**PhD position available in ISCR (Rennes), 36 months from October 2020**

**Title:** New heterohelicenes: syntheses, biological properties and applications in redox catalysis

| Supervisors: | Prof. Florence Mongin (33%), Prof. Jean-Pierre Hurvois (33%), Dr. William Erb (33%) |
| Place: | Chimie Organique et Interfaces (COrInt Team), Institut des Sciences Chimiques de Rennes, UMR 6226 CNRS, Campus de Beaulieu, Université de Rennes 1 (France) |
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| Financial support: | three-year doctoral contract | Net salary: ≈ 1400 € |
| Keywords: | heterohelicenes, heterocyclic synthesis, asymmetric synthesis, kinase inhibitors, redox mediators |

**Overview of the research project:**

Due to their special structure and resulting chirality, helicenes have aroused considerable interest from the chemist’s community and constitute a topic of research in perpetual evolution (Reviews: Chem. Soc. Rev. 2013, 42, 968, 1007 and 1051; Chem. Rev. 2019, 119, 8846). Although they found applications in asymmetric synthesis and in the field of organic materials, developments in medicinal chemistry are scarce.

Our research group recently identified a reaction cascade giving new helical fluorescent hexacycles (Bioorg. Chem. 2020, 94, 103347), able to inhibit enzymes involved in the development of cancers (Eur. J. Med. Chem. 2019, 172, 95), as well as in drug resistance (Pharm. & Therap. 2019, DOI: 10.1016/j.pharmthera.2019.107454). Since there are currently no inhibitors targeting these enzymes on the market, our first goal will be to benefit from molecular modelling to introduce selected substituents towards an improved pharmacological profile.

Due to the fluorescence properties of these small heterohelicenes, additional applications will be possible through collaborations with biologists.

Although the main group heteroatoms (N, O, S...) are known to bring specific electronic and optical properties to helicenes, the reported examples rarely involve polyheteroatomic compounds. Thus, our second goal will be to develop this new family of polyheteroatomic helicenes towards very original physicochemical properties. Therefore, while substituents able to facilitate helixes separations will be introduced, we will attempt enantioselective syntheses by recourse to chiral Lewis and Brønsted acids.

Finally, the cyclic voltammograms of the obtained polycycles will be recorded for the early evaluation of their redox properties. Indeed, up to now, helicenes have never been used as chiral redox catalysts. Therefore, in our third goal, we will benefit from these data to develop new helicene-based chiral catalysts able to promote new asymmetric transformations.

The PhD student will benefit from a collaborative network already established for the enzymatic (S. Bach, Roscoff, France) and cellular (L. Picot, V. Thiéry, La Rochelle, France) evaluation and for the molecular modelling studies (L. Nauton, P. Moreau, Clermont, France). The determination of the photophysical and chiroptical properties, as well as the calculations to rationalize these properties, will be performed either within the research unit or through international collaborations. Thus, the development of this original project around a new family of heterohelicenes for applications in leading fields is multicollaborative, and will allow the PhD student to acquire various and valuable skills.

**Scientific and general skills that will be acquired by the PhD student:**

- Organic synthesis (deprotemetallations, couplings, separation of enantiomers, enantioselective reactions)
- Analysis of the prepared compounds (NMR, GC-MS, IR, cyclic voltammetry, etc.)
- Bibliography, presentation of results, team work

**Selection criteria:**

Skills and interest in organic synthesis and in standard characterization tools (at least a five-month training period), interest for interfaces will be an advantage but is not mandatory, background in organic chemistry

**Application until April 13th 2020:**

- Detailed CV and Motivation letter (10 lines in the email)
- Names and emails of two contacts (for recommendations)
- Transcripts of marks for Master 1 or 2nd year of Engineer School
- When possible, transcripts of marks for the 1st semester of M2
- An interview will be planned for the candidates best fulfilling the criteria.