

KEYSTONE SYMPOSIA

on Molecular and Cellular Biology

Gene Control in Development and Disease (X6)

Scientific Organizers: Richard A. Young, Joanna Wysocka and Phillip A. Sharp

Sponsored by Novartis Institutes for BioMedical Research

Chromatin Architecture and Chromosome Organization (X5)

Scientific Organizers: Edith Heard and Peter Fraser

March 23-27, 2018 • Whistler Conference Centre • Whistler, British Columbia, Canada

Supported by Directors' Fund

Abstract & Scholarship Deadline: November 28, 2017 / Abstract Deadline: December 20, 2017 / Discounted Registration Deadline: January 17, 2018

FRIDAY, MARCH 23

Arrival and Registration

SATURDAY, MARCH 24

Welcome and Keynote Address (X6)

***Richard A. Young**, Whitehead Institute for Biomedical Research, USA

***Joanna Wysocka**, Stanford University School of Medicine, USA

***Phillip A. Sharp**, Massachusetts Institute of Technology, USA

Jennifer A. Doudna, HHMI/University of California, Berkeley, USA
Unexpected Activities of RNA-Guided CRISPR Enzymes

Welcome and Keynote Address (X5)

***Edith Heard**, Institut Curie, France

***Peter Fraser**, Florida State University, USA

Job Dekker, University of Massachusetts Medical School, USA
Folding, Unfolding and Refolding of Genomes

Basics (X6)

***Jennifer A. Doudna**, HHMI/University of California, Berkeley, USA

Patrick Cramer, Max Planck Institute for Biophysical Chemistry, Germany

Integrated Structural Biology of Gene Transcription

Karen Adelman, Harvard Medical School, USA

Pause Control in Development and Disease

Ronald M. Evans, HHMI/The Salk Institute, USA

Vitamin D and Dysregulated Transcription

Xiong Ji, Peking University, China

Short Talk: RNAPII Elimination Reveals Transcriptional-Dependent Three-Dimensional Chromatin Landscape

Diego Villar Lozano, University of Cambridge, UK

Short Talk: The Gene Expression Consequences of Mammalian Regulatory Evolution

Chromosome Architecture (X5)

***Wendy A. Bickmore**, University of Edinburgh, UK

***William Stafford Noble**, University of Washington, USA

Carlo Vermeulen, Hubrecht Institute, Netherlands
Locus-Specific Enhancer Hubs and Architectural Loop Collisions Uncovered from Single Allele DNA Topologies

Peter Fraser, Florida State University, USA

Chromosome Architecture Dynamics Using Single Cell HiC

Suzana Hadjur, University College London, UK

Role of Cohesin Complex Diversity in Genome Organization and Cell Fate Determination

Maciej Piotr Zaczek, Institute of Molecular Pathology, Austria

Short Talk: CTCF Constrains Cohesin Translocation along DNA

Elphège P. Nora, Gladstone Institute, USA

Short Talk: Dissecting the Molecular Connection between CTCF and Cohesin

Workshop 1: Transcription and Development (X6)

***Karen Adelman**, Harvard Medical School, USA

***Patrick Cramer**, Max Planck Institute for Biophysical Chemistry, Germany

Richard G. Jenner, University College London, UK

RNA Antagonizes the Interaction of PRC2 and Other Epigenetic Modifiers with Chromatin

Natalia B. Ivanova, Yale University School of Medicine, USA

Chromatin-Associated Factors Dppa2 and Dppa4 Guide Epigenetic Remodeling during Cellular Reprogramming

Ido Sagi, Hebrew University of Jerusalem, Israel

Studying Haploidy and Parental Imprinting in Human Pluripotent Stem Cells

Aydan Bulut-Karslioglu, University of California, San Francisco, USA

Chd1-Mediated Repair of Physiological DNA Breaks Sustains Hypertranscription and Proliferation of ES Cells

Ruben Esse, Boston University, USA

DOT1L in Enhancer Regulation

Sudhir Thakurela, Harvard University, USA

Genetic Determinants and Epigenetic Effects of Pioneer Factor Occupancy during Development

