

INSTITUTE FOR MOLECULAR AND SUPRAMOLECULAR CHEMISTRY
Laboratory of Organic and Bio-organic Chemistry

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Biobased chemistry : greener fine chemicals from carbohydrates and renewable platform molecules

Abstract: The project aims at designing novel chemicals prepared from carbohydrates and platform molecules. This contribution to the development of a cleaner and more environmentally acceptable chemicals relies in the laboratory strong expertise in biobased chemistry and the use of available biomass as a renewable resource.

Chemistry intervenes in all the manufactured goods, products and materials of the everyday life and in the most important fields of our society (energy, construction, transportation, foods, hygiene, health), greener chemicals more respectful of environment will bring both economic and societal progress.

The shortage of cheap fossil resources, the necessity to integrate renewable carbon in chemicals for lowering their carbon footprint, or the search for added-value products from agricultural crops or by-products, have driven many research groups to work on finding new ways and methods for transforming biomass into useful functional molecules or valuable chemical intermediates

Our lab has developed strong knowledge and experience in different areas of green chemistry, in particular new methodologies in the design of carbohydrate-based functional products including in the fields of surfactants and polymers and novel strategies using furanic platform molecules (Figure 1).

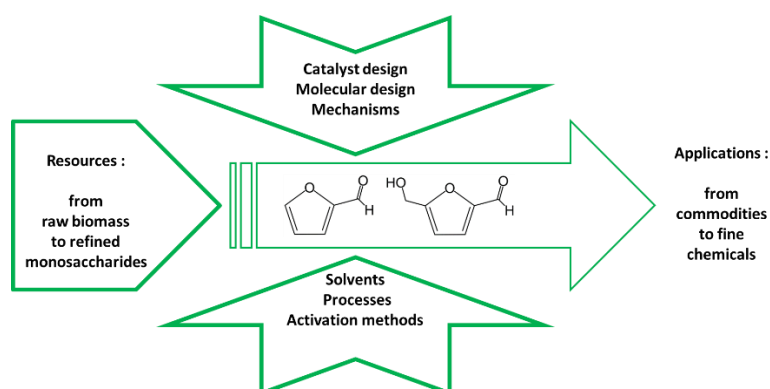


Figure 1: carbohydrates to platform molecules to new biobased chemicals

The purpose of this thesis will be to develop further the uses of carbohydrates and carbohydrate-based furanic derivatives such as HMF and analogues into useful functional biobased molecules or valuable chemical intermediates, in keeping with the recent projects engaged in the group. It will also rely on partnerships and collaborations with Chinese groups working in the same area.

This project will provide a strong chemical education in synthetic organic chemistry, together with a transdisciplinary experience in the frame of our collaborations with other groups in France and abroad at the interface of physical chemistry and biochemistry.

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Required background, benefit for the candidate:

The work will be conducted in Lyon, within the team "Organic and Bioorganic Chemistry" specialized in synthetic organic chemistry. The candidates must possess a strong background in synthetic organic chemistry. Experience in carbohydrate chemistry and/or in heterocyclic chemistry will be appreciated but is not mandatory. A good motivation to learn, communication skills, curiosity, and good team spirit are also among important qualities. Some knowledge of English is also important.

The work will involve various aspects of organic chemistry, notably multistep carbohydrate chemistry and multistep transformations of furanic derivatives. While focusing on synthetic organic chemistry, the project will offer opportunities to interact with colleagues in frontier disciplines such as physical chemistry, materials sciences or biochemistry and biology, depending on the possible applications of the novel biobased chemicals prepared during the thesis. The candidate will therefore benefit from a transdisciplinary education in organic chemistry and related sciences. A precise work plan will be given to the PhD candidate and careful supervision of his work will be organized, with regular work meetings and written reports.

Description of the laboratory:

The team Chimie Organique et Bioorganique is part of the Institute for Molecular and Supramolecular Chemistry and Biochemistry (ICBMS, <http://www.icbms.fr/>), the biggest research unit in synthetic and biological chemistry of the University of Lyon. Our team (<http://www.icbms.fr/cob>) is well known for its contributions in biological chemistry and carbohydrate chemistry. Early 2018, the lab has moved into its new facilities, in a brand new building with state-of-the-art facilities named "Lederer building" on the LyonTech La Doua campus. The PhD student will thus profit from excellent installations and facilities for developing his/her thesis work.

