

PhD position (2021-2024) available in the group**“Luminescent Lanthanide Compounds, Optical Spectroscopy and Bioimaging”****at the Center for Molecular Biophysics (CBM, CNRS UPR 4301, Orléans, France)****Rational Design of Versatile and Highly-Luminescent Lanthanide(III)-based Probes for Optical Imaging in the NIR-II Window**

CBM is a key participant in the development of biophysics in France, and is one of the largest research laboratories in the region Centre-Val de Loire. It was founded in 1967 to establish interdisciplinary collaborations between chemists, biologists and physicists. The group “Luminescent lanthanide compounds, optical spectroscopy and bioimaging” led by Prof. Stéphane Petoud has an extensive expertise in lanthanide coordination chemistry, spectroscopy and biological imaging with a particular focus on design, synthesis and characterization of molecular compounds and nanomaterials emitting in the near-infrared domain.

Recently, it has been demonstrated that optical imaging in the NIR-II window (1000-1700 nm) can provide additional advantages over imaging in the NIR-I domain (650-900 nm) leading to a significant improvement of the contrast at greater imaging depths, enhanced temporal and spatial resolution as well as higher signal-to-noise ratio for more sensitive detection. With such benefits, a wide range of applications can be envisaged that includes real-time image-guided surgery and drug delivery, mapping of sentinel lymph nodes, angiography and early detection of different diseases. However, today, the number of probes that can be used for such applications remains very limited.

The main goal of the project is to create a versatile family of highly-luminescent lanthanide(III)-based probes emitting in the NIR-II window upon low-energy excitation in the red, NIR-I or NIR-II ranges that would possess functional groups for their attachment to an antibody, peptide, drug, hydrophobic or hydrophilic motif, depending on the desired application. Such probes will be created on the basis of metallacrown scaffolds, polymer and/or inorganic nanoparticles and will benefit from the sharp emission bands of lanthanide(III) ions, the wavelengths of which are insensitive to the environmental conditions. Several strategies of sensitization of characteristic lanthanide(III) emission will be explored: (i) the indirect sensitization through chromophoric organic ligands or charge-transfer states associated with d-transition metal ions, (ii) the sensitization through d-d transitions or (iii) the energy transfer from another lanthanide(III) ion by downshifting or upconversion mechanisms. The project will include the design and synthesis of new emissive lanthanide probes, their complete characterization including the structural analysis and the extensive study of their photophysical properties. Finally, the most promising probes will be tested for optical imaging in the NIR-II window in biological media (plasma, serum, whole blood) and in tissue-mimicking phantoms.

Profile and skills required: The candidate should be self-motivated and be a good team player, ready to learn and tackle an ambitious and multidisciplinary project (Chemistry/Physics/Biology). The work will include international collaborations, thus good communication and organizational skills are also required. Applicants are expected to hold a Master degree in Chemistry/ Material Science/Physics/Biochemistry or related disciplines. Knowledge of lanthanide coordination chemistry and spectroscopy can be a plus but is not a pre-requisite.

The selected candidate will be enrolled at the doctoral school “Health, Biology, Biochemistry (SSBCV)” of the University of Orléans, France. The position is for three years with a starting date of October 1st, 2021.

To apply, please forward your CV, names of references and motivation letter to:

Dr. Svetlana V. Eliseeva (svetlana.eliseeva@cnrs-orleans.fr) or Prof. Stéphane Petoud (stephane.petoud@inserm.fr).