2018-00669 - Post-doctorant(e) : Coupling of population dynamics and domain evolution

Niveau de diplôme exigé : Thèse ou équivalent
Fonction : Post-Doctorant

A propos du centre ou de la direction fonctionnelle

Located at the heart of the main national research and higher education cluster, member of the Université Paris Saclay, a major actor in the French Investments for the Future Programme (I3ex, LabEx, IRT, Equipex) and partner of the main establishments present on the plateau, the centre is particularly active in three major areas: data and knowledge; safety, security and reliability; modelling, simulation and optimisation (with priority given to energy).

The 450 researchers and engineers from Inria and its partners who work in the research centre's 31 teams, the 100 research support staff members, the high-level equipment at their disposal (image walls, high-performance computing clusters, sensor networks), and the privileged relationships with prestigious industrial partners, all make Inria Saclay Île-de-France a key research centre in the local landscape and one that is oriented towards Europe and the world.

Contexte et atouts du poste

Models of structured population dynamics are increasingly used to study the time-evolution of the distribution of a population along space, age, or other morphological, physiological or behavioral traits. One of the main interests of such models lies in gaining insight on the long-term behavior of the population. Hence environmental changes, even when happening at a slower time scale than the birth/rate processes, should not be neglected. This has been highlighted in the literature and mathematical models have already been developed to take into account the environmental fluctuations' impact on the population dynamics. However the reverse phenomenon is also true: changes in the population can affect the environment. We are then faced with a two-way coupling between environmental and population changes.

Mission confiée

The post-doctoral project will be dedicated to designing a mathematical framework enabling this double coupling and applying it to the specific issue of coupled germ cell growth and somatic cell kinetics in ovarian follicle development.

In ovarian follicles, a growing oocyte (the germ cell) is surrounded by increasingly many layers of somatic cells. The oocyte synthesizes and releases specific growth factors which influence the proliferation and differentiation functions of the overlaying somatic cells. In turn, the somatic cells release stimulate the growth of the oocyte. Hence the oocyte growth influences both the spatial structure of the cell population and its proliferation rate, while the changing number of somatic cells controls the oocyte growth.

Principales activités

The work will consist in developing a mathematical framework for the coupling of structured population dynamics and domain evolution using the PDE formulation. The model formulation will be inspired from an available stochastic individual-based model. Individual-based models allow one to keep track of the trajectory of each individual cell. However, when the population size increases, simulations become very costly, and continuous models are preferred. Then the population is described by a density and its evolution is given by a deterministic partial differential equation (PDE).

The new model will be applied to the case of ovarian development, and numerical simula- tions will be confronted to experimental data to validate the model. It will then be used to predict and explain the behavior of cell populations. The new formulation will render the model developed in more universal and applicable to other problems as well, such as the interplay between myocardium reshaping and cell dynamics during cardiac remodeling.

Compétences

A general background in applied mathematics is required, including solid notions in the analysis and simulation of partial differential equations. Interest in mathematical biology and biomedical sciences would be appreciated.

Informations générales

- Thème/Domaine : Interaction et visualisation
- Ville : PALAISEAU
- Centre Inria : CRI Saclay - Île-de-France
- Date de prise de fonction souhaitée : 01-11-2018
- Durée de contrat : 1 an, 4 mois
- Date limite pour postuler : 10-04-2018

Contacts

- Equipe Inria : M3DISIM
- Recruteur : Clement Frederique / frederique.clement@inria.fr

Conditions pour postuler

Applicants have to provide the following documents to be considered at the selection procedure:

- CV
- publication list and 2 representative publications (that you judge representative of your work)
- motivation letter (explaining why the selected topic, how do you think you can fit the topic, what are your motivations for the topic compared to your previous work, etc)
- 2 recommendation letters
- perspective of professional insertion after the post-doc

 Sécurité défense :

Ce poste est susceptible d’être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L’autorisation d’accès à une zone est délivrée par le chef d’établissement, après avis ministériel favorable, tel que défini dans l’arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l’annulation du recrutement.

Politique de recrutement :

Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.

Attention : Les candidatures doivent être déposées en ligne sur le site Inria.
Avantages sociaux

- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave
- Flexible working hours
- Sports facilities

Rémunération

Monthly gross salary: 2,653 euros