

## MODELING THE 3D CONFORMATION OF GENOMES

### Important Dates

<i>Detailed Outline:</i>	June 1, 2017
<i>Draft Chapter:</i>	<b>December 1, 2017</b>

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### *Description*

This book will provide a state-of-the-art summary of physical modeling approaches applied to biological datasets that describe conformational properties of chromosomes in the cell nucleus. Chapters should explain how to convert raw experimental data into 3D conformations, and how to use models to better understand biophysical mechanisms that control chromosome conformation. The coverage will range from basic principles to modeling aspects related to polymer physics, and data-driven models for genomic domains, the entire human genome, epigenome folding, chromosome structure and dynamics, and predicting 3D genome structure.

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### *Chapter Contents*

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## Contents

### **I. Overview**

1. Introduction
2. Biological data useful for modeling
3. Molecular mechanisms of structure formation

### **II. Polymer physics**

4. Large-scale chromatin architecture
5. Polymer physics of chromosomes
6. Supercoiling of chromosomes
7. Modeling chromosome structure in bacteria
8. Energy landscape of chromosomes

### **III. Data-driven polymeric models**

#### *Restrain-based models*

Restraint-based modelling of genomes and genomic domains  
Modeling of single-cell Hi-C datasets  
Modeling the entire human genome

#### *Direct interactions*

Modeling epigenome folding  
Maximum-entropy modeling of chromosome structure

#### *Mediated interactions*

Chromatin folding captured by the strings and binders model  
Predicting the 3d structure of genome

#### *Dynamics*

Chromosome dynamics

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### Book

Woods, David D. and Erik Hollnagel. 2006. *Joint cognitive systems*. Boca Raton: Taylor & Francis.  
• In text: (Woods and Hollnagel 2006)

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Wiens, J. A. 1983. Avian community ecology: An iconoclastic view. In *Perspectives in ornithology*, ed. A. H. Brush, and G. A. Clark, 355-403. Cambridge: Cambridge Univ. Press.  
• In-text: (Wiens 1983)

### Journal article

Terborgh, J. 1974. Preservation of natural diversity. *BioScience* 24: 715-22.  
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