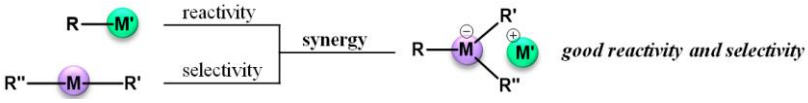
Master 2 Internship in Organic Chemistry

Title: Synthesis of exotic boronic ester using organomagnesiates complexes.

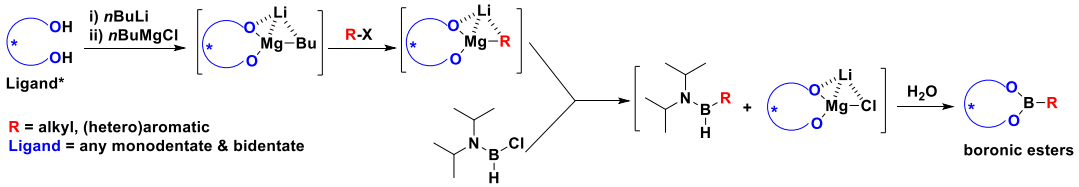
Period: 5-6 months starting January-February 2024.

Context: Organomagnesiates are bimetallic complexes that result in combining a "polar" (*e.g.* an organolithium, M' in scheme 1) with a "soft" organometallic (*e.g.* organomagnesium, M in scheme 1), which behaviour is significantly different from those of the precursor. The principle is a synergy created by mixing two different organometallic reagents allowing increased selectivity and reactivity. Indeed, those reagents tolerate easier a bromine or ester function for example. They can as well be used under non-cryogenic conditions compared to the monometallic reagent. Moreover, those heterobimetallic reagents are from cheap and abundant metals which are the key towards the development of sustainable chemical processes.[1] Combined with a chiral ligand, they also can be very powerful to induce enantioselectivity.[2] In the last few years, we developed and studied (chirales) organomagnesiates complexes as metal-halogen agent for the synthesis of diversely (chirales) 3-substitued and 3,3'-disubstitued (aza)phthalides.[2c, 3]



Scheme 1: Concept of bimetallic complex

Research objectives: The aim of this project is to use organobimetallic complexes' properties to develop an original straightforward way to access to (chiral) alkyl and (hetero)aromatic boronic ester using a specific key boron reagent, *i*PrBHCl.[4]



Scheme 2: General concept and goal to achieve

Indeed, (hetero)aromatic and alkyl usually have different pathways and modifications of the ester on the boron is based on transesterification with specific esters. This proposed boronic ester synthesis route would also be atom-efficient especially compared to the conventional route using B_2Pin_2 (Bis(pinacolato)diboron), B_2cat_2 (Bis(catecholato)diboron), etc… and would make it easy to put a wide range of ester on the boron (which can be chiral) atom and all in one pot. So, the student will have to work on synthetic methodology in order to develop this reaction. To do this, the various parameters of the reaction will be studied (T°C, time, solvent, ligand, additive, equivalent etc…) and rationalized.

Candidate profile: The candidate should come from an organic chemistry related Master cursus, have good experimental abilities (launch reaction, extraction, purification on silica gel, ^{1}H NMR) and skills in organic chemistry, be highly motivated, and capable of autonomy.

Application: Applications should be sent to Sabrina Touchet (sabrina.touchet@univ-lorraine.fr) and should include a detailed CV, a cover letter and a copy L3, M1 results.

References : 1. Chau, N. T. T.; Meyer, M.; Komagawa, S.; Chevallier, F.; Fort, Y.; Uchiyama, M.; Mongin, F.; Gros, P. C. *Chem. Eur. J.* **2010**, 12425. 2. a) Catel, D.; Payen, O.; Chevallier, F.; Mongin, F.; Gros, P. C. *Tetrahedron*, **2012**, *68*, 4018-4028. b) Payen, O.; Chevallier, F.; Mongin, F.; Gros, P. C. *Tetrahedron: Asymmetry*. **2012**; *23*, 1678-1682. c) S. Touchet, S. S. R. Kommidi, P. C. Gros, *ChemistrySelec* **2018**, *3*, 3939. 3. a) S. Touchet, C. Yeardley, C. T. O'Hara, P. C. Gros, *Eur. J. Org. Chem.* **2021**, 4835, *VIP*. b) L. Hammas, S. Touchet, S. Adach, C. Comoy *Eur. J. Org. Chem. Submitted*. 4. a) G. Alcaraz, E. Clot, U. Helmstedt, L. Vendier, S. Sabo-Etienne, *J. Am. Chem. Soc.* **2007**, *129*, 8704. b) G. Alcaraz, U. Helmstedt, E. Clot, L. Vendier, S. Sabo-Etienne, *J. Am. Chem. Soc.* **2008**, *130*, 12878. 5. a) S. Touchet, F. Carreaux, B. Carboni, A. Bouillon, J.-L. Boucher, *Chem. Soc. Rev.* **2011**, *40*, 3895.