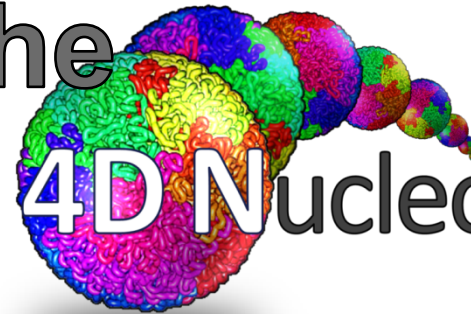


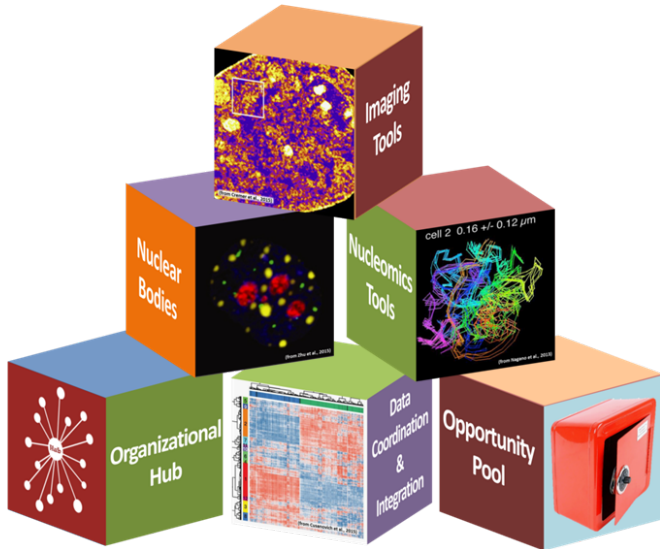
# Building the 4D Nucleome



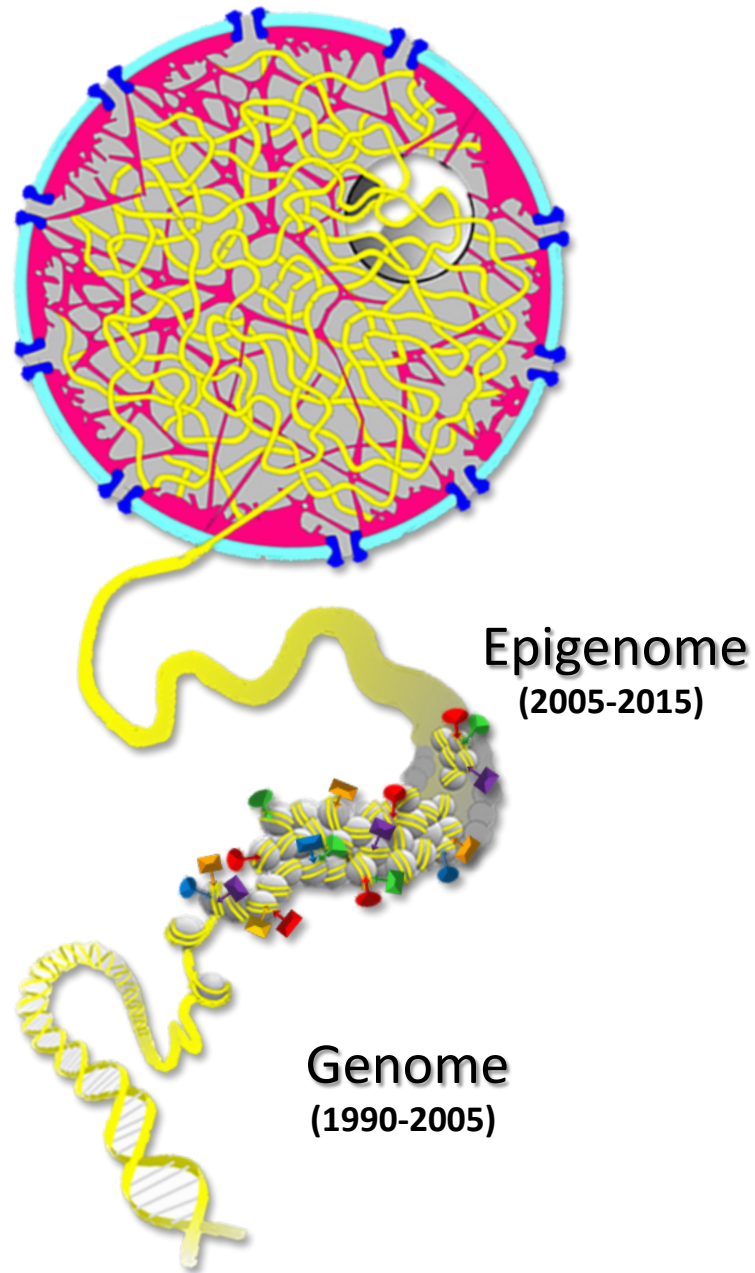
**Lisa Helbling Chadwick, PhD**

**National Institute of Environmental  
Health Sciences**

**Program Director, 4D Nucleome**

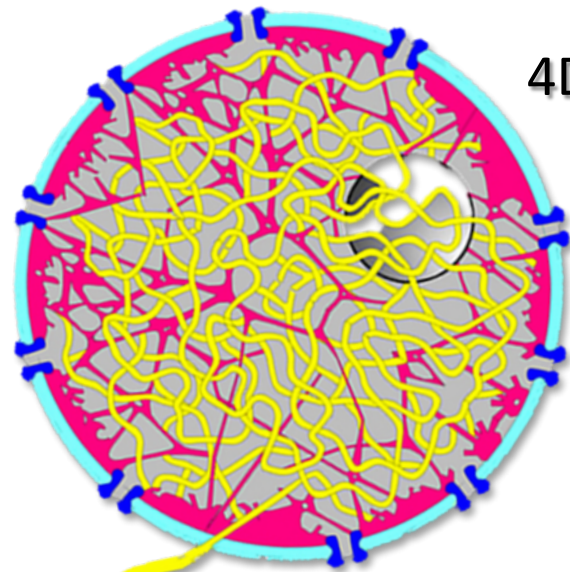


# A journey from genome to nucleome

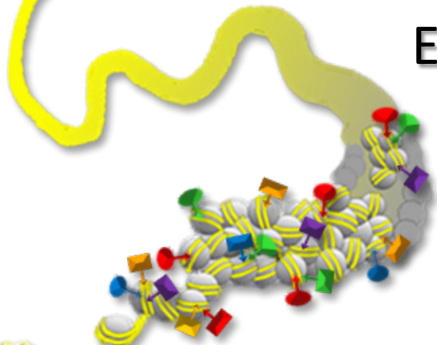


# A journey from genome to nucleome

4D Nucleome  
