'Physical Biology of Chromatin' group
Laboratory of the Biology and Modeling of the Cell
CNRS, ENS de Lyon, France
http://www.ens-lyon.fr/LBMC/equipes/biologie-physique-de-la-chromatine

M2 internship/Funded PhD position in biological physics:

Inferring chromosome mechanical properties from optogenetics

Our group is looking for a Master student/PhD candidate in biological physics or computational biology to work on chromosome folding in close collaboration with experimentalists.

Context: Inside the cellular nucleus, DNA is tightly packed into a polymer-like structure called chromatin. Characterizing how chromatin self-organizes is one of the major challenges faced in recent years by biology. During the last decade, thanks to the development of advanced experimental techniques, major progresses have been realized in our understanding of the multi-scale chromosome organization during interphase. An increasing number of experimental evidences has suggested that the spatio-temporal organization of the genome may play a decisive role in the regulation of gene expression and in diseases. It is therefore of high importance to better characterize the mechanisms driving such organization. Being long polymers by nature, chromosome structure and dynamics strongly depend on the intrinsic mechanical properties of the chromatin fiber such as its rigidity, its compaction or its diameter. However, due to technological limitations, there is no straightforward way to measure such properties *in vivo*. More importantly, how do cells regulate them in response to environmental or developmental cues remains largely unknown. In this project, we aim to address that question using an interdisciplinary strategy based on optogenetics and biophysical modeling.

Objectives: The student will develop a research activity on the modeling of chromatin fiber structure and dynamics in order to infer mechanical properties like rigidity from optogenetic experiments (specific genetic alterations induced by visible light) in live yeast cells. It will involve the development of original models coupling statistical and polymer physics, of efficient simulation schemes, and of statistical tools to analyze experimental data. The project will be realized in close collaboration with the group of Gaël Yvert for experimental biology (LBMC, ENS de Lyon). This work will provide

grounds to a wide spectrum of totally-novel investigations on how cells regulate their chromosome mechanics.

Environment: The candidate will integrate our group 'Physical Biology of Chromatin' that mainly focuses on understanding the fundamental bases of chromatin and gene regulation using physical modeling and computational approaches. Our innovative research is conducted in close interaction with top-leader experimental partners. The group is integrated within the Laboratory of Biology and Modeling of the Cell that aims to characterize the molecular bases underlying the organization and functioning of cellular processes in normal and pathological conditions . It is based at Ecole Normale Supérieure de Lyon, a French top-leading research and educational institute.

Profile of the candidate: We are looking for a creative and highly motivated candidate with a background in statistical or polymer physics, in computer science or in computational biology. Advanced skills in programming is required and a previous interdisciplinary experience in connection with biological issues would be a plus.

To apply, please send your CV and a motivation letter to Daniel Jost at daniel.jost@ens-lyon.fr