Job vacancy #2023-06768

Post-Doctoral Research Visit F/M Numerical modeling of the impact of blood flow on the development of cerebral vasculopathy

Contract type: Fixed-term contract
Level of qualifications required: PhD or equivalent
Fonction: Post-Doctoral Research Visit
Level of experience: Recently graduated

About the research centre or Inria department

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.

Context

Sickle cell disease (SCD) is the most common rare disease in France. Amongst the severe SCD complications, SCD-related cerebral vasculopathy (SCD-CV) generally appearing during childhood, is responsible for ischemic stroke, making SCD the first etiology of stroke in children and young adults.

This project is the first multidisciplinary project with a global approach attempting to develop a personalized and innovative tool allowing to determine the mechanisms of sickle-cell disease vasculopathy. However, the detection of patients at risk, the choice, and the follow-up of SCD-CV treatments are impaired by our only partial understanding of the pathophysiological mechanisms and the lack of evaluation tools at the individual level.

The aim of this postdoctoral researcher is to develop and validate a patient-specific (numerical and 3D-printed) fluid model for SCD-CV studies, and evaluate the impact of hemodynamics shear forces on sickle cell disease-related cerebral vasculopathy development

The project is in a collaboration between Irene Vignon-Clementel (Inria, simbiotx team), a world-renowned specialist for computational biofluid dynamics, Prof. Bartolucci (AP-HP), a world-renowned internal medicine specialist in sickle-cell disease, Dr Frederic Segonds (ENSAM) a specialist in the field of 3D printing and Dr Kim-Anh NGUYEN, a specialist in the physiopathology of platelets (Research team EFS Île de France, INSERM U955).

The researcher will be embedded within a highly multidisciplinary and international Inria research team, Simbiotx: https://team.inria.fr/simbiotx/

The project is funded by the E4H (Engineering for health, IP Paris) institute:https://www.ip-paris.fr/en/research/interdisciplinary-centers/e4h

Assignment

Mission: To develop (from existing INRIA CFD software - FeLiSce) and validate a patient-specific hemodynamic model (digital and 3D printed) for SCD-CV studies, and to assess the impact of hemodynamic shear forces on the development of cerebral vasculopathy related to sickle cell disease.

For a better understanding of the proposed research topic:
Very little CFD research exists in this field. A first paper in progress can be sent on request. See also: https://inria.hal.science/hal-03931644v1

Collaboration:
The person recruited will be in contact with the teams mentioned above.

Responsibilities:
The person recruited is in charge of developing the CFD model and will take initiatives for collaboration with the different groups.

Main activities
Main activities:
- Develop the patient-specific model within the already established pipeline that uses the opensource code FeLiSce, paraview, etc.
- Data analysis to find a mechano-biology mechanism
- Provide meaningful information to other teams for in-vitro validation (3D printing, PIV) and platelet experiments
- Take a significant role in the team life

Additional activities:
- Document the code and numerical tests
- Write articles and project advancement reports
- Disseminate the results in diverse scientific settings (conferences, clinical partners, ...)

Skills

1. Technical skills and level required:
   - At ease with fluid mechanics concepts (vorticity, ...), and have experience in numerical solvers for PDEs,
   - At ease with python and able to modify existing C++ code
   - Able to learn about biology (mechanobiology) & pathophysiology

2. Languages: fluent English (speaking & writing), French speaking a plus

3. Relational skills: good interpersonal relation skill

4. Other valued appreciated: sense of responsibility, self-driven, being curious, being a team-player

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 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

Remuneration

2788 € gross / month

General Information

- **Theme/Domain**: Modeling and Control for Life Sciences
  Biologie et santé, Sciences de la vie et de la terre (BAP C)
- **Town/city**: Palaiseau
- **Inria Center**: Centre Inria de Saclay
- **Starting date**: 2023-12-01
- **Duration of contract**: 2 years
- **Deadline to apply**: 2023-11-30

Contacts

- **Inria Team**: SIMBIOTX
- **Recruiter**: Vignon Clementel Irene / Irene.Vignon-Clementel@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 recruited person will:
- have a background in computational engineering, fluid mechanics or biomedical engineering
- ideally have already experience on hemodynamics modeling and/or ML
- be open for multidisciplinary work and differences in scientific cultures (wanting to learn and listen),
- seek excellence,
- have a taste for real-world application

**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.

**Instruction to apply**

**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.