

U Chicago-CNRS Collaboration program: Fully Funded PhD studentship in Montpellier

Stochastic transcriptional bursting in space and time

Project : In order to generate a functional organism, cell fate decisions must be taken at the right place and at the right time. Decades of genetic studies in Drosophila have dissected the gene regulatory networks responsible for the establishment of precise patterns of gene expression. In certain cases, network architecture reveals error correction mechanisms. However, recent live recent live imaging studies show that transcription occurs in a random on/off manner called "bursts". The details of how transcription factors control bursting are unknown and are the focus of this proposal. Our project is concerned with a particular class of TFs called pioneer factors, such as Zelda. To study the impact of TF pioneer factors on transcription (MS2/MCP) combined to an innovative signal processing approach, able to position each single polymerase initiation event for each nucleus in vivo. In order to understand how order emerges from stochastic local events, both microscopic and coarse-grained mesoscopic models will be developed. The micro-meso relationship will be rigorously studied in the framework of limit theorems for Markov processes.

Techniques: Confocal imaging; Data analysis (image analysis, statistics, programming in R/Matlab or Python); Mathematical modelling (continuous- and discrete-time Markov processes).

Candidate : Motivation, perseverance, rigor, creativity and curiosity. Knowledge in drosophila genetics is a plus but not mandatory. Interest in mathematical and quantitative biology and expertise in programming are mandatory. Required diploma: A research master degree from a University, Engineering School or "Grande Ecole", in a field relevant to the project (biology, mathematics, physics, engineering). Students with interdisciplinary profile are strongly encouraged to apply. *The PhD student will be trained in an interdisciplinary environment and his/her contribution will concern all the aspects of the project: theoretical, mathematical and experimental.*

Environment: This project belongs to an interdisciplinary project in collaboration with three labs: Mounia Lagha, Ovidiu Radulescu and John Reinitz. The PhD student will be based in Montpellier and co-supervised by OR and ML but will travel regularly to U Chicago to work with the Reinitz lab, where a second PhD student will be working on a related project. The experiments will be primarily performed in the Lagha lab and the mathematical modelling in the Radulescu lab. The student will join the I2S graduate school http://www.edi2s.univ-montp2.fr/

How to apply: Please send an email containing "[PhD France-Chicago]" in its subject, with your motivation letter, CV and reference names to <u>mounia.lagha@igmm.cnrs.fr</u> and <u>ovidiu.radulescu@umontpellier.fr</u>. *More details about the project can be found at https://ovidiu-radulescu.yj.fr/ and http://www.laghalab.com/*.

Start date: 01/10/2020.

