PhD student position funded by the ANR

Enantioselective synthesis of atropisomers using supramolecular photoredox organocatalysts

Supervisor: Dr. Stéphanie Durot
Location: Laboratory of Synthesis of Multifunctional Molecular Architectures (http://www.lsamm.fr/ Dir. Pr. Valérie Heitz), Strasbourg Institute of Chemistry (CNRS UMR 7177), Strasbourg University, France
Keywords: atropisomers, chirality, asymmetric synthesis, supramolecular chemistry, photocatalysis

Project

Atropoisomers are an important class of chiral molecules whose enantioselective synthesis can represent a challenge and requires the development of efficient original, highly selective, and environmentally-friendly reactions.[1]
Catalysis in confined space is a method of choice for controlling the reactivity and selectivity of chemical and photochemical reactions.[2] This project proposes to combine[3] redox photocatalysis[4] and supramolecular chemistry by designing three-dimensional chiral architectures that can preorganize substrates via reversible interactions (Fig. 1).
The potential of porphyrins as redox photocatalysts in organic synthesis has recently been demonstrated,[5] and molecular cages incorporating porphyrins have been shown to be effective both for molecular recognition and supramolecular catalysis.[6] The targeted molecules are (hetero)biaryls of recognized interest for the design of bioactive molecules and asymmetric catalysis.

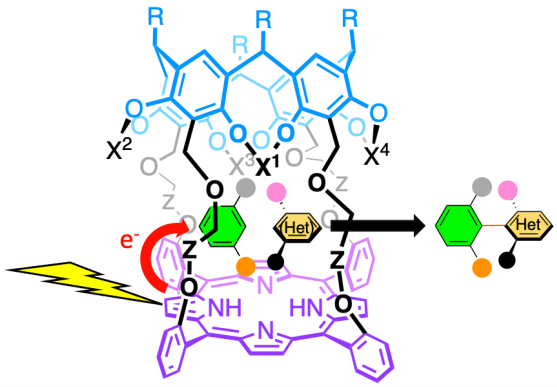

Figure 1: Principle of photoredox catalysis of a supramolecular porphyrin-based cage. (Hetero)aryls are stabilized in the cavity formed by a porphyrin (purple) linked to a capping unit (blue). Under visible light irradiation, electron transfer from the porphyrin to one substrate triggers the conversion to one atropisomer.

This multidisciplinary project involves collaborators in Strasbourg, Lyon and Marseille.
The PhD student will carry out the synthesis of porphyrin catalysts and substrates, as well as the photocatalyzed reactions within the chiral cages providing access to biaryl atropoisomers.

Candidate profile

Motivated to work on a collaborative project in a booming field, in the rich scientific environment of Strasbourg? You have an engineering or master degree in organic chemistry, with skills in organic synthesis, and good knowledge of the usual techniques of molecular synthesis, purification and characterization of molecules. You are interested in chirality, supramolecular chemistry and photocatalysis. You are curious, rigorous, open-minded and fluent in English, with good communication skills. If you have expertise in photochemistry or photocatalysis, it is an asset, but not mandatory.

Position

The PhD position is funded by the Agence Nationale de la Recherche (ANR) for 3 years, starting in September or October 2024.
The gross salary is ca. 2100 €/month.

Application

Send an email to sdurot@unistra.fr, with a single pdf file including a CV, a motivation letter, a letter of recommendation, academic transcripts of your master (M1 and M2, with rankings), a summary of your research and contact of two references of people you worked with. Please mention "Atropisomer PhD application" as the subject.
Applications will be examined as soon as received. After a preselection, online interviews will be organized.

References

[1] Cheng, J. K., Xiang, S.-H., Li, S., Ye, L., Tan, B., *Chem. Rev.* **2021**, *121*, 4805. [2] Morimoto, M., Bierschenk, S. M., Xia, K. T., Bergman, R. G., Raymond, K. N., Toste F. D. *Nat. Catal.* **2020**, *3*, 969. [3] Yang, C., Inoue, Y., *Chem. Soc. Rev.* **2014**, *43*, 4123. [4] Prier, C. K. Rankic, D. A., MacMillan, D. W. C., *Chem. Rev.* **2013**, *113*, 5322. [5] Costa e Silva, R., Oliveira da Silva, L., de Andrade Bartolomeu, A., Brocksom, T. J., de Oliveira, K. T., *Beilstein J. Org. Chem.* **2020**, *16*, 917.
[6] a) Durot, S., Taesch, J., Heitz, V., *Chem. Rev.* **2014**, *114*, 8542. b) Leenders, S. H. A. M. Gramage-Doria, R., de Bruin, B., Reek, J. N. H., *Chem. Soc. Rev.* **2015**, *44*, 433. c) Schoepff, L., Kocher, L., Durot, S., Heitz, V., *J. Org. Chem.* **2017**, *82,* 5845. d) Djemili, R., Kocher, L., Durot, S., Peuronen, A., Rissanen, K., Heitz, V., *Chem. Eur. J.* **2019**, *25*, 1481. e) Schoepff, L., Monnereau, L., Durot, S., Jenni, S., Gourlaouen, C., Heitz, V., *ChemCatChem* **2020**, *12*, 5826. f) Zanetti-Polzi, L., Djemili, R., Durot, S., Heitz, V., Daidone, I., Ventura, B., *Chem. - Eur. J.* **2020**, *26*, 17514. g) Djemili, R., Adrouche, S., Durot, S., Heitz, V., *J. Org. Chem.* **2023**, *88*, 14760.