Dr Yves QUENEAU's CV:

Dr Yves Queneau (60 yo) is a **CNRS Research Director** (Equivalent to Research Professor) and **Head of the COB Team**, of the Institut de Chimie et Biochimie Moléculaires et Supramoléculaires (ICBMS), deeply involved in carbohydrate chemistry at the interface with green chemistry and with bioorganic chemistry. He graduated from the University of Paris-Sud (Orsay) in 1988, where he received his PhD under the supervision of Professor André Lubineau. Appointed as CNRS fellow in 1988, he then spent one year in Prof Samuel Danishefsky's group in New York, USA (1991). He later moved to Lyon in a mixed CNRS-industrial research facility dedicated to carbohydrate chemistry where he was promoted to a Research Director in 1995. In 2003, he joined the University of Lyon, where he has led the INSA part of the Institut de Chimie et Biochimie Moléculaires et Supramoléculaires (ICBMS) and leads the team Organic and Bioorganic Chemistry. In 2007, he was promoted to a Research Director 1st Class and since 2009, he is also appointed as **Honorary Professor at the University of Hull** (UK).

He teaches carbohydrate chemistry and green chemistry in several universities in France and abroad. He was awarded the CNRS Bronze Medal in 1994 and the "Europol'Agro" Prize for Scientific Innovation in 1998 and is among the recipients of the 2010 and 2014 CNRS rewards for scientific excellence and doctoral supervision. He develops his research in carbohydrate chemistry and bioorganic chemistry and has published more than 175 papers, book chapters and patents in his career. He serves as member in many panels and committees as well as referee for numerous journals, and is a member of the board of editors of the book series Specialist Periodical Reports of the Royal Society of Chemistry for the "Carbohydrate Chemistry, Chemical and Biological Approaches" series, and review editor for Frontiers in Chemistry, Supramolecular Chemistry. Recently, he wrote a chapter on "Carbohydrate-based amphiphiles: a resource for biobased surfactants" to the Volume on Green Chemistry and Chemical Engineering in the forthcoming edition of the Springer Encyclopedia of Sustainability Science and Technology edited by Chinese Academician Prof Buxing HAN.

With a 30-year experience in carbohydrate chemistry, Yves Queneau is a specialist in the design, the synthesis and the study of the properties of carbohydrate containing molecular architectures, with a focus on the use of available sugars and other carbohydrate-based platform molecules as starting materials for fine chemistry with strategies directed towards new bio-based chemicals, including, surfactants and monomers.

Over the last 15 years, Dr Queneau made regular visits to China and has developed collaborations and shared the responsibility of scientific meetings with Prof HUANG Peiqiang (Xiamen), Prof HE Mingyuan in ECNU (Shanghai), and Prof GU Yanlong in HUST (Wuhan). He notably co-chaired the recent French-Chinese conference on Green Chemistry (www.FC2GChem.org) in Wuhan and Shanghai in Nov 2014 and 2018 and in Lyon in 2016 as a co-chair together with Prof Mingyuan HE and Prof Buxing HAN. He was guest editor in chief of special issues in Comptes-Rendus Chimie in 2008 and in Science China Chemistry in 2010 dedicated to collaborations in chemistry between China and France. He has delivered several conferences in Beijing, Shanghai, Wuhan, Guangzhou, Xiamen in the past ten years and also taught some carbohydrate chemistry in Wuhan, where he is an invited professor since 2014. In 2015 he was awarded the LU Jiaxi lecture award by the College of Chemistry and Chemical Engineering of the University of Xiamen.

Dr Laurent SOULERE, Associate Professor, with Habilitation (HDR)

Dr Laurent Soulère has received his PhD in the University of Toulouse in 2001 under the supervision of Professor Périé. He then spent 18 months as post-doctoral fellow in the group of Pr. Waldmann at the Max Planck Institut for Molecular Physiology in Dortmund, Germany, and one more year in the laboratory of environment and biomolecular chemistry at the University of Perpignan, France. In 2004, he was appointed as assistant professor at the ICBMS, INSA Lyon, in the team Organic and Bioorganic Chemistry. He has strong expertise in the design of biologically active molecules and computational methods. He has published more than 60 articles. Dr Soulère is among the recipients of the 2009 and 2014 rewards for scientific excellence and doctoral supervision from INSA Lyon. He develops his work within the COB team of ICBMS providing his knowledge and expertise at the interface between organic and bioorganic chemistry.

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