Elodie Emilie Thierion, University of Cambridge, UK

Gene Regulation Dynamics and Evolution in Somites

Workshop 1: 4DN (X5)

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

***Thoru Pederson**, University of Massachusetts Medical School, USA

CRISPR Barcoding Reveals Changes in Interphase Chromosome Conformation and Dynamics in Human Cells

Josef Redolfi, Friedrich Miescher Institute for Biomedical Research, Switzerland

Crosslinking- and Ligation-Free Detection of Chromosomal Interactions using DamID and Physical Modeling

Kerstin Bystricky, University of Toulouse, France

Chromatin Dynamics in Real Time and at Nanoscale Resolution Reveal Transcription-Dependent Long-Range Correlation

Saumya Agrawal, RIKEN, Yokohama Campus, Japan

Association between Three-Dimensional Localization and Function of Long Noncoding RNAs

Sofia Quinodoz, California Institute of Technology, USA

Higher-Order Inter-Chromosomal Hubs Shape 3-Dimensional Genome Organization in the Nucleus

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Valerio Orlando, King Abdullah University of Science and Technology, Saudi Arabia

Ago1 in Association with NEAT1 lncRNA Contributes to Nuclear and 3D Chromatin Architecture in Human Cells

Alice Sherrard, University of Bristol, UK

Imaging Chromatin Dynamics Reveals a Novel Mechanism for Nuclear Organization after Cell Division

Marlies E. Oomen, University of Massachusetts Medical School, USA
Cell Cycle Dynamics of CTCF Binding and its Relation to Chromosome Organization

Control Elements (Joint)

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

***Mikhail Spivakov**, Babraham Institute, UK

Eileen E.M. Furlong, European Molecular Biology Laboratory, Germany

Functional Insights into Genome Topology and Enhancer Function during Embryonic Development

Joanna Wysocka, Stanford University School of Medicine, USA
Enhancers in Development

Rajat Gupta, Massachusetts General Hospital, USA
Short Talk: A Genetic Variant Associated with Five Vascular Diseases Distally Regulates Gene Expression via Long-Range Enhancer Interactions

Jeff Alexander, University of California, San Francisco, USA
Short Talk: Live-Cell Imaging Reveals Enhancer-Dependent Sox2 Transcription Is Not Associated with Enhancer Proximity

Poster Session 1

SUNDAY, MARCH 25

Genome Structure (Joint)

***Suzana Hadjur**, University College London, UK

***Stavros Lomvardas**, University of California, San Francisco, USA

Juanma Vaquerizas, Max Planck Institute for Molecular Biomedicine, Germany
Chromatin Architecture during Early Development

Bing Ren, Ludwig Institute for Cancer Research, USA
Regulation of Lineage-Specific Chromatin Organization at Enhancers

Wendy A. Bickmore, University of Edinburgh, UK
The Remote Control of Gene Expression

Edda G. Schulz, Max Planck Institute for Molecular Genetics, Germany
Two Coupled Feedback Loops Explain Random Mono-Allelic Xist Upregulation at the Onset of X-Chromosome Inactivation

Julie Ahringer, University of Cambridge, UK
Short Talk: ARC-C for Genome-Wide Analysis of Regulatory Element Interactions at High Resolution

Meet the Editors Panel (Joint)

***Edith Heard**, Institut Curie, France

***Richard A. Young**, Whitehead Institute for Biomedical Research, USA

Sharon Ahmad, Journal of Cell Science, UK

Marie Bao, Cell Press, USA

Katherine Brown, Company of Biologists, UK

Melina Casadio, Rockefeller University Press, USA

Alex Eccleston, Nature, UK, UK

Markus Elsner, Nature Biotechnology, Germany

Tiago Faial, Nature Genetics, USA

Sarah Geisler, Cell, USA

Di Jiang, PLOS Biology, USA

Steve Mao, Science, AAAS, USA

Carolina Perdigoto, Nature Communications, UK

Nicole Rusk, Nature Methods, USA

Rupa Sarkar, Nature Protocols, UK

Esther Schnapp, EMBO, Germany

Julie Sollier, Cell Press, USA

Anke Sparmann, Nature Structural and Molecular Biology, UK

Ruth Zearfoss, Cell Press, USA

Eytan Zlotorynski, Nature Reviews Molecular Cell Biology, UK

Epigenetics (X6)