(2015-2020)



Epigenome  
(2005-2015)



Genome  
(1990-2005)

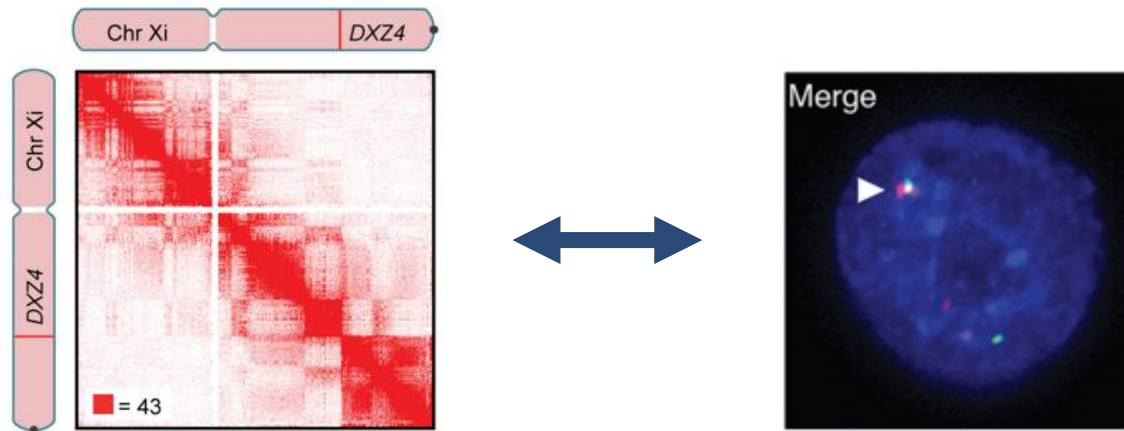


The 4D Nucleome Program seeks to advance understanding of:

- *The principles underlying nuclear organization of mammalian genomes in space and time*
- *The role that nuclear organization plays in gene expression and cellular function*
- *How changes in nuclear organization affect normal development and disease*

