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BIOLOGICAL SCIENCES DIRECTORATE | BIO

2021

TORMENTING GENOMES

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DIRECTOR
OF THE SOL AND JUDITH BERGSTEIN INSTITUTE OF SYSTEM GENETICS

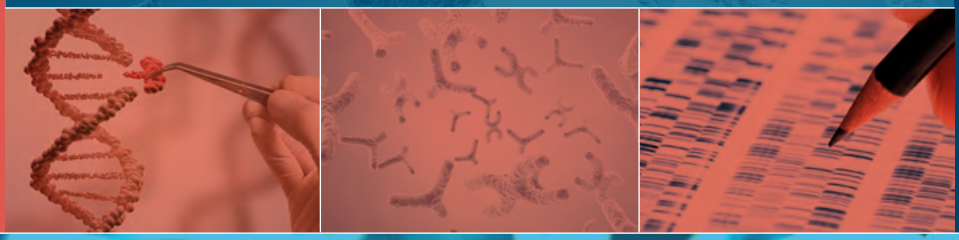
PROFESSOR
DEPARTMENT OF BIOCHEMISTRY AND MOLECULAR PHARMACOLOGY

NEW YORK UNIVERSITY LANGONE HEALTH

DATE
March 19

TIME
11 am - 12 pm

REGISTER
Here



National Science Foundation
WHERE DISCOVERIES BEGIN

ABSTRACT

TORMENTING GENOMES

Rapid advances in DNA synthesis techniques have made it possible to engineer diverse genomic elements, pathways, and whole genomes, providing new insights into design and analysis of systems. In a major genome engineering effort, the synthetic yeast genome project, Sc2.0, is well on its way with the 16 synthetic Saccharomyces cerevisiae chromosomes now >99% completed by a global team. A hallmark of the synthetic genome is a set of strategically located loxP sites that enable genome restructuring using an inducible evolution system termed SCRaMbLE, which can generate millions of derived variant genomes with predictable structures leading to complex genotypes and phenotypes. Remarkably, the 3D structures of synthetic and native chromosomes are very similar. In a second experimental effort, the yeast karyotype was recently completely engineered, by systematically fusing pairs of telomeres and deleting single centromeres, thus generating an isogenic series of yeast ranging from n=16 to n=2. These strains show reproductive isolation and a massively altered 3D genome structure, yet they are surprisingly “Normal” and show high fitness. Even moving megabase segments to distant locations has little impact on fitness. However, another form of tormenting the genome—by switching human for yeast DNA packaging machinery—does lead to observable outcomes. Finally, the DNA synthesis pipeline, GenomeFoundry@ISG, has been automated, opening the door to parallelized big DNA assembly, including assembly of human genomic regions of 100 kb along with multiple designer synthetic variants thereof. Such segments can be precisely delivered to stem cells to dissect genomic “dark matter”, to perform transplants of specific human genomic regions to animal genomes, and to endow human cells with new capabilities.

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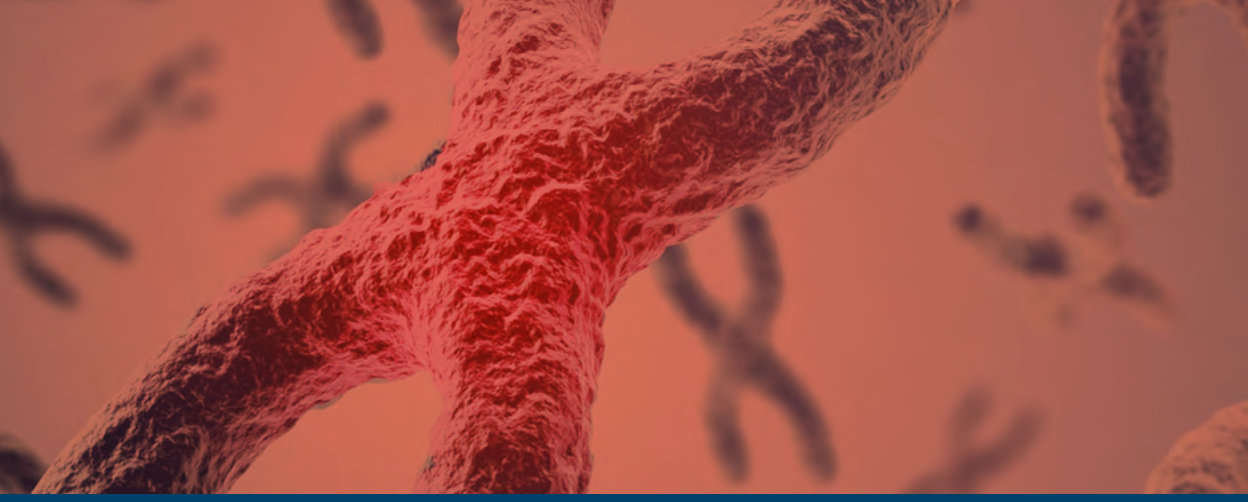
ABOUT THE SPEAKER

Jef Boeke is the Founding Director of the Institute for Systems Genetics at NYU Langone Health. He is known for work on mechanistic and genomic aspects of retrotransposition and develops technologies in genetics, genomics, and synthetic biology. He earned a Bachelor's degree in Biochemistry from Bowdoin College (1972) and a Ph.D. in Molecular Biology from the Rockefeller University (1982), where he worked on the genetics of filamentous phage assembly with Peter Model and Norton Zinder. His postdoctoral work was completed at MIT/Whitehead Institute, on yeast/transposon genetics with Gerald Fink. He served on the faculty of the Department of Molecular Biology & Genetics at the Johns Hopkins University School of Medicine from 1986-2014, where he also founded the High Throughput Biology Center.

www.thedarkmatterproject.org

www.yeastart.org

https://med.nyu.edu/research/boeke-lab



UPCOMING LECTURES | 2021

NSF BIO Distinguished Lecture Series

The mission of the Directorate for Biological Sciences (BIO) is to enable discoveries for understanding life. BIO-supported research advances the frontiers of biological knowledge, increases our understanding of complex systems, and provides a theoretical basis for original research in many other scientific disciplines.

Presented by BIO, this distinguished lecture series will bring in speakers that represent the breadth of biological research and the varied fields within the biological sciences.

All sessions will be conducted virtually.

APRIL 23, 2021
11:00 a.m. – 12:00 p.m.
DR. BERONDA MONTGOMERY
Michigan State University

MAY 6, 2021
11:00 a.m. – 12:00 p.m.
DR. GENE ROBINSON
University of Illinois at Urbana-Champaign

JUNE 17, 2021
11:00 a.m. – 12:00 p.m.
DR. DAVID ASAI
Howard Huges Medical Institute

For more information, refer to the NSF BIO Distinguished Lecture Series **website** or contact **Jared Dashoff at jdashoff@nsf.gov**.

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