Synthesis & Applications of Carbohydrate-Based Amphiphiles

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Biography

Sami HALILA is a CNRS Director of Research specialized in Glycochemistry in the Group of "Self-Assembly of Glycopolymers" at CERMAV, a CNRS Laboratory in Grenoble Alpes University – France.

S. Halila completed in 2001 his PhD at the University of Picardie Jules Vernes, Amiens (France) in Carbohydrate Chemistry, followed by Postdoctoral positions at ENSC Rennes, Ghent University and CERMAV (Grenoble, France). In 2006, he was hired at CERMAV-CNRS at Hugues Driguez's team (Team "Chemistry and Biology of Oligosaccharides") to develop carbohydrate-based substrates or inhibitors of glycoside-hydrolases involved in diseases. In 2014, he moved to the Glycopolymer Self-Assembly group where the main topic was related to the synthesis and self-assembly of "sweet" amphiphilic diblock copolymers in solution or in thin-film.

Currently, his work is focusing on the synthesis and self-assembly of carbohydrate-based amphiphile systems and their applications in various fields of glycosciences including nanoparticles, supramolecular gels, antiadhesive therapy and biosensors. He coordinated many national and international projects (ANR, Carnot, Labex, Brazil, China,…) and is the author of more than 60 publications and 5 patents – Recently, S. Halila has received the prestigious international "The cosmetic Victories" academic award for his work on the eco-friendly development of a carbohydrate-based organogelator, "Carbogel".

Abstract

Carbohydrates are Ubiquitous in Nature and consist a huge feedstock of renewable and biodegradable materials. Moreover, they cover most of the living cells and are now recognized as major actors in many biological processes by interacting with various carbohydrate-binding proteins such as lectins, growth factors, enzymes and so on. As a result, carbohydrates present many opportunities for intervention in disease diagnosis and therapy. However, carbohydrates are scarcely found alone since they are linked to lipids (glycolipids, glycosphingolipids) forming the cell wall, to proteins (glycoproteins, proteoglycans) inducing 3D conformation and increasing stability and others. Despite the elegant carbohydrate chemistries devised by glycochemists, an effective and modular synthetic approach that meets the ever-increasing interest in the preparation of functional carbohydrate derivatives is needed. Over the last decade, a continuous effort has been devoted to my research for the use of chemo-, stereo- and site-selective modification of the reducing-end of carbohydrates without the use of protecting groups in the spirit of click chemistry for the production of functional carbohydrate derivatives and mainly glyco-amphiphiles with self-assembly properties in bulk or in solution.[1]

During my talk, I will focus my presentation on the synthetic strategies allowing the modification of the reducing end of low-molecular weight carbohydrates by integrating hydrophobic segments leading to glyco-amphiphiles. Next, I will show how glyco-amphiphiles have been applied in various fields including self-assembly in solution (nanoparticles, gels)[2],[3] and with an opening on liquid crystal based-biosensor taking advantages on interaction with pathogenic carbohydrate-binding proteins.

References

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