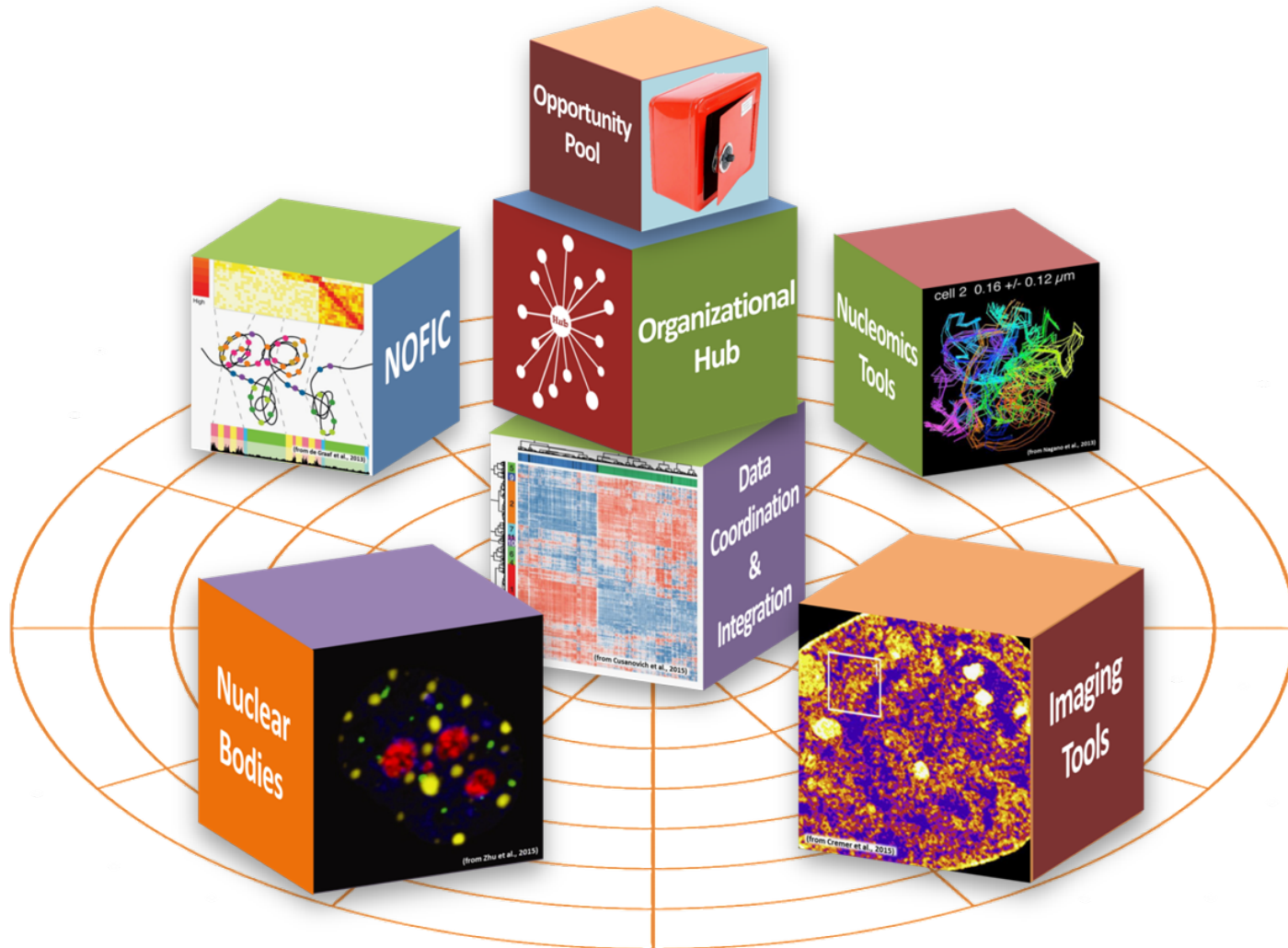
# Expected deliverables

- **Next generation tools** to explore the relationship between genome organization and function – both molecular tools and imaging tools
- **Reference maps** of the 3D organization of the genome in a variety of human cells/tissues and cell states.
- **Development of community standards and metrics**
- **Greater understanding of poorly-characterized nuclear structures and nuclear bodies:** role in genome organization & function.
- **Approaches to integrate molecular information with imaging information**



