

PhD Offer

Synergical Effect with MAGnetic/PHotosensitizer nanO-assemblies for cancer photothERapy (SEMAPHORE)

Host laboratory: ISCR-UMR6226 / CEISAM-UMR6230

Supervision: Olivier Mongin (ISCR-UMR6226) and Lénaïc Lartigue (CEISAM-UMR6230)

Starting date: October 1th 2024

Application deadline: May 2nd 2024

Brief description of the project:

Phototherapy including photodynamic therapy and photothermal therapy is a therapeutic procedure used to treat cancerous tumors with light. The photodynamic therapy requires the presence of a photosensitizer, oxygen and light irradiation to generate the cytotoxic singlet oxygen and/or heat. The use of two-photon excitable photosensitizer (phthalocyanine or porphyrin) allows a better penetration of the exciting light-beam into the biological tissues than the conventional photosensitizers.^{1,2} Photothermal therapy is a clinical procedure based on the generation of heat to kill cancerous tumors more sensitive to temperature than healthy cells. Compared to classical photothermal agents as gold nanoparticles or graphene, magnetic nanoparticles are biodegradable.

Photosensitizers and magnetic nanoparticles are assembled in a single nanoplatform to offer dual therapy.³ In synthetic point of view, the project proposes to develop a library of such photoactive nano-assemblies and select the most efficient ones. In methodological point of view, the project aims to highlight the synergistic effects of this dual approach.

Candidate Activities:

1. Synthesize phthalocyanine or porphyrin molecules
2. Synthesize magnetic nanoparticles
3. Prepare a library of nanoassemblies incorporating magnetic nanoparticles and photosensitizers.
4. Studying and understanding the magnetic and photophysical properties of nanoassemblies.
5. Study the photothermal properties of nanoassemblies
6. Understanding synergistic effects in nanoassemblies

We are looking for candidate with excellent experience in organic chemistry and basis in synthesis and characterization of nanomaterials. Knowledge of nanomagnetism and/or photophysics would be a plus without it being mandatory.

To apply (and/or for more information), please send a cover letter outlining your motivation, a complete CV with the list of publications and at least two references to:

- Lénaïc Lartigue : lenaic.lartigue@univ-nantes.fr
- Olivier Mongin : olivier.mongin@univ-rennes.fr

¹ S. Abid, S. Ben Hassine, Z. Sun, N. Richy, F. Camerel, B. Jamoussi, M. Blanchard-Desce, O. Mongin, F. Paul, C. O. Paul-Roth, *Macromolecules* **2021**, *54*, 6726–6744.

² L. Shi, Z. Sun, N. Richy, M. Blanchard-Desce, O. Mongin, F. Paul, C. O. Paul-Roth, *Chem. Eur. J.* **2024**, *30*, e202303243 (DOI: 10.1002/chem.202303243).

³ Brevet français n° FR3135617, *Nano-assemblages à base de curcumine ou de dérivé de la curcumine et leur procédé de préparation*, 20 mai **2022**