Title	Chemically-fueled Synthesis of Organic Molecules
PI	Leonard Prins
Research Group	Systems Chemistry
Curriculum	Chemical Sciences
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Systems chemistry aims at understanding how properties can emerge from a collection of interacting molecules. This is a question of fundamental interest as it sheds light on how life may have originated on Earth. It is also of practical interest because understanding the origin of life-like properties such as motion, adaptation, communication,... allows the development of next-generation, intelligent materials and, who knows, even synthetic life.

Our group has a particular interest in understanding how energy (light, ATP,...) can be used to maintain a chemical system in a non-equilibrium state, which is one of the hallmarks of life. We have recently contributed to an understanding of the physical organic chemistry of non-equilibrium systems [1,2]. Energy can be transferred from a source to a chemical system by energy and information ratchet mechanisms. In recent years, such mechanisms have been exploited in synthetic systems for the development of molecular machines (motors, pumps, etc) and materials. We are interested in exploiting ratchet mechanisms for the synthesis of small organic molecules. These studies permit a complete understanding of all kinetic processes and a quantification of the non-equilibrium state of the system. The obtained knowledge permits innovative methods for the development of catalysts and high-energy materials.

Learning from Nature. Studying how nature exploits energy to maintain a non-equilibrium state allows the development of innovative synthetic catalysts and materials.

Competences and skills: organic synthesis, physical-organic chemistry, supramolecular chemistry, spectroscopy, catalysis, kinetics, light-activated molecules

Possible hosting group(s) for the period abroad (tentative list, may change):

Bart Jan Ravoo, University of Münster, Germany

Jurriaan Huskens, University of Twente, Netherlands

References

[1] K. Das, L. Gabrielli, L.J. Prins, *Angew Chem. Int. Ed.*, **2021**, *60*, 20120-20143

[2] G. Ragazzon, L. J. Prins, *Nat. Nanotechnol.* **2018**, *13*, 882–889.