From: Darrow  
EM et al.,  
PNAS 2016

# Building the 4D Nucleome Network



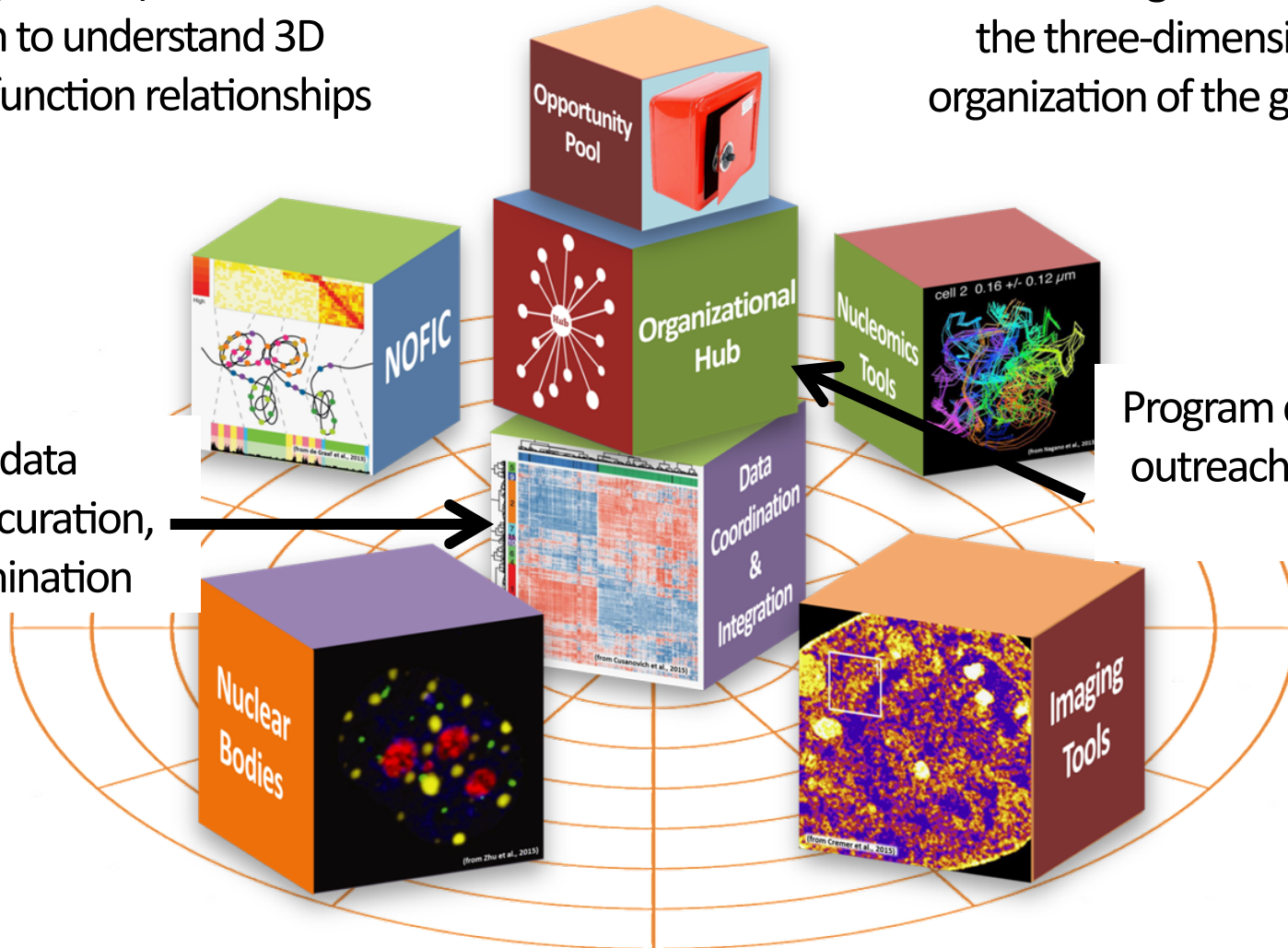
Grants awarded in summer 2015

Technology development and data production to understand 3D structure/function relationships

Development and validation of novel technologies to investigate the three-dimensional organization of the genome

Data/metadata collection, curation, and dissemination

Program coordination, outreach, opportunity funds



Development of tools and technologies to investigate the structure and function of nuclear bodies/domains

Development and validation of novel imaging technologies for visualizing the structure and function of the genome, and how it changes

# www.4dnucleome.org

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**The Common Fund's 4D Nucleome program** aims to understand the principles underlying nuclear organization in space and time, the role nuclear organization plays in gene expression and cellular function, and how changes in nuclear organization affect normal development as well as various diseases.

