



PhD position in Chemistry at the interface of **synthesis / biology** for the development of **anticancer theranostic compounds** (fully funded, M/W)

Research program: **Development of actuatable theranostic prodrugs for cancer treatment in deep tissues** funded by the French National Research Agency.

Location: **Institut Curie**, Campus Universitaire, Bat. 110-111-112, 91898 Orsay (Paris area), in the Unit « Chemistry and Modelling for biology of cancer (UMR9187).

Supervisor: Dr Guillaume Bort.

Employment Type: Full time.

Starting date: 2nd of October 2023.

Salary: 2135 €/m gross salary.

Application at <https://emploi.cnrs.fr/Offres/Doctorant/UMR9187-GUIBOR-002/Default.aspx>

Mission:

The possibility to **control the activation of treatment in space and time *in vivo*** has garnered significant attention and efforts over the past 20 years. **Externally triggered theranostic prodrugs** are one of the most promising tools in this field. In particular, photosensitive prodrugs and nanoobjects showed great promise for spatio-temporally controlled and non-invasive activations *in vivo*. However, most of the currently described photosensitive systems can only be activated by UV to near-IR lights. This limits *in vivo* activation to few millimetres below the skin, which hugely restrains clinical applications, mainly to ophthalmology or skin treatment. **To date, there is no non-invasive approach for using light-sensitive materials in deep tissues.**

The project takes part in the development of tools able to provide **treatment in deep tissues** in a **space- and time-controlled resolution**. **Theranostic prodrugs** detectable by nuclear magnetic resonance imaging (**MRI**) and able to be activated by **radiotherapy clinical beams**, will be developed. This project aligns with the perspective of future advancements in molecular systems for clinical applications by relying on activation techniques utilizing already-available clinical infrastructures. The **chemical** (prodrug synthesis), **physical** (activation mechanism) and **biological** (cell-death mechanism, therapeutic effect) **locks will be investigated** in collaboration with Institut Curie (Paris, Orsay), Institute of Light and Matter (Villeurbanne) and Laboratory of Chemoinformatics (Strasbourg). The PhD candidate will be based at Institut Curie (Orsay) in the “Chemistry and Modelling for Biology of Cancer” laboratory and in the “Chemistry and Modelling for Protein Recognition” team, under the supervision of Dr Guillaume Bort.

Job description:

The project entails the **development of theranostic prodrugs** for cancer treatment, designed for MRI monitoring and activation upon radiotherapy. Both the **physical and biological mechanisms** underlying prodrug activation and cell toxicity, respectively, will be investigated.

In addition to organic and inorganic synthetic chemistry, the candidate will acquire skills in **cell biology, fluorescence microscopy, flow cytometry and characterisation upon radiation.**



The PhD candidate will also be involved in other activities related to this project and supported by collaborations such as **density functional theory calculation**, development of **algorithm** for machine-learning and **data analysis**.

Developed skills :

- Synthesis of theranostic prodrug using organic and inorganic chemistry.
- Activation assessment and characterization of photophysical properties.
- Investigation of stability/activation/diffusion in biological environments, cytotoxicity and immunogenicity.
- Bringing forward ambitious yet feasible designs for new compounds, synthesis pathways, characterization techniques; being proactive.
- Participating in the supervision of engineers and trainees.
- Reporting results to collaborators and presenting at international conferences, participating in scientific manuscript writing.

Required Skills:

Applicants should hold a **master's degree in chemistry**. We are seeking a motivated individual with a passion for tackling technical and scientific challenges to potentially make breakthrough innovations in medical treatments, and with a **strong interest in multidisciplinary approaches**. Proficiency in English oral communication and a great team spirit are essential.

This project offers excellent opportunities to **develop skills** in organic/inorganic chemistry, radiation physics, cell biology and associated characterization techniques. Candidates are expected to be **highly motivated** to take advantages to work in a leading research environment, to benefit from a **multi-collaboration context**, and to potentially contribute in the **valorisation phases** (patent, etc.) of the project.

Scientific environment:

A leading player in the fight against cancer, Institut Curie brings together an **internationally-renowned Research Center** and an **advanced Hospital Group** that provides care for all types of cancer. Founded in 1909 by Marie Curie, Institut Curie comprises three sites (Paris, Saint-Cloud and Orsay), where more than **3,500 members of staff** are dedicated to achieving three objectives: **hospital care**, **scientific research**, and the **sharing** of knowledge and the preservation of legacy. As a private foundation that is recognized as serving the public interest, Institut Curie is supported by donations and grants. This support is used to fund discoveries that will **improve treatments** and the **quality of life** of **cancer patients**. The successful candidate will benefit of a vibrant environment based on the **pluri-disciplinary approaches** and excellence offered by over 85 research groups constituting the Institut Curie.

The project associated with this position currently benefits from various collaborations, encompassing different areas of expertise. These collaborations involve molecular observation at attosecond-timescale resolution using **ultrafast spectroscopy**, *in vitro* and *in vivo* evaluation of **immunogenicity** and **therapeutic effects**, and the development of **machine-learning algorithms** and **density functional theory models**. The PhD candidate will be at the **intersection of these diverse approaches** and will have the **opportunity to participate** in multiple collaborative studies.



Contact:

If you need more details, please contact Dr Guillaume Bort (guillaume.bort@cnrs.fr). The applications should include at least the contact details of 2 referees and it should be submitted using the CNRS job platform at <https://emploi.cnrs.fr/Offres/Doctorant/UMR9187-GUIBOR-002/Default.aspx>.