PhD Position F/M Mathematical models for retinal physiology and pathology [welcome package]

Contract type: Fixed-term contract

Level of qualifications required: Graduate degree or equivalent

Fonction: PhD Position

Context

The PhD project focuses on the study of mathematical models for physiology and pathology of the retina, with a specific interest in degenerative diseases such as age-related macular degeneration. The overall objective is to develop new mathematical models and techniques, to deepen interdisciplinary knowledge, and to improve simulation algorithms for medical research. The general objective will be approached from different perspectives depending on the specific problem at hand, combining techniques from mathematical analysis, partial differential equations, numerical analysis, scientific computing, data analysis and artificial intelligence.

The project is intrinsically interdisciplinary and interconnected with Laboratoire Jacques-Louis Lions (UMR 7598), Centre Inria de Paris (équipe MAMBA-MUSCLEES), Hôpital National des Quinze-Vingts (Paris Eye Imaging), Institut de la Vision, Sorbonne Université and CNRS. The rich research environment offers frequent talks and visits by esteemed researchers, favouring opportunities for collaboration with leading groups in Europe and globally.

Assignment

The successful candidate will take part in one or more of the following interdisciplinary research directions:

- Modelling the biomechanical properties of the cell monolayer of retinal pigment epithelium and their changes due to senescence.
- Modelling the growth of lesions in the retinal pigment epithelium in presence of age-related macular degeneration.
- Modelling certain aspects of retinal metabolism related to the renewal of photoreceptor outer segments and the formation of A2E.
- Refinement and validation of reaction-diffusion models for the biochemistry of the visual cycle.

For further details, see the references below or contact L. Alasio (INRIA & LJLL).

References

*Thresholding scheme and epithelia*


*Models for wound healing*

Models for the visual cycle

- L. Alasio, Towards a new mathematical model of the visual cycle. hal-03517553 (2022).

Age-related macular degeneration and medical imaging


Main activities

- Study previous results, read articles and compile literature reviews.
- Learn and propose new mathematical methods for theoretical investigation, contribute to experiment design.
- Learn, develop and test new models and algorithms related to the topic.
- Conduct numerical simulations, sensitivity analysis and contribute to the model validation based on data.
- Analyse, criticise and improve both theoretical and applied work.
- Write scientific articles and reports, often with multiple co-authors.
- Present new results at conferences and workshops.
- Write a doctoral thesis.

Skills

The candidate must have the following skills:

- Strong background in applied mathematics, or related fields.
- Good programming skills, prior experience with FreeFEM, FEniCS, MATLAB or Python is desirable.
- Proficiency in both written and spoken English.
- Ability to work independently as well as collaboratively.
- Ability and desire to read prior work and to build upon it in one's own work.

Benefits package

- 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
- Flexible organization of working hours (after 12 months of employment)
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

Remuneration

Monthly gross salary: 2100 € during the first and second years. 2190 € the last year.

General Information

- Theme/Domain: Modeling and Control for Life Sciences
- Scientific computing (BAP E)
- Town/city: Paris
Inria Center: **Centre Inria de Paris**
Starting date: 2024-10-01
Duration of contract: 3 years
Deadline to apply: 2024-06-30

**Contacts**

- Inria Team: **MAMBA**
- PhD Supervisor: Alasio Luca / luca.alasio@inria.fr

**About Inria**

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

**The keys to success**

- The ideal candidate will have a robust knowledge of applied mathematics, with a Master’s degree level experience in both theoretical analysis and numerical implementations.
- Prior knowledge of mathematical biology and/or cross-disciplinary studies will be a real asset.
- Experience in the use of conventional tools of numerical computing employed for test and simulation is expected, as well as experience with word processing for scientific editing.
- On the personal side, a strong interest towards research in applied mathematics and skills in oral and written expression are awaited, as well as originality of thought, open-mindedness and capacity to work individually and in a team.
- The candidate must have an excellent track of records and a Master's Degree (or equivalent).

**Instruction to apply**

The documents required for the candidate's file (to put in the same pdf file):

- Motivational letter highlighting the alignment of the candidate's education with the proposed subject
- CV
- Master's transcripts
- Letters of recommendation

**Defence Security**:

This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST). Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

**Recruitment Policy**:

As part of its diversity policy, all Inria positions are accessible to people with disabilities.

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*Warning*: you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.