PhD opportunity – 3 years

Dual Organometallic Platforms with Advanced Optical Imaging for Enhanced Anti-Inflammatory Therapies

Doctoral school: ED406 (Chimie Moléculaire Paris Centre - https://ed406.sorbonne-universite.fr/)
Laboratory: CPCV (Chimie Physique, Chimie du Vivant – UMR8228 – Département de chimie de l'ENS-PSL / CNRS / Sorbonne Université) - Team Methrox (https://ens-bic.fr/)
Location: Département de chimie de l'Ecole Normale Supérieure, 24 rue Lhomond, PARIS
Supervision: Helene Bertrand (helene.bertrand@ens.psl.eu) and Christophe Sandt (christophe.sandt@synchrotron-soleil.fr)
Start date: January 2026

Research project: Transition metal carbonyl M(CO)s complexes have been investigated for the treatment of a variety of diseases, as antibiotics, anti-cancer and anti-malarial agents. They are also of interest because of their ability to release carbon monoxide (CO) under the appropriate conditions. CO is an important signalling agent in biological systems, its various *in vivo* activities including anti-inflammation, vasodilation, anti-apoptosis and anti-proliferation. CO is a promising candidate for a number of critical health conditions. CO-releasing molecules (CORMs) present a promising CO-delivery solution. However, if applications of metallic CORMs are getting closer, no clinical data is available so far and some challenges remain in the field, first on mechanistic understandings of the mode of action of such complexes and also on the design of safer CORMs with acceptable pharmaceutical attributes. The toxicity of the species generated by the CO release, called iCORM for inactive CORM, from CORMs needs to be addressed. There is therefore a need for new tools (CORMs and analytical approaches) for real-time tracking and assessment of CO-release and activity in cells.
In this ANR-funded project, we propose to explore new designs in molecular complexes as photoCORMs, and their conjugation on gold nanoparticles. The synthetic objects will be studied in cellular models relevant to inflammatory conditions, for which CO delivery is promising. The fate of CORMs in cells will be thoroughly monitored combining studies of their biological activity and state-of-the art analytical approaches for quantification, kinetic tracking and mapping of the metallic species in cells.
This is a collaborative project between **Sorbonne Université** (H. Bertrand), **synchrotron SOLEIL** (C. Sandt) and **NTU Taiwan** (K.V. Kong).

Mission: The successful candidate will be based in the METHROX team of the laboratory CPCV (ENS chemistry department, Paris) where his/her main responsibilities will be the s**ynthesis** of metal carbonyl complexes and their ligands, their **physico-chemical characterizations** (stability, CO-release) by means of diverse spectroscopic techniques (NMR, UV-Vis, fluorescence, IR), and their **evaluation in cells** (cell culture, imaging techniques, toxicity studies, mode of action studies). The candidate will **closely interact with the partners and will carry experiments in their respective labs**. The candidate will study the cell uptake and CO-release kinetics in living cells at the SMIS beamline, Soleil using synchrotron FTIR microspectroscopy. The candidate will make improvements on the microfluidic device used for live cell studies. The candidate will develop the gold nanoparticle conjugates with photoCORMs and study these systems using Raman based imaging techniques in collaboration with NTU Taïwan and during short research stays (years 2 and 3) in the partner's laboratory.

Required qualifications:
The candidate must be highly motivated and very enthusiastic, with:

- Master degree in organic chemistry or in chemistry at the interface with biology
- A strong interest in pluridisciplinary projects and environments
- Strong interpersonal and communication skills in French and in English

Contacts & How to apply: helene.bertrand@ens.psl.eu
Please send a detailed CV, a letter of motivation, grades from M1/M2 master levels, and a list of references who can be contacted.
Incomplete applications will not be considered.