

KEYSTONE SYMPOSIA

on Molecular and Cellular Biology

Higher-Order Chromatin Architecture in Time and Space (X3)

Scientific Organizers: Jennifer E. Phillips-Cremins, Job Dekker and Stavros Lomvardas

Supported by the Directors' Fund

Skirting Mendel: Non-Classical Mechanisms of Phenotypic Variation, Inheritance and Disease (X4)

Scientific Organizers: J. Andrew Pospisilik, Anne C. Ferguson-Smith and Ben Lehner

March 15-19, 2020 • Whistler Conference Centre • Whistler, BC, Canada

Supported by the Directors' Fund

Discounted Abstract & Scholarship Deadline: November 12, 2019 / Abstract Deadline: February 12, 2020 / Discounted Registration Deadline: February 12, 2020

SUNDAY, MARCH 15

Arrival and Registration

MONDAY, MARCH 16

Welcome and Keynote Address (X3)

***Jennifer E. Phillips-Cremins**, University of Pennsylvania, USA

Xiaowei Zhuang, Harvard University, USA

Imaging the 3D Organization of the Genome

Welcome and Keynote Address (X4)

Stanislas Leibler, Rockefeller University, USA

Bet Hedging, Variation and Generational Effects on Evolution

Genome Reconfiguration in the Cell Cycle (X3)

***Job Dekker**, University of Massachusetts Medical School, USA

Genome Folding and Re-Folding during the Cell Cycle

Gerd A. Blobel, Children's Hospital of Philadelphia, USA

Principles of Chromatin Organization through the Lens of the Cell Cycle

Amos Tanay, Weizmann Institute, Israel

Single Cell Hi-C Deconvolutes Proliferation and Differentiation in Embryonic Mesoderm, Ectoderm and Blood Chromosome Conformations

Andrew Beel, Stanford University, USA

Short Talk: Principles of Mitotic Chromosome Structure

Victoria Hoskins[†], Johns Hopkins School of Medicine, USA

Short Talk: Exploring the Role of Lamin C in Re-Establishing Genome Organization after Cell Division

Non-Mendelian Variation in Humans (X4)

Emma Farley, University of California, San Diego, USA

High-Throughput Genotype to Phenotype Assays to Pinpoint Enhancer Mutations Underlying Disease

Jordana T. Bell, King's College London, UK

Heritable and Non-Heritable Variation: Lessons from Twins

Robert A. Waterland, Baylor College of Medicine, USA

Environmental Effects on Stochastic Establishment of DNA Methylation in Humans

Short Talks Chosen from Abstracts

Workshop 1: Genome Misfolding in Disease (X3)

***Stavros Lomvardas**, Columbia University, USA

Matthias Merkenschlager[†], Imperial College London, UK

Characterization of Neuronal Gene Dysfunction in the Human Cohesin Deficiency Syndrome CdLS, and Experimental Modeling by Transient Cohesin Depletion and Subsequent Rescue in Post-Mitotic Neurons

Zachary M. Carico, University of North Carolina at Chapel Hill, USA
A Cancer Mutation to the Hinge of Cohesin Subunit SMC1A Alters Genome Architecture and Dysregulates Transcription

George Spracklin, University of Massachusetts Medical School, USA
DNA Methylation Is Required to Maintain Heterochromatin Architecture in Colon Cancer Cells

Dominik Szabo, Max Delbrück Center, Germany
ASD-Associated 16p11.2 Deletion Leads to Disruption of Chromatin Organization and Dysregulation of Synaptic Genes in Neuronal Precursor Cells

Anna Gonzalez Manjon[†], Netherland Cancer Institute, Netherlands
Nuclear Lamina Interactions Regulate ABCB1 Gene Expression and Taxol Sensitivity

Kyoung-Dong Kim, Chung-Ang University, South Korea
Mapping the EBV Tethering Sites on Human Chromosomes through 4C Analysis

Causes and Consequences of Genome Folding on Genome Function (X3)

