**  
Genomics and Randomized  
Trials Network

**CEER Program**  
Centers for Excellence  
in ELSI Research

**KOMP2**  
KOMP  
Phenotyping

**HMP**  
Human Microbiome  
Project

**GTE<sub>x</sub>**  
Genotype-Tissue  
Expression

**H3Africa**  
Human Heredity and  
Health in Africa

**Protein Capture  
Reagents**

**LINCS**  
Library of Integrated Network-  
based Cellular Signatures

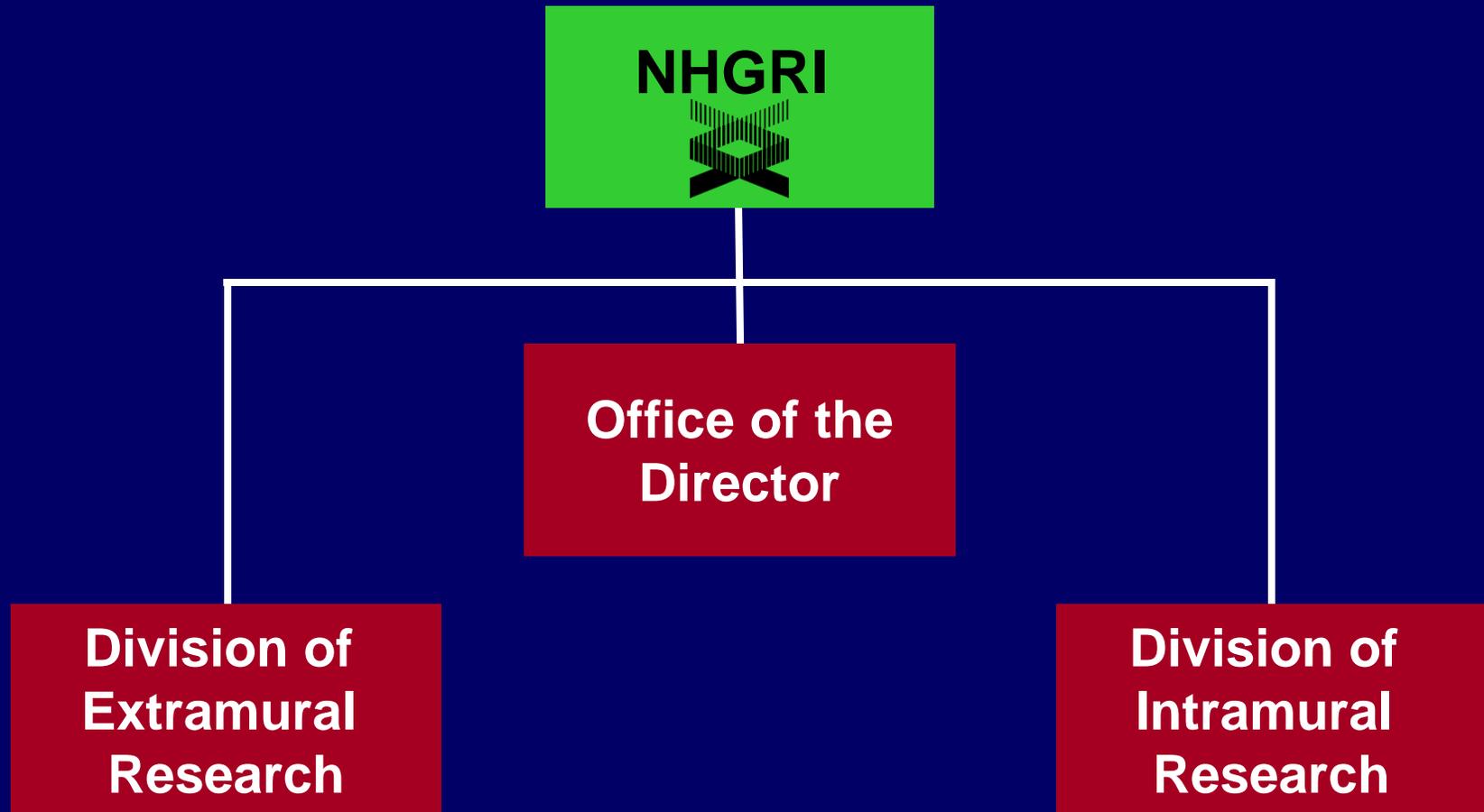
**MLP**  
Molecular Libraries  
Program



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# Current NHGRI Organizational Structure

