Research Topic for the ParisTech/CSC PhD Program

Field : *Chemistry, Physical Chemistry and Chemical Engineering*
Subfield: *Organic Chemistry*
Title: *New iron complexes for enantioselective hydrogen transfer catalysis*
ParisTech School: *Chimie ParisTech*
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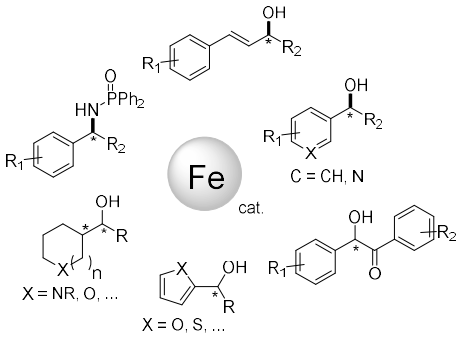
Research group/Lab: *i-CLeHS – CSB2D, Chimie ParisTech*
(Lab/Advisor website): *Institute of Chemistry for Life and Health Sciences (i-CLeHS), CSB2D Team - https://www.chimie-paristech.fr/*

Short description of possible research topics for a PhD:

Asymmetric hydrogenation of unsaturated organic substrates is one of the most important synthetic tools used as an access to chiral scaffolds of pharmaceutical interest. The most powerful methods developed so far use noble metal catalysts (Ru, Rh, Ir, ...), which have a low natural abundance and are therefore expensive, and gaseous hydrogen. An important challenge is to develop new asymmetric hydrogenation methodologies which rely (i) on the use of non-noble transition metals as catalysts and (ii) on the use of liquid hydrogen vectors, which can be used as more easily-handled surrogates of H_2.



Iron appears as a good candidate for the development of new organometallic chiral catalysts, due to its low cost and toxicity. The goal of this project is to develop new chiral iron complexes which will be used in highly enantioselective hydrogenation and transfer hydrogenation of organic substrates, leading to a variety of targets of synthetic and pharmaceutical interest (Scheme 1). In order to ensure the robustness and the versatility of the system, various classic liquid hydrogen vectors will be used (e.g. formic acid, Hantzsch esters, cyclohexa-1,4-diene).

Required background of the student: experience in organic/organometallic synthesis.

A list of 5(max.) representative publications of the group:
(1) Review: Kyne, S.; Lefèvre, G.; Ollivier, C.; Petit, M.; Ramis-Cladera, V.-A.; Fensterbank, L. *Chem. Soc. Rev.*, **2020**. Iron and cobalt catalysis: new perspectives in synthetic radical chemistry, *accepted*.
(2) Rousseau, L.; Herrero, C.; Clémancey, M.; Imberdis, A.; Blondin, G.; Lefèvre, G. *Chem. Eur. J.* **2020**, *26*, 2417.
(3) Desaintjean, A.; Belrhomari, S.; Rousseau, L.; Lefèvre, G.; Knochel, P. *Org. Lett.* **2019**, *21*, 8694.
(4) Ayad, T.; Phansavath, P.; Ratovelomanana-Vidal, V. *Chem. Rec.* **2016**, *16*, 2750.
(5) Reviews : a) Echeverria, P.-G.; Ayad, T.; Phansavath, P.; Ratovelomanana-Vidal, V. *Synthesis* **2016**, *48*, 2523. b) R. Molina-Betancourt, Echeverria, P.-G.; Ayad, T.; Phansavath, P.; Ratovelomanana-Vidal, V. *Synthesis* **2020** (DOI: 10.1055/s-0040-1705918). Recent Progress and Applications of Transition-Metal-Catalyzed Asymmetric Hydrogenation and Transfer Hydrogenation of Ketones and Imines through Dynamic Kinetic Resolution.