This program will develop technologies, resources and data to enable the study of the 4D Nucleome, including novel tools to explore the dynamic nuclear architecture and its role in gene expression programs, models to examine the relationship between nuclear organization and function in both normal development and disease, and reference maps of nuclear architecture in a variety of cells and tissues.

# 4D NUCLEOME DATA COORDINATION AND INTEGRATION CENTER

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## About

The 4D Nucleome (4DN) Data Coordination and Integration Center (DCIC) aims to collect, store, curate, display, and analyze data generated in the 4DN Network. The DCIC is a collaboration of two centers from three institutions: Harvard University, Massachusetts Institute of Technology (MIT), and The Washington University in St. Louis (WashU). The Harvard/MIT DCIC is tasked with building the infrastructure for data collection and integration. The Harvard/MIT and WashU centers will collaborate on the development and incorporation of novel data visualization tools.

Our team of investigators and staff has a track record in analysis of chromatin interaction data, image processing, data visualization, integrative analysis of genomic and epigenomic data, data portal development, large-scale computing, and development of secure and flexible Cloud technologies. We will develop efficient submission pipelines for data and metadata from 4DN data production groups and we will define data/metadata requirements and quality metrics in conjunction with the production groups and ensure that high-quality, well-annotated data become available to the wider scientific community in a timely manner.

Furthermore, we will develop a user-friendly data portal for the broad scientific community. This portal will provide an easy-to-navigate interface for accessing raw and intermediate data files, allow for programmatic access via APIs, and will incorporate the analysis and visualization tools developed by DCIC as well as other Network members. For computing and storage scalability and cost-effectiveness, significant efforts will be devoted to development and deployment of cloud-based technology. We will conduct tutorials and workshops to facilitate the use of 4DN data and tools by external investigators.

## Partners

[Harvard Medical School](#)  
Boston, MA, USA

[Harvard University](#)  
Cambridge, MA, USA

[Massachusetts Institute of Technology](#)  
Cambridge, MA

[Washington University in St. Louis](#)  
St. Louis, WA, USA

## Funding

[National Institutes of Health Common Fund](#)

## Links

[4D Nucleome Web Portal](#)  
Public Website

[4D Nucleome Member Wiki](#)  
Internal Wiki

[4D Nucleome @ Common Fund](#)  
National Institutes of Health

[Epigenome Browser](#)  
Washington University



# www.4dnucleome.org

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# Transformative Collaborative Project Award

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## Grant Opportunity

4D Nucleome Opportunity Pool Initiative announces:

### **Transformative Collaborative Project Award**

The Transformative Collaborative Project Award (TCPA) provides research support for up to 24 months to enable eligible investigators to pursue novel research directions or develop new technologies and tools that will further help the 4DN Program to achieve its stated goals. Applicants are asked to use the TCPA to build unique trans- or interdisciplinary teams that are focused on finding solutions to complex or challenging biological problems relevant to the 4DN mission and to propose research or tool-development projects that complement existing 4DN efforts. All non-4DN applicants who receive a TCPA will become 4DN Investigators for the duration of the TCPA project and will be expected to abide by all guidelines and policies established by the network.

Read [FY17 TCPA funding announcement \(9/30/2016\)](#)

**Applications due January  
27, 2017!**

# 4DN Working Group Members

## Co-chairs:

Roderic Pettigrew, MD, PhD	NIBIB
Dinah S. Singer, PhD	NCI
Phil Smith, PhD	NIDDK

## Working Group Coordinators:

Olivier Blondel, PhD	NIDDK
Richard Conroy, PhD	NIBIB
Judy Mietz, PhD	NCI

## Common Fund Program Leaders:

Ananda Roy, PhD	OSC
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## 4DN Program Director:

Lisa Helbling Chadwick, PhD	NIEHS
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## 4DN Program Analyst:

Iddil Bekirov, PhD	NIDDK
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## Working Group:

David Balasundaram, PhD	CSR
Terry Bishop, PhD	NIDDK
Anthony Carter, PhD	NIGMS
Sean Hanlon, PhD	NCI
Rebecca Lenzi, PhD	OSC
Mike Pazin, PhD	NHGRI
Lisa Postow, PhD	NHLBI
Matt Reilly, PhD	NIAAA
Robert Riddle, PhD	NINDS
John Satterlee, PhD	NIDA
Geetha Senthil, PhD	NIMH
Jessica Smith, PhD	OSC
Jose M. Velazquez, PhD	NIA