***Geeta J. Narlikar**, University of California, San Francisco, USA

***Joseph R. Ecker**, The Salk Institute for Biological Studies, USA

Leonard I. Zon, HHMI/Boston Children's Hospital, USA
Epigenetic Pathways Regulating Cell Fate

Oliver J. Rando, University of Massachusetts Medical School, USA
Small RNA Trafficking during Sperm Epididymal Maturation Is Essential for Early Development in Mammals

Edith Heard, Institut Curie, France
Developmental Dynamics of X-Chromosome Structure

Zachary Hugh Harvey, Stanford University, USA
Short Talk: A Prion That Mediates Meiotic Inheritances of Activated Chromatin States

Spatio-Temporal Dynamics of Chromatin (X5)

***Eileen E.M. Furlong**, European Molecular Biology Laboratory, Germany

***Juanma Vaquerizas**, Max Planck Institute for Molecular Biomedicine, Germany

Stavros Lomvardas, University of California, San Francisco, USA
Interchromosomal Interactions Regulate Singular Olfactory Receptor Choice

Victor G. Corces, Emory University, USA
Mechanisms of Transgenerational Inheritance

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Amos Tanay, Weizmann Institute, Israel
Single Cell Approaches in Epigenomics and 3D Chromosome Organization

Yong Hoon Kim, University of Pennsylvania School of Medicine, USA
Short Talk: Rev-erb alpha Dynamically Modulates Chromatin Looping to Control Circadian Gene Transcription

Poster Session 2

MONDAY, MARCH 26

New Models (X6)

***Magdalena D. Zernicka-Goetz**, University of Cambridge, UK

***Yonatan Stelzer**, Weizmann Institute of Science, Israel

Phillip A. Sharp, Massachusetts Institute of Technology, USA
Phase Separation in Transcription Control

Ibrahim Cissé, Massachusetts Institute of Technology, USA
Super-Resolution Imaging of Transcription in Live Mammalian Cells

Geeta J. Narlikar, University of California, San Francisco, USA
Phase-Separation in Heterochromatin Formation

Ankur Jain, University of California, San Francisco, USA
RNA Phase Separation and Neurodegenerative Disease

Sheila Teves, University of California, Berkeley, USA
Short Talk: A Stable Mode of Bookmarking by TBP Recruits RNA Polymerase II to Mitotic Chromosomes

Mounia Lagha, Centre National de la Recherche Scientifique, France
Short Talk: Zelda and Transcriptional Memory in Drosophila Embryos

Yuelin Song, Massachusetts Institute of Technology, USA
Short Talk: Dynamic DNA Methylation Heterogeneity at Super-Enhancers in Single-Cells

Chromatin Architecture, Development and Disease (X5)

***Karen L. Reddy**, Johns Hopkins University, USA

***Leonid Mirny**, Massachusetts Institute of Technology, USA

Jane A. Skok, New York University School of Medicine, USA
The Mechanisms Underlying the Impact of MMSET Overexpression on Gene Regulation in Multiple Myeloma

Ana Pombo, Max-Delbrück-Centrum für Molekulare Medizin, Germany
Genome Architecture Mapping: Exploring Mechanisms of 3D Chromatin Folding in Rare Cell Types

Mikhail Spivakov, Babraham Institute, UK
Mapping Genomic Regulatory Architecture and Interpreting Non-coding Variation with Promoter Capture Hi-C

Kevin G. Monahan, Columbia University, USA
Short Talk: Ldb1 Is Required for the Formation of a Multi-Chromosomal Enhancer Hub that Governs Singular Olfactory Receptor Transcription

Alistair Boettiger, Stanford University, USA
Short Talk: Nanoscale Visualization of cis-Regulation in Development using ORCA

