

Post-doctoral level position (M/W; 24 months) in non-linear optical microscopy and computational imaging: Stem cell tracking, tissue remodeling, muscle disease

Location INRAE/Oniris 0703 joint research unit PAnTher; Oniris (National Veterinary, Food and Agriculture School-Nantes-Atlantique) - Veterinary Campus; 101, route de Gachet, 44307 Nantes cedex 01, France

The research unit PAnTher seeks to decipher the fundamental mechanisms underlying **genetic diseases affecting muscle and/or nervous system**, and to define **new therapeutic strategies**. The scientific goal is to advance the state of generic knowledge and provide resources for advanced medical applications. For that, it combines **fundamental and preclinical research, technological innovation** and high-level training within an original team of 20-25 people, where **veterinarians, clinicians, researchers and engineers** combine their expertise to promote excellence in the service of human and animal health. The unit also develops the APEX platform, dedicated to **veterinary pathology and fluorescence bio-imaging**. APEX offers high-tech microscopy developments in response to scientific imaging issues. It boasts a unique range of equipment including confocal microscopes, a spectral microscope, a biphotonic microscope, a light sheet microscope and a fluorescence slide scanner.

Background to the position to be filled and associated mission The successful candidate will participate in a **preclinical research** program in the field of regenerative medicine for muscular dystrophies. The aim of this program is to determine the **efficacy and safety** of a **human adult stem cell** transplantation approach on which the unit has been working for over 15 years (PMID: 29221805, 32695846, 37402811). It is part of an ambitious **European H2020 project**, FAIR CHARM ("Fast infrared coherent harmonic microscopy"; www.faircharm.eu), led by an interdisciplinary consortium of academic institutions, public research centers and international companies. Based on the principles of disruptive photonics, the aim of this project is to provide **two innovative imaging solutions** in non-linear microscopy: a spectro-temporal laser imaging device based on diffractive excitation (SLIDE) and a short-wave infrared microscope equipped with new sources laser in the infrared wavelength region around 1700 nm (SWIM). Their use could originally allow capturing in real time and at depth the biological processes and structural changes that characterize tissues. In this way, the project could provide invaluable information for assessing the therapeutic strategy envisaged. It is based in particular on a demonstration we have previously produced using multiphoton microscopy with the consortium's leader (PMID: 28644009).

The candidate will be in charge of designing, developing, adapting and testing new imaging methodologies, using the 2 prototypes provided by the consortium partners. He/she will document the optical properties of the harmonic nanoparticles used to label cells administered *in vivo*. He/she will produce a comparative study of the signals obtained with the newly designed SLIDE and SWIM prototypes and the multiphoton microscope already present on the unit. The specific will be to present the extent to which there are improved performances in terms of imaging penetration depth, speed, sensitivity as well as feature selectivity and image resolution with the prototypes. He/she exploit machine learning and deep learning to allow automation of the image analysis.

He/she will work under the supervision of Karl Rouger (team and project leader) and Laurence Dubreil (APEX bio-imaging axis referent). He/she will interact with other members of the UMR and with members of foreign teams in the FAIR CHARM consortium.

Main activities

- define the study and data collection plan (non-linear optical microscopy imaging) to be implemented to provide information on the potential of the 2 prototypes to answer the biological questions posed
- provide feedback to partners on the prototypes' potential and limitations and organize technical progress review
- process data (analyze, interpret and validate results)
- disseminate and promote results and technological achievements
- manage and organize technical resources within the framework of the project
- apply health and safety rules in the field

Knowledge

- multiphotonic microscopy (in-depth theory and practice)
- optical instrumentation and in particular non-linear microscopy
- data collection, analysis and processing (in-depth knowledge)
- programming skills to realize machine and deep learning
- health and safety regulations
- applied computer science
- english language

Operational skills

- expertise in the use of multiphotonic microscopes and control software (expert)
- provide scientific and technological expertise for the project
- design sampling plans and experimental set-ups (expert)
- guarantee the quality and relevance of analysis tools and results
- use informatic tools and software specific to the activity (proficiency): Python, Matlab, Fiji, Napari
- ability to communicate orally and in writing to different audiences

Behavioral skills

- autonomy, initiative, organizational skills
- scientific rigor, critical sense
- analytical reasoning, task planning
- ability to work as part of a team (interpersonal skills)

Candidate profile

- highly motivated, curious and enthusiastic applicant holding a PhD in non-linear optical microscopy, with a strong interest in biology, human disease and biomedical applications
- a former experience in fluorescence microscopy (especially confocal microscopy or light sheet microscopy) will be appreciated
- the candidate will bring his/her knowledge on data processing, data analysis and will get support to develop deep learning analysis tools.

About the working environment

Located some ten kilometers from the center of Nantes, the PAnTher Unit is set in a privileged natural environment, close to the Erdre river. The calm of the countryside, just minutes from one of France's most attractive and lively cities, and less than an hour from the Atlantic and its beautiful coastline.

Start date: January, 2024

Duration: 24 months

Gross salary: depending on the level of experience

For further information, please contact: Karl Rouger (karl.rouger@inrae.fr) ou Laurence Dubreil (laurence.dubreil@inrae.fr); *Web site UMR* : <https://www6.angers-nantes.inrae.fr/panther/>; *APEX core facility* : https://www6.inrae.fr/anatomie_pathologique_sante_animale

Applications: please, send a single pdf file with your CV, a brief cover letter, university grades and contact details of at least two referees in an e-mail entitled Postdoc_UMR703 FAIRCHARM to the scientific coordinators of the project: Karl Rouger (karl.rouger@inrae.fr) and Laurence Dubreil (laurence.dubreil@inrae.fr). Deadline for submission: December 22, 2023