***Bing Ren**, Ludwig Institute for Cancer Research, USA

Bas van Steensel, Netherlands Cancer Institute, Netherlands
Dynamics of Lamina-Associated Domains

Jennifer E. Phillips-Cremins, University of Pennsylvania, USA
3D Epigenome Reconfiguration in Brain Development and Neurodegenerative Disease

Daniele Canzio, University of California, San Francisco, USA
The Role of Chromosome Architecture in Generating a Code for Neural Self-Recognition

Peiyao Zhao, Florida State University, USA
Short Talk: Replication Timing Maintains the Global Epigenetic State and Genome Compartmentalization in Human Cells

Christopher Sansam, Oklahoma Medical Research Foundation, USA
Short Talk: Roles for Rif1 in Establishing and Changing The DNA Replication Timing Program During Vertebrate Embryonic Development

The Repeat Genome, Heritability and the Stabilization of Phenotypes (X4)

Maria-Elena Torres-Padilla, Helmholtz Centre Munich, Germany
Epigenetic Mechanisms of Cellular Plasticity and Reprogramming to Totipotency

Anne C. Ferguson-Smith, University of Cambridge, UK
Epigenetic Variation at Repeats within and across Generations

Robert A. Martienssen, Cold Spring Harbor Laboratory, USA
Regulation of Transposons in Eukaryotes: Functions and Implications

Short Talks Chosen from Abstracts

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Poster Session 1

TUESDAY, MARCH 17

Genome Reconfiguration in Development (X3)

***Gerd A. Blobel**, Children's Hospital of Philadelphia, USA

Nancy E. Kleckner, Harvard University, USA
Chromosomes as Mechanical Objects

Ana Pombo, Max-Delbrück-Centrum für Molekulare Medizin, Germany
Genome Architecture Mapping Detects Extensive Allele-Specific Chromatin Contacts in Hybrid mESCs

Benoit G. Bruneau, Gladstone Institutes, USA
Chromatin Organization in Heart Development

Suzana Hadjur, University College London, UK
Chromatin Topology Regulation and Stem Cell State Plasticity

Jonathan A. Beagan†, University of Pennsylvania, USA
Short Talk: 3-D Genome Architecture Orchestrates Activity-Dependent Gene Expression in Neurons

A. Marieke Oudelaar, University of Oxford, UK
Short Talk: Dynamics of the 4D Genome during Lineage Specification, Differentiation and Maturation In Vivo

Benjamin R. Sabari, University of Texas Southwestern Medical Center, USA
Short Talk: Enhancer Features that Drive Formation of Transcriptional Condensates

Modelling Bi-Stability, Buffering, Bursting (X4)

Martin Howard, John Innes Centre, UK
Dissecting the Mechanistic Basis of Polycomb Nucleation and Spreading: Fusing Mathematical Modelling with Experiments

Speaker to be Announced

Vincent Colot, École Normale Supérieure, France
Inheritance Patterns and Phenotypic Consequences of DNA Methylation Variation in Arabidopsis

Lucia Clemens-Daxinger, Leiden University Medical Center, Netherlands
(Epi)genetics of Parental Effects

Short Talks Chosen from Abstracts

Visualizing Genome Folding in Single Cells (X3)

Ting (C.-ting) Wu, Harvard Medical School, USA
Such a Lot of Genome to See...

***Clodagh C. O'Shea**, The Salk Institute for Biological Studies, USA
ChromEMT: Visualizing 3D Chromatin Structure and Compaction of the Human Genome in Interphase and Mitotic Cells

Long Cai, California Institute of Technology, USA
Simultaneous Visualization of Gene Expression and Genome Structure in Single Cells

Alexandros Pertsinidis†, Memorial Sloan Kettering Cancer Center, USA

Short Talk: Single-Gene Live-Cell Imaging Reveals Links between Genome Organization, Promoter-Enhancer Communication and Transcription Control

Guillaume A. Orsi†, École normale supérieure de Lyon, France
Short Talk: A Unique Higher-Order Chromatin Architecture in Insect Sperm Nuclei

Mechanisms of Tuning Variation I – Quantitative in vivo Systems (X4)

