Synthesis and Applications of Glyco-Amphiphiles

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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.

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) and with an opening on liquid crystal based-biosensor taking advantages on interaction with pathogenic carbohydrate-binding proteins.