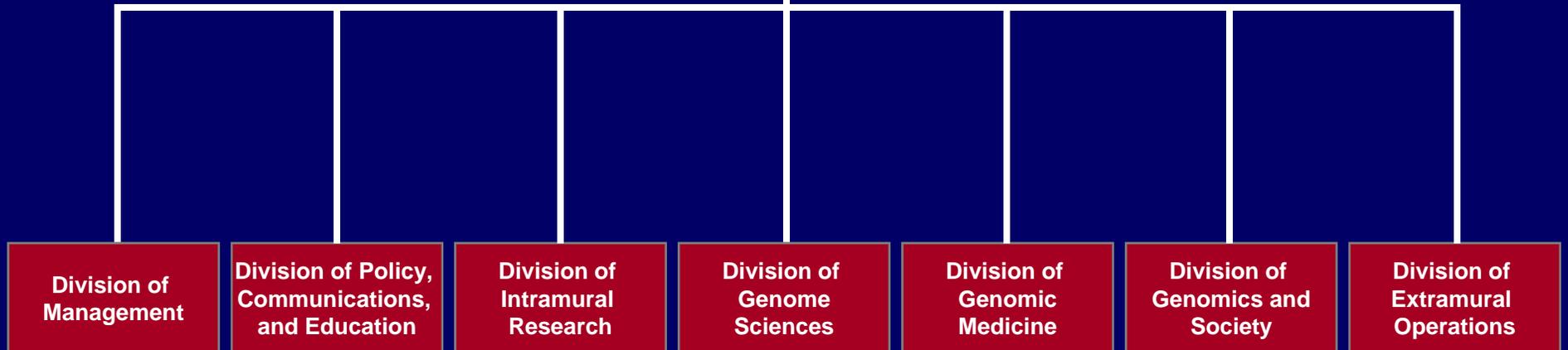


**Major  
Changes**

**Minor  
Changes**

**No  
Changes**

# Proposed NHGRI Organizational Structure



From the Office of the Director

Extramural Research Program

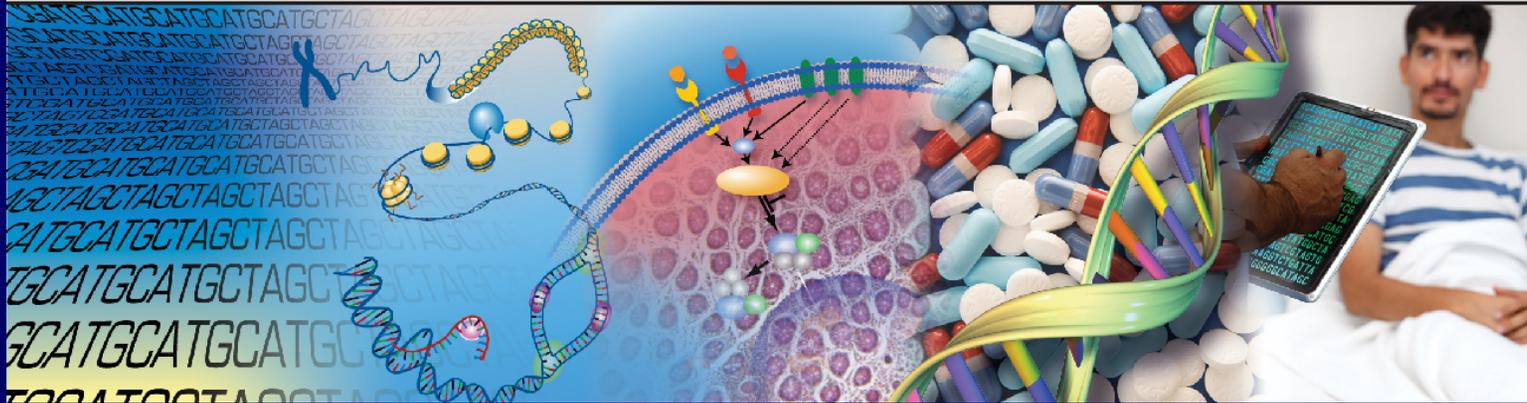
Understanding  
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Understanding  
the Biology of  
Disease

Advancing  
the Science of  
Medicine

Improving the  
Effectiveness of  
Healthcare



**Division of  
Genome Sciences**

**Division of  
Genomic Medicine**



**Genomics & Society**

**Division of  
Genomics and Society**



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# NIH Reform Act of 2006

H. R. 6164

One Hundred Ninth Congress  
of the  
United States of America

AT THE SECOND SESSION

*Begun and held at the City of Washington on Tuesday,  
the third day of January, two thousand and six*

## An Act

To amend title IV of the Public Health Service Act to revise and extend the authorities of the National Institutes of Health, and for other purposes.

*Be it enacted by the Senate and House of Representatives of  
the United States of America in Congress assembled,*

### SECTION 1. SHORT TITLE.

This Act may be cited as the "National Institutes of Health Reform Act of 2006".

## TITLE I—NIH REFORM

### TITLE I—NIH REFORM

Reform Act of 2006.

This Act may be cited as the "National Institutes of Health Reform Act of 2006".

### SECTION 1. SHORT TITLE.

This Act may be cited as the "National Institutes of Health Reform Act of 2006".



# Steps to Reorganization

- **Public meetings:**
  - Webinar (January 18)**
  - NACHGR Meeting (February 13)**
- **Submission of reorganization package**
- **If approved, pursue next steps of appointing Division Directors and implementing new organizational structure**

# **Anticipated Benefits of Reorganizing**

- **Organizational structure will more effectively align with the Institute's research portfolio (i.e., 'structure will match function')**
- **New divisions and anticipated substructures will improve succession planning of senior leadership**
- **New structure commensurate with Director's vision for organizational management**

**Additional information:**

**[genome.gov/reorg](http://genome.gov/reorg)**

**To provide feedback:**

**[NHGRIcomments@nih.gov](mailto:NHGRIcomments@nih.gov)**

