PhD POSITION IN ORGANIC CHEMISTRY

RESEARCH PROJECT

Development of an Exogeneous Bioresponsive Catalytic System for *in vivo* Chemistry

Location: University of Strasbourg (France) – Laboratory of Functional Chemosystems (LFCS, UMR-CNRS 7599) ; University of Mulhouse (France) – Institut de Science des Matériaux de Mulhouse (IS2M, UMR-CNRS 7361)
Starting date: october 2015 (duration: 36 months)
Financial support: IDEX program

Context and aims of the PhD thesis:
The development of chemical transformations that could be performed in a biological reaction medium (without denaturating it) in the presence of biocompatible reagents and catalysts suscites currently huge interest. This emerging research field is called "**bioorthogonal chemistry**".
Biocompatible reactions constitute powerful tools in order to trace, to manipulate or to activate target biomolecules. In the last decade 1,3-dipolar cycloadditions in the presence of copper salts have been successfully performed in a biological environment thus paving the way to other bioorthogonal synthetic transformations. Among metal-based catalysts used in organic synthesis, palladium has become the most promising metal for the development of biocompatible reactions. Homogeneous palladium salts or organometallic complexes have been already used to generate chemically modified proteins, and to activate *in cellulo* biological molecules. The main drawback of these systems is the necessity to perform the transformations in the presence of an excess of a palladium source due to the scavenging of the precious metal by proteins. In order to overcome this drawback we propose to explore encapsulation of palladium in heterogeneous polymer microspheres. Such supported catalysts have shown excellent activity and stability for Suzuki-Miyaura reactions in classical organic chemistry.
Beyond bioorthogonal bond-forming reactions, the aim of this PhD thesis is the development of the first catalytic system that will be regulated by the physiological state of a living organism (bioresponsive catalyst). For this purpose we will prepare various heterogeneous nanometric palladium catalytic systems and study their activity in a biological reaction medium by using pro-fluorescent substrates. Hence, the presence of a metabolite generated by a cell would trigger the catalytic cycle and consume an exogeneous substrate.
To address the numerous challenges, this project will be realized *via* a collaboration between IS2M and LFCS. In particular, the preparation of heterogeneous palladium catalysts and the determination of their activity in biocompatible conditions will be realized at IS2M. Their biocompatibility, activity *in cellulo* and bio-responsiveness will then be ascertained at LFCS.

How to apply:
The candidate should have a Master degree in chemistry with a strong background in organic chemistry and good knowledges in material science. Strong motivation for research is expected. Candidates should apply (curriculum vitae with references, motivation letter and M1 and M2 marks) as soon as possible, before june 30th 2015 by email to the PhD supervisor and PhD co-supervisor.

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