Jean J. Gautier, Columbia University, College of Physicians and Surgeons, USA
Short Talk: Nuclear Actin Polymerization Drives DNA Double-Strand Break Mobility and Clustering for Homology-Directed Repair

Rani E. George, Dana-Farber Cancer Institute, USA
Short Talk: The CTCF Paralog BORIS Promotes Novel Chromatin Regulatory Interactions in Cancer Cells

Development (X6)

***Natalia B. Ivanova**, Yale University School of Medicine, USA

***Peter C. Scacheri**, Case Western Reserve University, USA
Eliezer Calo, Massachusetts Institute of Technology, USA
Tissue-Selective Effects of Nucleolar Stress and rDNA Damage in Developmental Disorders

Magdalena D. Zernicka-Goetz, University of Cambridge, UK
Building the Mammalian Embryo in vivo and in vitro

Joseph R. Ecker, The Salk Institute for Biological Studies, USA
Single Cell Methylomes Reveal Neuronal Populations and Regulatory Elements in the Mammalian Brain

Yonatan Stelzer, Weizmann Institute of Science, Israel
Short Talk: Parent- and Sex-Specific DNA Methylation Dynamics during Mouse Development

Integrating Chromatin States and Genome Architecture to Understand Genome Function (X5)

***Susan M. Gasser**, Friedrich Miescher Institute for Biomedical Research, Switzerland

***Giacomo Cavalli**, Institute of Human Genetics, France

John A. Stamatoyannopoulos, Altius Institute for Biomedical Sciences, USA
Transcriptional Circuitry and Regulatory Landscapes

Richard A. Young, Whitehead Institute for Biomedical Research, USA
Phase Separation and Genome Architecture

William J. Greenleaf, Stanford University, USA
Understanding the Physical Genome

Jiao Sima, Florida State University, USA
Short Talk: CRISPR Dissection of a Replication Domain Reveals Discrete Internal cis Elements Regulating Replication Timing and Chromatin Compartment

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Poster Session 3

TUESDAY, MARCH 27

Disease (X6)

***Richard A. Young**, Whitehead Institute for Biomedical Research, USA

***Cheryl Arrowsmith**, University of Toronto, Canada

Peter C. Scacheri, Case Western Reserve University, USA
Mechanisms of Aberrant Enhancer Activation in Cancer

Manolis Kellis, Massachusetts Institute of Technology, Broad Institute, USA

Functional Dissection of Disease-Associated Variation

Matthias Merkenschlager, Imperial College London, UK
Cohesin Links Inflammation and Cancer

Chao Lu, Columbia University, USA

Short Talk: Reprogramming of Chromatin Organization by Cancer-Associated Histone H3 Mutations

Michele Gabriele, University of Milan, European Institute of Oncology, Italy

Short Talk: YY1 Haploinsufficiency Disrupts Histone Acetylation in Gabriele-De Vries Neurodevelopmental Syndrome

Jesse M. Engreitz, Broad Institute of Harvard and MIT, USA
Short Talk: Principles of Enhancer Function from Thousands of CRISPR Perturbations

Chromatin Architecture and the Nuclear Positioning (X5)

***Ana Pombo**, Max-Delbrück-Centrum für Molekulare Medizin, Germany

***Jane A. Skok**, New York University School of Medicine, USA

Karen L. Reddy, Johns Hopkins University, USA
The Nuclear Lamina and the Shifting Shape of Epigenomes

Bas van Steensel, Netherlands Cancer Institute, Netherlands
Mechanisms of Gene Regulation in Lamina-Associated Domains.