Shelley L. Berger, University of Pennsylvania, USA
From Ants to Cancer Evolution: Epigenetic Systems Control

Oded Rechavi, Tel Aviv University, Israel
Transgenerational Memory in C.elegans

Eric A. Miska, University of Cambridge, UK
Cichlid Evolutionary Radiation

Short Talks Chosen from Abstracts

Poster Session 2

WEDNESDAY, MARCH 18

Mechanisms Governing Long-Range Looping (X3)

***Elphège P. Nora**†, Gladstone Institute, USA

Bing Ren, Ludwig Institute for Cancer Research, USA
Long-Range Regulation of Enhancer Promoter Interaction

Stavros Lomvardas, Columbia University, USA
Role for Genome Folding in Olfaction

François Spitz, Institut Pasteur, France
Functions and Regulation of 3D Genome Architecture

Rafael Casellas, NIAMS-NCI, National Institutes of Health, USA
Cohesin Loading and Transcriptional Regulation

Tsung-Han Hsieh, University of California, Berkeley, USA
Short Talk: Resolving the 3D Landscape of Transcription-Linked Mammalian Chromatin Folding

Mariana Rama Pedro Alves, European Molecular Biology Laboratory, Germany

Short Talk: Multi-Enhancer Transcriptional Hubs Confer Phenotypic Robustness

Sahana Holla, National Institutes of Health, USA

Short Talk: Positioning Heterochromatin at the Nuclear Periphery Suppresses Histone Turnover to Promote Epigenetic Inheritance

Inter- / Trans-Generational Mechanisms (X4)

Oliver J. Rando, University of Massachusetts Medical School, USA
Paternal Mechanisms of Intergenerational Control in Mice

Ben Lehner, Centre for Genomic Regulation, Spain

Understanding Genotype-Phenotype Maps Using Deep Mutagenesis

Qi Chen, University of California, Riverside, USA

Sperm RNA Code: How Many Secrets in Programming Offspring Phenotypes?

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Coleen T. Murphy, Princeton University, USA
C. elegans uses Bacterial Small RNAs and RNA Interference to "Read" and Remember the Microbiome

Short Talks Chosen from Abstracts

Spatiotemporal Genome Folding Dynamics (X3)

***Bas van Steensel**, Netherlands Cancer Institute, Netherlands

Joanna Wysocka, Stanford University, USA

Long-Range Gene Regulation by Enhancers

Bradley R. Cairns, HHMI/University of Utah, USA

Mechanisms for Establishing Developmental Gene Poising/Silencing and Chromosome Architecture in Early Zebrafish Embryos

Karen L. Reddy, Johns Hopkins University, USA

Dynamic Spatiotemporal Organization of LADs and Lamins after Mitosis

Jeannie T. Lee, Massachusetts General Hospital / Harvard Medical School, USA

Folding and Unfolding the X-Chromosome Origami

Histone-Based Mechanisms of Rewiring and Feedback (X4)

Robert Schneider, Helmholtz Center Munich, Germany

Capturing Transcriptional Memories, One-Cell at a Time

Victor G. Corces, Emory University School of Medicine, USA

Mechanisms of Transgenerational Inheritance of Obesity Epiphenotypes

Mofang Liu, Shanghai Institutes for Biological Sciences, Chinese Academy of Sciences, China

Piwi, a New Disease Factor in Human Male Infertility?

Short Talks Chosen from Abstracts

Poster Session 3

THURSDAY, MARCH 19

Phase Separation in the 3D Nucleus (X3)

***Anders Sejr Hansen**, Massachusetts Institute of Technology, USA

Clifford P. Brangwynne, Princeton University, USA

Optical Control over Nuclear Bodies

Leonid Mirny, Massachusetts Institute of Technology, USA

Biophysical Mechanisms of Chromosome Organization

Gary Karpen, University of California, Berkeley, USA

Do Liquid-Like Properties Regulate Genome Organization and Function?

