
Preface

DOI: 10.1039/9781788010641-FP007

This volume, 43 of the series Carbohydrate Chemistry, illustrates the diversity of the field of the glycosciences, encompassing chemical and biological approaches towards a wide range of applications, from potential novel therapeutic strategies to novel chemical products and processes for everyday life.

In Chapter 1, Alberto Marra and Renaud Zelli provide a rich and complete overview of iminodisaccharides and iminooligosaccharides. They cover *O*-, *S*-, *N*-, and *C*-linked iminodisaccharides for which they have reviewed the chemical and enzymatic synthetic strategies. These compounds are mostly studied for their glycosidases or glycosyltransferases inhibition properties. The authors finally provide a useful listing of all types of enzymes which have been addressed in the literature related to iminooligosaccharides since 1985.

Laurence Mulard, in Chapter 2, addresses the tremendous structural diversity of surface bacterial polysaccharides and their implications in vaccine development. The chapter focuses on the subtle *O*-acetylation pattern of microbial polysaccharides, in relation to their properties to act as shields against environmental assaults at the primary interface with the host. The chapter is illustrated with structures that are part of pre-clinical programs for vaccine development or components of marketed vaccines.

The regioselectivity of the glycosylation reaction is reviewed in Chapter 3, Vincent Ferrieres and Laurent Legentil look at both enzymatic and chemical strategies. The authors first discuss the benefits of the use of glycosyltransferases, glycosylhydrolases and glycosylphosphorylases as biocatalysts towards defined oligosaccharides, showing how enzyme engineering techniques can improve the efficiency and regioselectivity. With respect to the chemical approaches, the authors address the key issues, namely the reactivity order of various hydroxy groups, the importance of hydrogen bonding, armed/disarmed character of donors or their partial protection, covering the essentials of this fundamental reaction in carbohydrate chemistry.

Chapter 4 gives a complete overview of glycosyltransferases inhibitors, a topic with considerable importance to provide novel strategies for fighting abnormal glycosylation diseases. In their review, Paula Videira, Filipa Marcelo and Ravneet Grewal discuss the conventional specific inhibitors, notably those designed as mimics of donor, acceptor or transition state. Recently proposed alternative chemotype designs, not substrate like, are also discussed, illustrated with promising examples that could lead to therapeutic developments.

Carbohydrate microarrays are high-throughput and sensitive tools which can uncover complex carbohydrate structures and protein-carbohydrate interactions. In Chapter 5, Angelina Palma, together with Diana Ribeiro, Benedita Pinheiro and Ana Luisa Carvalho, beautifully

illustrate the power of these tools for the determination of plant cell wall structure and degradation pathways. The chapter reviews nicely the literature on cell wall structure and degradation, offers a complete overview on glycan microarrays and on the existing platforms and specific chemical modifications required for the grafting of the carbohydrates on the surfaces. The authors illustrate the efficiency of the method with numerous examples, including efficient coupling technologies with mass spectroscopy or high-performance thin layer chromatography.

In the search for cleaner chemical processes, the solvent is a critical issue. In Chapter 6, Yanlong Gu and Palanisamy Ravichandiran show that carbohydrates can be useful components of novel media for chemical reactions. They review particularly the properties and uses of combinations of carbohydrates and organic or inorganic salts leading to low-melting mixtures which can then be used as the medium for various organic reactions showing specific chemical activation abilities.

Following the same philosophy which is to develop innovative eco-friendly chemicals and processes from carbohydrates, Thierry Benvegnu, together with Louise Renault and Freddy Pessel, have reviewed in Chapter 7 the field of carbohydrate-based surfactants. After an overview covering the most typical kinds, they focus on compounds constructed with uronic building blocks widely available from marine resources, referring to them as “blue” (and green) novel surfactants. They also address other novel building blocks, such as isosorbide and trehalose, as well as more elaborate systems which comprise a spacer between the hydrophilic and the hydrophobic moieties. Finally, they review recent work on the direct transformation of polysaccharides, such as cellulose, starch, xylan or alginates to various types of surfactants (alkylpolyglycosides or glycuronamides), or even directly from lignocellulose to lignocellulosic hydrolysate fatty esters.

In keeping with the field of physicochemical properties of amphiphilic systems built on carbohydrates, Richard Daniellou, together with Cédric Peyrot, Pierre Lafite and Loïc Lemiègre address the field of formation of hydrogels using low molecular weight hydrogelators. They give an overview of the main types of monosaccharidic or disaccharidic hydrogelators, as well as bolaamphiphilic systems, discussing their syntheses and some of their properties in relation to their structure.

We hope that readers will enjoy this volume, and that the wide scope of contributions, arising from synthetic, biological, structural, and applied motivations, will stimulate transdisciplinary approaches towards novel developments in the glycosciences.

Yves Queneau
Amélia P. Rauter
Thisbe K. Lindhorst