PhD project
Analysis of atypical meiosis and mitosis in non-model nematode species
http://www.ens-lyon.fr/LBMC/NematodeCell/

Start date: October 2019, PhD fellowship funded by CNRS

Keywords: comparative cell biology, nematodes, asexuality, meiosis, mitosis, spindle mechanics, biophysics

Description:
Basic cell functions show remarkable conservation across phyla. All eukaryotic cells must divide, replicate their DNA, assemble chromosomes, etc. Because of this overt conservation, very little is known about the evolution of the mechanisms that sustain these basic functions. How variable are these mechanisms in closely related species, and what changes are possible?

Our lab has established the nematode early embryo as a study system to address these questions. We have developed two main axes: i) exploring which modification to female meiosis allows asexual reproduction (ex. [1]), ii) which molecular and physical changes are responsible for the different mechanics of the mitotic spindle between species (ex. [2]).

Nematode early embryos are ideal because they are large cells, their first cell division is very fast (15 minutes in *C. elegans*) and many subcellular events can be analyzed by simple DIC microscopy. Moreover, the one-cell embryo of the reference species *C. elegans* has been extensively studied both at the biophysical and molecular level, offering a framework to start comparative analysis. Last, functional approaches using RNAi or CRISPR/Cas9 are now feasible in non-model nematode species ([3] and our unpublished results).

For this PhD project, we will i) compare cellular properties such as dynamics of the microtubule and actin cytoskeleton, the kinetochores, the repartition of molecular motors, etc. between *C. elegans* and a couple of non-model nematode species displaying interesting phenotypes. This will be achieved by live-cell imaging of fluorescently tagged proteins generated by CRISPR/Cas9. ii) investigate the evolution of key molecular components of spindle mechanics (molecular motors, microtubule-associated proteins, regulator of the acto-myosin network, regulation of cohesins, …) across species using RNAi and mutants generated by CRISPR/Cas9.

References:

Environment: Our institute (LBMC) is situated on the campus of the Ecole Normale Supérieure de Lyon (ENS-site Monod) in the south of the Lyon city center (France). ENS offers an interdisciplinary environment (30 research structures, from archaeology to quantum physics). The project is part of an interdisciplinary and international research program.

Student requirements: Applicants must have a master or engineer degree in biology or biophysics. Background in either cell biophysics, cell biology, molecular genetics is required. Previous experience with the CRISPR/Cas9 system and/or nematodes will be appreciated. We are looking for highly motivated candidates with a special interest for evolutionary questions and/or cellular biophysics. Good relational skills are important for the project, as it will be carried out in an interdisciplinary and international environment. Please include a CV, a cover letter with the name of at least two references and a 1-page summary of your master thesis.

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