Albana Kodra[†], Columbia University, USA

Short Talk: Single-Cell Characterization of the Multi-Chromosomal Enhancer Hub in the Olfactory Sensory Neurons

Katherine Alexander, University of Pennsylvania, USA

Short Talk: p53 Transcription Factor Mediates Nuclear Speckle Association of Target Genes

Kyle Eagen, Northwestern University, USA

Short Talk: Chromatin Hyperacetylation Impacts Chromosome Folding by Forming a Nuclear Subcompartment

Mechanisms of Tuning Variation II: Buffering and Canalizing Genetic Programs (X4)

J. Andrew Pospisilik, Van Andel Institute, USA

Epigenetic Underpinnings of Metabolic Disease Heterogeneity

Daniel F. Jarosz, Stanford University School of Medicine, USA

Protein Folding, Environmental Stress, and the Diversification of Phenotype

Ralf Sommer, Max Planck Institute for Developmental Biology, Germany

Predatory Feeding Plasticity in Nematodes: Genetics, Epigenetics and Trans-Generational Effects

Matthew C. Lorincz, University of British Columbia, Canada

Chromatin-Guided De Novo Methylation in the Mammalian Germline and Beyond

Short Talk Chosen from Abstracts

Workshop 2: Insights Revealed by Novel Architecture Perturbations (X3)

***Elzo de Wit**, Netherlands Cancer Institute, Netherlands

Veer I. P. Keizer[†], Institut Curie, France

Pulling on Chromatin: Mechanical Micro-Manipulation of Chromatin in Live Cells

Rachel Patton McCord[†], University of Tennessee, USA

3D Genome Organization Changes Associated with Melanoma Constricted Migration

Di Zhang[†], University of Pennsylvania & Children's Hospital of Philadelphia, USA

Creation of New Contact Domains via Random Genome Editing

Bobbie Pelham-Webb, Weill Cornell, USA

The Transcriptional and Architectural Resetting of Pluripotent Stem Cell Identity during G1 Entry

Pavan Choppakatla, Rockefeller University, USA

Regulation of Mitotic Chromosome Shape and Individualization by Linker Histones

Giovanni Pascarella, RIKEN Yokohama Institute, Japan

Somatic Recombination of Alu and L1 Elements Is a Common Feature of the Human Genome

Natalia Westervelt, Florida State University, USA

Characterization of the ICCE Repeat in Mammals Reveals an Evolutionary Relationship with the DXZ4 Macrosatellite through Conserved CTCF Binding Motifs

Swati Tyagi[†], The Salk Institute for biological studies, USA

Mapping NPC-Chromatin Interactions Reveals New Principles of Genome Organization at the Nuclear Periphery

Mechanistic Insights from Imaging and Engineering the 3D Genome (X3)

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***Rachel Patton McCord**, University of Tennessee, USA

Anders Sejr Hansen, Massachusetts Institute of Technology, USA

Dynamics of 3D Genome Organization in Live Cells at Single-Molecule Resolution

Erez Lieberman-Aiden, Baylor College of Medicine, USA

Models and Mechanisms of Loop Extrusion

Elzo de Wit, Netherlands Cancer Institute, Netherlands

WAPL Maintains a Cohesin Loading Cycle to Preserve Lineage Specific Distal Gene Regulation

Elphège P. Nora†, Gladstone Institute, USA

Short Talk: Talk Title to be Announced

Jop Kind†, Hubrecht Institute, Netherlands

Short Talk: Talk Title to be Announced

Rewire the Germline - Rewire the Zygote (X4)

Petra Hajkova, Imperial College London, UK

Epigenetics Transitions Defining the Zygote

Mary A. Gehring, Whitehead Institute for Biomedical Research, USA

RNA Pol IV and Plasticity during Seed Development

Nicola Iovino, Max Planck Institute of Immunobiology and

Epigenetics, Germany

Establishment of the Zygotic Epigenome in Drosophila

Short Talks Chosen from Abstracts

Meeting Wrap-Up: Outcomes and Future Directions (Organizers) (X3)

Meeting Wrap-Up: Outcomes and Future Directions (Organizers) (X4)

FRIDAY, MARCH 20

Departure