

Doctoral Researcher in Medicinal & Organic Chemistry M/W:

*Design of smart **sustained-release** drug delivery systems:
synthesis, characterization and applications in **nano-medicines (Nano-SURE)***

Period: 36 months

Salary: ~ 1700 eur net

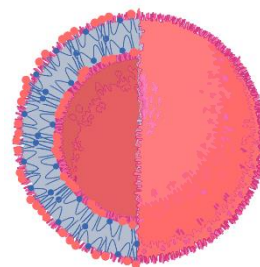
Starting date: September 2024

Studies: M2 level

Missions:

The discovery of liposomes more than 60 years ago predicted a paradigm shift in the design and administration of future drugs using nanotechnologies. However, despite their undeniable advantages (*e.g.*, increased biocompatibility, modularity, versatility of payloads, etc.), this vectorization system still suffers from an early loss of their cargo, limiting its popularization in clinics.

Supported in its 1st phase by the Initiative of Excellence (IdEx - Univ Bordeaux; NanoPRECOS project), our group has recently validated a proof of concept to improve the stability of amphiphilic nanoparticles (*e.g.* liposomes) through a simple and effective approach: we have designed and synthesized bola-amphiphiles as key compounds to be incorporated in amphiphilic drug delivery systems (DDS), like bolasomes (see image). The current doctoral project aims to optimize the bolas identified previously in the laboratory in order to bring this technology to a clinical application in cancer therapy. Several chemical modifications are to be investigated in order to target: (1) a sustained-drug release (2) a stimuli-triggered drug release (*e.g.* light, pH, etc.).



The doctoral candidate should have undeniable qualities in organic chemistry. A multi-step approach is envisaged to access targeted molecules, involving standard methods of heterocyclic chemistry, organometallic chemistry, peptide couplings, etc. The ability to acquire new techniques in analytical chemistry, formulation and characterization of nano-assemblies (HPLC, DLS, FCS, cryo-TEM, etc.) is also essential for the success of the project. The choice of molecules to be synthesized will be guided by molecular modeling studies (coarse-grained molecular dynamics) conducted by our group.

The project is being developed in collaboration with our national partners (IECB, BRIC - Bordeaux) and international partners (Phospholipid Research Center - Germany).

Bibliography:

Wires nanomed nanobiotechnol (2017) 9:e1450. doi: [10.1002/wnan.1450](https://doi.org/10.1002/wnan.1450)

Micromachines 13 (2022) 1623, doi:[10.3390/mi13101623](https://doi.org/10.3390/mi13101623)

Nature Communications 14 (2023) 6659, doi: [10.1038/s41467-023-41946-8](https://doi.org/10.1038/s41467-023-41946-8)

Journal of Colloid and Interface Science 653 (2024) 1792, doi:[10.1016/j.jcis.2023.09.195](https://doi.org/10.1016/j.jcis.2023.09.195)

Activities:

- multi-step organic synthesis (Michel additions, heterocyclic chemistry, organometallic chemistry, amphiphilic chemistry, orthogonal protective groups, fluorophores, etc.)
- analytical characterization of the synthesized chemicals: NMR, MS, IR, UV/Vis, Fluorescence spectroscopy, HPLC)
- bibliography
- regular reports and work-in-progress meetings in English
- scientific article writing

Skills:

- organic chemistry: multistep synthetic chemistry
- analytical chemistry: NMR, MS, IR, UV/Vis, FS, HPLC
- professional English necessary to work in an international environment

Funding:

This project is financially supported by the *Ministère de l'Enseignement Supérieur de la Recherche et de l'Innovation (MESRI)*. This funding is already secured by the host group.

Host institution:

This project will be conducted at CBMN (Institute of Chemistry and Biology of Membranes and Nano-objects, Bordeaux). CBMN is a joint research unit of the **CNRS**, the **University of Bordeaux** (Science and Technology Department for health), the **Institut National Polytechnique Bordeaux** and the **Bordeaux Science Agro**. CBMN has around 200 persons (50% permanent and 50% non-permanent). CBMN is a multidisciplinary institute and operates at the interface between **Chemistry**, **Biology** and **Physics** by hosting 16 research groups organized in four scientific domains.

The research in CBMN is based on the expertise and the development of 7 technological platforms for the production and biophysical characterization of nanomaterials, lipids and proteins (NMR, X-ray, Electron Microscopy, Mass Spectrometry, Vibration Spectroscopies (IR-Raman-PWR), AFM, synthesis and production of recombinant proteins) of very high level associated with CBMN.

The **Nano-SURE Project** will be driven by the **MMB** group (Molecular Modeling and Bioengineering), supervisor Dr. Edouard Badarau (<http://www.cbm.u-bordeaux.fr/28-chimie-biophysique-modelisation-de-biomolecules-et-imagerie-numerique.html#trombinoscope>).

The **MMB** group is part of the **Chemical Biology and Supramolecular Chemistry** Department of CBMN, and has expertise in experimental chemistry, biological experiments and molecular simulations.

For further details on the host institution, the candidates are advised to navigate on the CBMN webpage, at: <http://www.cbm.u-bordeaux.fr>

Contact:

Interested candidates should contact the project coordinator:

Dr. Edouard BADARAU (edouard.badarau@u-bordeaux.fr)