

Postdoctoral position, Lyon, France
**Monte-Carlo simulations of SPECT imaging
for nanoparticles-based cancer treatment**

<https://www.creatis.insa-lyon.fr/site7/fr/node/45881>

The [CREATIS](#) laboratory and the [Léon Bérard](#) cancer centre (CLB, Lyon, France) open a 24 months postdoc position in the field of simulations in biomedical imaging. The position is funded by the SPEDIV project (INCA, INSERM).

General view

The project deals with the in-vivo quantification of the distribution of therapeutic nanoparticles with two imaging devices: SPECT and spectral photon counting CT. The proposed position is dedicated to the first, dealing with SPECT quantification and Monte-Carlo simulations.

Summary of the SPEDIV project

Metal-based tumoral radiosensitization using high-Z nanoparticles (NPs) is currently under investigation for cancer treatment. However, despite good in vitro results, in vivo performances are under discussion. The characterization of sensitizing enhancement ratio requires precise in vivo quantification of the distribution of NPs in the irradiated tissues to relate the absorbed dose and the biological effects. But in vivo quantification is still challenging. In this project, we will evaluate the feasibility of quantifying the in vivo distribution of commercialized gadolinium-based NPs (AGuIX) with a new spectral photon counting computed tomography (SPCCT) scanner. We will compare the performance of this modality with respect to 111Indium SPECT. SPCCT and SPECT quantifications will be first evaluated on phantoms. In a second step, animal models of chondrosarcomas will be used to compare the in vivo quantification with ex vivo measures. Finally, precise comparison will outline the pros and cons of each modality for the quantification of these NPs. At the end of the project, we will be able to provide the performance and interest of SPCCT for the quantification of the in vivo distribution of metal-based nanoparticles for enhancing radiation therapy efficiency and safety.

Tasks:

The tasks of the recruited person will be to:

- 1) Participate to the SPECT quantification calibration protocol. The imaging device is a nanoSPECT/CT, four NaI(Tl) detectors, multiplexed, multi pinhole (MMP) from BioScan. It allows integrated helical-SPECT and spiral-CT, with a spatial resolution between 0.8 and 0.4 mm (focused scanning). The proprietary reconstruction algorithm is OSEM-based. This system is available in the Imthernat imaging facility (Lyon) managed by a member of the consortium.
- 2) Participate to the SPCCT acquisitions for the validation of NP quantification and participate to in-vivo SPECT acquisition (mostly managed by the LAGEP team).
- 3) Develop and validate the MonteCarlo simulation model of the nanoSPECT. The imaging device will be modelled with [Gate](#). Validation will be performed with acquired experimental data on phantom. Our team is currently developing a fast SPECT simulation method (based on ARF and FFD) that will have to be used and evaluated.

Profile

- The candidate must hold a master in medical physics, physics or image processing.
- Scientific interests: Monte Carlo simulations, computer sciences (medical image processing), x-ray and particle physics,
- Programming skills: high level in C++ required.
- Language: English required.
- Location: Centre Léon Bérard, Lyon, France.
- Salary (gross): about 1900 euros/month (CNRS)
- Period: 2 years starting from early 2017.

Contacts

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