PhD in computational modelling of early embryonic development

Description of the project

We are seeking two highly motivated PhD students to work in the Unit of Theoretical Chronobiology in collaboration with the Nonlinear Chemistry Unit on a project related to the modelling of cell differentiation. This interdisciplinary project will focus on the relation between the structure of gene regulatory networks (GRN) governing cell differentiation and their functional robustness. Both projects relate to the differentiation of cells of the inner cell mass (ICM) into cells of the epiblast (Epi) or of the primitive endoderm (PrE) in early mammalian development, a process that has much implication for understanding the dynamics of embryonic stem (ES) cells.

The first project (position #1) aims at investigating the sensitivity of realistic GRN configurations to noise, based on the theory of stochastic processes. The GRN's that will be explored include the ones developed for the specification of ICM cells into Epi or PrE but also alternative GRN, so that generic robustness properties will be identified. The investigation will be mainly based on bifurcation analysis and stochastic numerical simulations.

The second project (position #2) relates to the initial source of heterogeneity in the mouse embryo, which is a crucial question to understand the initiation of cell specification. The research will be carried out in collaboration with the laboratory of Claire Chazaud, GReD, Clermont University (France). Using single-cell transcriptomics data provided by this group, the PhD student will identify candidate genes playing a role in the initiation of cell specification, extend our previously published models by incorporating these genes, and assess through dynamical simulations if these extended networks are able to account for experimental observations.

Profile

Applicants must hold a master's degree in mathematical biology, chemistry, physics, bioengineering or equivalent and have a strong interest for interdisciplinary research at the edge between nonlinear dynamical systems and biology. Experience with biological and/or stochastic modelling, and connecting models to real data, is an advantage. Applicants must be proficient in both written and oral English.

What we offer

The positions are available from Sept 1, 2021, and for a duration of 4 years. You will work in an interdisciplinary environment, with joined supervision. You will be located on the Plaine Campus of ULB, Brussels.

Applications and further information

Please contact Geneviève Dupont (gdupont@ulb.ac.be) for further information.

To apply send (1) your CV, (2) a letter stating your background, the project you are interested in and your motivation to apply for the position, and (3) two contacts for references. Deadline for application: 31st of May 2021. Students may apply before completion of their Master degree.