Susan M. Gasser, Friedrich Miescher Institute for Biomedical Research, Switzerland
Histone H3K9me Mediates Heterochromatin Sequestration and Stabilizes Repeat Elements with BRCA1

Giacomo Cavalli, Institute of Human Genetics, France
Polycomb Proteins and 3D Genome Folding in the Epigenetic Regulation of Development

Robert Johnston, Johns Hopkins University, USA
Short Talk: Pairing TADs (PairITs) Drive Homologous Chromosomes Together to Promote Interchromosomal Gene Regulation

Wei Xie, Tsinghua University, China
Short Talk: Conservation and Divergence of Chromatin Reprogramming in Early Mammalian Development

Poster Session 4

Workshop 2: Disease Connections (X6)

***Ross L. Levine**, Memorial Sloan Kettering Cancer Center, USA

***Manolis Kellis**, Massachusetts Institute of Technology, Broad Institute, USA

Zuzana Tothova, Dana-Farber Cancer Institute, USA

STAG2 Mutations Alter Cohesin Ring Structure and Function and Provide Therapeutic Vulnerabilities in Acute Myeloid Leukemia

Damien Downes, University of Oxford, UK
Systematic Dissection of GWAS loci using Chromatin Conformation and NG Sequencing Approaches

Elliott C. Ferris, University of Utah, USA
Convergent Patterns of Accelerated Evolution in Hibernating Mammals May Elucidate New Regulatory Mechanisms Shaping Human Metabolic Disease

Nicholas C. Gomez, Rockefeller University, USA
Stem Cell Reprogramming during Oncogenesis and Development

Kai Ge, NIDDK, National Institutes of Health, USA
Enhancer Epigenomic Regulation in Differentiation, Development and Cancer

Debora R. Sobreira, University of Chicago, USA
Obesity-Associated Variants within FTO Are Functionally Connected to the Coordinated Expression of IRX3 and IRX5 in Brain and Adipose Tissue

Rajesh C. Rao, University of Michigan, USA
Wdr5 Acts as a Temporal Rheostat to Control Retinal Neuroectoderm Versus Mesoderm Fate Choice

Workshop 2: Modeling and Simulations (X5)

***Geoffrey Fudenberg**, University of California, San Francisco, USA

***Marc A. Marti-Renom**, CNAG-CRG, Spain
Kristin Abramo, University of Massachusetts Medical School, USA
Building an Interphase Nucleus

Annaelle Brunet, University of Oslo, Norway
Lamina-Associated Domains as Tuning Actors Configuring the Mechanical Constraints of the Chromatin Domain at Nuclear Periphery

Nick Gilbert, University of Edinburgh, UK
Chromatin-Associated RNA Recycling by XRN2 Regulates Transcription and Chromosome Structure

Kohta Ikegami, University of Chicago, USA

***Leonard I. Zon**, HHMI/Boston Children's Hospital, USA

***Zuzana Tothova**, Dana-Farber Cancer Institute, USA

James E. Bradner, Novartis Institutes for BioMedical Research, USA
Transcription and Drug Discovery

Cheryl Arrowsmith, University of Toronto, Canada
Probing the Epigenome using Chemical Biology

Ross L. Levine, Memorial Sloan Kettering Cancer Center, USA

Mutations in Epigenetic Regulators in the Biology and Therapy of Myeloid Malignancies

Physical Modeling of Chromatin and Chromosomes (X5)

***William J. Greenleaf**, Stanford University, USA

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*Phospho-Lamin A Binding at Enhancers
Coordinates Nuclear Envelope Breakdown with
Mitotic Transcriptional Quiescence*

Michele Di Pierro, Rice University, USA
*De Novo Prediction of Human Chromosome
Structures: Epigenetic Marking Patterns Encode
Genome Architecture*

Jie Liang, University of Illinois at Chicago, USA
*Deep Sampling to Reconstruct Large 3D
Ensembles of Chromatin Chains from 2D
Heatmaps of Captured Conformations*

Therapeutics (X6)

**William
Stafford
Noble**,
University of
Washington,
USA
*Modeling the
3D Architecture
of the Genome*

Leonid Mirny,
Massachusetts
Institute of
Technology,
USA
*Biophysical
Models of
Chromatin
(re)Organization*

**Marc A.
Marti-Renom**,
CNAG-CRG,
Spain
*Structure
Determination
of Genomes
and Genomic
Domains by
Satisfaction of
Spatial
Restrains*

**Meeting
Wrap-Up:
Outcomes and
Future
Directions
(Organizers)
(X6)**

**Meeting
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**WEDNESDAY,
MARCH 28**

Departure