

ESR 7 position

Project title: Stimuli-Responsive Nanoreceptors

Location: Université de Strasbourg, France

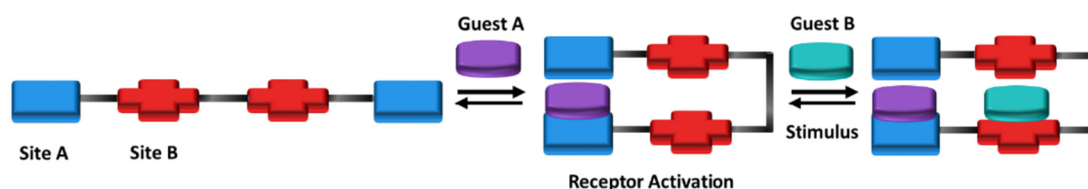
Supervisor: Prof. Valérie Heitz

Objectives of the individual project:

The PhD will be recruited within the NOAH European Training Network (Network of functional molecular containers with controlled switchable abilities, Link) that has received funding from the European Union's Horizon 2020 under the Marie Skłodowska-Curie action (H2020-MSCA-ITN-2017).

This multi-disciplinary project focusses on the encapsulation of molecular guests into multi-component nanoreceptors. In biological systems, chemical messengers of information are required to trigger a biological response. The biological response can be best interpreted in terms of a change of the physico-chemical properties of the system in order to realize a function, such as the modulation of reactivity (ATP synthesis), movement (muscle contraction), and substrate affinity (G-protein in vision). This behavior relies on allosteric regulation, a stimuli-induced process which is at the heart of the development of the new nanoreceptors of this project.

The scientific project will consist in the synthesis of different multicomponent nanoreceptors able to respond to photo or chemical stimuli to control the encapsulation of guest molecules. To this end, the recognition units will allow orthogonal recognition of two different guests in order to have a cooperative effect analogous to an allosteric regulation. In other words, the recognition of the first guest (Guest A) will allow the recognition of the second. It is expected that the complexation of the ion will stiffen the receptor thus restricting the number of degrees of freedom. This conformational change will lead to the receptor activation which will help the supramolecular recognition of a 2nd guest (Guest B). A signaling output (charge transfer band or fluorescence quenching) will be detected as the result of the supramolecular events (signaling transduction cascade). Once the allosteric regulation demonstrated of the recognition units, photo- and physico-chemical investigations will be undertaken in order to probe the guests' release.



The PhD candidate will be involved in the synthesis of the building blocks (involving organic chemistry) followed by their structural characterizations (NMR High-Resolution Mass Spectrometry, X-ray analysis). Binding studies in solution will then be investigated using various techniques (^1H NMR titrations, UV-Vis titrations). Additional expertise in photophysics and DFT calculations will be provided through collaborations within the NOAH network.

References of the research group related to the subject:

- [1] L. Kocher, S. Durot, V. Heitz *Chem. Commun.* **2015**, 51, 13181–13184.
- [2] S. Durot, J. Taesch, V. Heitz, *Chem. Rev.*, **2014**, 114, 8542–8578.
- [3] J. Taesch, V. Heitz, F. Topić, K. Rissanen, *Chem. Commun.*, **2012**, 48, 5118–5120.
- [4] L. Schoepff, L. Kocher, S. Durot, V. Heitz, *J. Org. Chem.* **2017**, 82, 5845–5851.
- [5] A. Gosset, Z. Xu, F. Maurel, L.-M. Chamoreau, S. Nowak, G. Vives, C. Perruchot, V. Heitz, H.-P. Jacquot de Rouville, *New J. Chem.* **2018**, 42, 4728–4734.



Planned secondment(s):

Academic Secondment: Three months secondment at Warwick to establish comparisons on synthesis and characterization of covalent molecular cages and non-covalent ones.

Industrial Secondment: Six-months secondment at Biolitec facilities, where he/she will discuss the potential of switchable cages as switchable catalysts.

Hosting Institution:

The subject will be developed at the Faculty of chemistry at University of Strasbourg an internationally recognized academic and research centre of excellence in France (Shanghai Ranking: 19th in chemistry, ≈ 260 doctoral students, 650 students/year). More especially, the PhD will conduct his research in the laboratoire LSAMM which is interested in using principles of supramolecular chemistry in order to realize molecular systems able to operate complex and specific functions.

Free French courses are available on campus every year

Eligibility requirements

Candidates of any nationality can apply, but in order to be eligible for the position the following criteria need to be fulfilled:

- The applicant shall at the time of recruitment be in the **first four years of his/her research career** and have **not been awarded a doctoral degree**.
- The applicant must not have resided or carried out his/her main activity **in France for more than 12 months in the 3 years immediately prior to the recruitment**.

Candidate profile: candidates must hold a **Master's degree in Chemistry** with excellent academic transcripts. We are looking for **highly motivated** students with **good communication skills**.

Questions regarding the recruitment can be sent to: noah@noah-itn.eu.

Questions regarding the project can be sent to: v.heitz@unistra.fr and hpjacquot@unistra.fr

