

2 post-doctoral positions in “Radiobiology modeling and experimentation”

1 The PICTURE project

PICTURE is a 3-year project funded by AVIESAN that will start in Spring 2021. This highly pluridisciplinary project (biophysics modeling, G4-DNA Monte Carlo simulations, experimental radiobiology, instrumentation, computing science for imaging) aims at providing important knowledge on the radiobiological mechanisms and guidelines for future treatment planning systems and the optimization of Radioelement-Based Therapies (RBT). It gathers 3 research groups: the PHABIO¹ and LRMC² groups in IP2I (Lyon) and the PNAM³ group in LPSC (Grenoble) in collaboration with the LIRIS⁴ lab.

Indeed, despite the remarkable advances of radiotherapy in the last decades, new treatment modalities are currently investigated to improve the treatment of diffuse and aggressive cancerous tumors. Among these modalities, Radioelement-Based Therapies such as targeted-radionuclide therapies and boron neutron capture therapy raise a growing interest thanks to respectively the fast development of radioimmunotherapy and of epithermal neutron sources based on accelerators.

Like in ion-beam therapy, treatment planning of RBT requires biological dose estimation as soon as ions are emitted by the radio-emitters (i.e. low-energy protons, alpha and lithium ions). Due to the short range of these ions (few μm), one expects that the distribution of radio-emitters and the geometry of cell impact the biological dose. It is therefore of utmost importance to consider extra-nuclear sensitive volumes in particular when radio-emitters are located outside the cell nucleus. At the moment, the cell nucleus is the only sensitive volume considered in the biophysical models able to predict biological dose in ion-beam therapy. One of such models, NanOx, has been recently developed by the PHABIO team of IP2I. Its very good predictive performances, as well as its design enabling convenient implementation of new mechanisms and an easy coupling with Monte-Carlo tools like G4-DNA, make it the tool of choice to address the modeling of biological dose for RBT. The extension of the NanOx model, including the consideration of extra-nuclear sensitive sites, will lead to the introduction of new biological parameters that will be determined by means of innovative techniques.

2 Missions

2 post-doctoral fellows will be recruited during this project:

- A 30 month postdoc in IP2I (group PHABIO) in charge of NanOx tool optimization, the instrumentation in Radiograaff and the confocal microscopy in close collaboration with the engineers of the laboratory;
- A 24 month postdoc in LPSC (group PNAM) in charge of the Geant4, Geant4-DNA and GATE simulations involved in the modeling of the Radiograaff irradiation beam line, the calculation of the radioelement distributions in BNCT, the influence of these distributions on cell survival, etc.

The 2 post-docs will work in close collaboration.

3 Candidate profiles

- Physics of radiation interactions in matter
- Scientific programming and modeling (C++, Python, Monte Carlo modeling)
- High motivation to work within a multidisciplinary project

¹Physique appliquée au biomédical

²Laboratoire de Recherche Moléculaire et Cellulaire

³Physique Nucléaire et Applications Médicales

⁴Laboratoire d'InfoRmatique en Image et Systèmes d'information (Lyon)

4 Applications

- Applications should include: a letter of motivation, a CV, a list of publications and at least one letter of reference
- Inquiries regarding the position may be made to:
 - LPSC: Rachel Delorme (rachel.delorme@lpsc.in2p3.fr)
 - IP2I:
 - * Étienne Testa (e.testa@ipnl.in2p3.fr)
 - * Michaël Beuve (michael.beuve@univ-lyon1.fr)

5 Miscellaneous

- Starting date: April 1, 2021
- Term of contract: 12 months (renewable for the total duration of post-doc)
- Contract: Fulltime
- Salary: Approximately 2550 € per month (gross)
- Experience: Up to 2 years of postdoctoral experience at the starting date of the contract