Post-Doctoral Research Visit F/M Post-doctoral position in mathematical and/or computational biology: Multiscale modeling of single cell-based dynamics of ovarian development

Le descriptif de l'offre ci-dessous est en Anglais

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

A propos du centre ou de la direction fonctionnelle

The Inria Saclay-Île-de-France Research Centre was established in 2008. It has developed as part of the Saclay site in partnership with Paris-Saclay University and with the Institut Polytechnique de Paris.

The centre has 39 project teams, 27 of which operate jointly with Paris-Saclay University and the Institut Polytechnique de Paris; its activities occupy over 600 people, scientists and research and innovation support staff, including 44 different nationalities.

Contexte et atouts du poste

The postdoc position is open in the framework of the AI4scMED (“MultiScale AI for SingleCell-Based Precision Medicine”) consortium (https://ai4scmed.github.io) of PEPR Santé Numérique (project no. 22-PESN-0002) headed by INRIA-INSERM, gathering researchers from different institutions on AI developments for single-cell biology applied to precision medicine.

The position is an opportunity to be involved in a strongly interdisciplinary consortium, and to strengthen experience in mathematical and computational biology by working on the embedding of single cell spatial data within a multiscale modeling framework.

The contract is expected to start between October 1st and December 1st, 2024.

Mission confiée

The postdoc fellow is expected to use and develop the computational platform Simuscale (Bernard et al 2024) which enables one to simulate both intra- and extra-cellular processes at different time scales, and whose decoupled architecture allows for an easy and parsimonious extension of implemented models with e.g. a new kind of intra-cellular formalism.

A mechanistic Gene Regulatory Network (GRN) model based on a Piecewise Deterministic Markov Process (PDMP) formalism has been recently implemented in Simuscale. This approach has been shown to realistically simulate cell dynamics, including cell-cell interactions and cell fate decision-making, as well as simulating realistic single-cell transcriptomic data (Nguyen et al. 2024).

A similar approach coupling cell population dynamics with GRN will be applied to ovarian development. Ovaries are highly dynamical organs subject to permanent remodeling, which is associated with the development of ovarian follicles, the basic functional and anatomical units of the ovary consisting of an oocyte (the future female gamete) and populations of somatic cells. Getting insight into the multiscale mechanisms underlying ovarian follicle development and their changes all along reproductive lifespan will be of great help for early diagnosis and management of ovarian aging. The development of oocytes within germline cysts was recently examined at the single cell level in the mouse (Niu & Spradling 2020). This study has illustrated the intricacy of the cellular and molecular levels, including key spatial aspects involved in the earliest steps of ovarian follicle development.

The postdoc fellow will implement in Simuscale a model for the formation of ovarian follicles, in order to integrate a molecular description at the single cell level into a spatially realistic model. The research project will focus on the selection of oocytes from precursor germ cells (Niu & Spradling 2020, Niu & Spradling 2022) and the formation of the pool of ovarian follicles with which female mammals are endowed once and for all at birth. From available scRNAseq data in literature, a gene regulatory network controlling germ cell differentiation will be inferred. The GRN will be coupled with a spatial model of cell populations involving both germ cells and somatic cells, as the model already designed for the
subsequent growth of ovarian follicles (Clément et al. 2021).

References


T.N.T. Thao Nguyen, M. Martin, C. Arpin, S. Bernard, O. Gandrillon, F. Crauste (2024). In silico modelling of CD8 T cell immune response links genetic regulation to population dynamics. bioRxiv, doi: 2024.03.01.582928

Principales activités

Review the literature
Design the models for cell population dynamics and GRN
Implement the models in the Simuscale environment
Interpret the model outputs
Write and disseminate the results to the scientific community

Compétences

Technical skills

The applicant should have a PhD in mathematical or computational biology. Any complementary training in biology, mathematics, or computer science, will be a plus.

The applicant will have an experience in mathematical and/or computational biology and will be able to implement new and existing C++ codes. They should be able to share code through Git, and to use High Performance Computing facilities. In addition, the usage of various (deterministic, stochastic) mathematical formalisms, including agent-based models, and an experience in parameter estimation with experimental data will be considered as a plus.

Language: English (basic French notions may ease daily life)

Relational skills

Interdisciplinary meetings and research are at the core of the project, so it is expected that the Postdoc Fellow is comfortable with researchers from other fields. Good ability for team playing will be appreciated.

Avantages

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours)
- + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

Rémunération

Monthly gross salary : 3.250 euros/month

Informations générales

- Thème/Domaine : Modélisation et commande pour le vivant
  Biologie et santé, Sciences de la vie et de la terre (BAP A)
- Ville : Palaiseau / Paris
- Centre Inria : Centre Inria de Saclay
- Date de prise de fonction souhaitée : 2024-11-01
- Durée de contrat : 1 an, 6 mois
- Date limite pour postuler : 2024-08-31

Contacts

- Équipe Inria : MUSCA
- Recruteur: Clément Frédérique / Frederique.Clement@inria.fr

A propos d’Inria
Inria est l’institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L’institut fait appel à de nombreux talents dans plus d’une quarantaine de métiers différents. 900 personnels d’appui à la recherche et à l’innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 200 start-up. L’institut s’efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l’économie.

L'essentiel pour réussir

Before any application, please get in contact with Chloé Audebert, Frédérique Clément and Fabien Crauste

Please provide a detailed CV - including names of the supervisors (of internships, PhD thesis, postdocs if relevant) as well as names and emails of 2 reference contacts - and a motivation letter.

Attention: Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d’autres canaux n’est pas garanti.

Consignes pour postuler

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.