Carbohydrates—Tools for Stereoselective Synthesis

Of the biopolymers, the carbohydrates present the greatest structural diversity. In contrast to peptides and nucleic acids, the oligosaccharides branch in a myriad of directions occupying a vast three-dimensional space. The polyol and amine containing monosaccharides project functionality in diverse stereochemical arrays. These arrays range from C_3- to C_8-long chains. While carbohydrates have long been recognized as stereochemically enriched starting materials for the total synthesis of natural products, the other uses in asymmetric synthesis have been underappreciated. These other applications which include the use of carbohydrates as chiral auxiliaries, as chiral reagents, as chiral ligands, and as non-metallic organocatalysts are comprehensively reviewed in this new book.

While the book has carbohydrates in the title, its real target audience is the ever-growing organic chemistry community that aims to develop new asymmetric synthetic transformations and asymmetric catalysts. Specifically, the book tries to make the synthetic and organometallic communities aware of the potential for carbohydrate to serve as chiral starting materials, in a manner similar to what Stephen Hanessian did with *Total Synthesis of Natural Products: The 'Chiron' Approach* for the natural product synthesis community. It is important to note that the book is not a review of transformations that have been carried out on carbohydrate substrates; rather it is a thorough survey of the various carbohydrate structural motifs that have been used to induce asymmetric in a range of stereoselective transformations.

Not surprisingly, there is a lot of material to review, which is clearly too much for one person to review on his own. In fact, only three of the 16 reviews were written by the editor himself. Thus, Professor Boysen wisely decided to assemble a team of approximately 24 experts in the field to help him write the reviews. The 16 chapters they produced are a collection of focused reviews covering the use of various carbohydrate structural motifs in 16 unique asymmetric synthetic applications where the sugars provide the chiral space required to induce the asymmetry. Importantly, each chapter is a significant review of a specific aspect of the use of carbohydrates as asymmetric reagents/auxiliaries and not an account of one group's effort. A notable exception to this is the review by Wong, Nettles, and Shi on the use of carbohydrates in organocatalytic oxidations, where the work from Shi's lab arguably dominates this field. Regardless, each of these chapters is a comprehensive and well referenced. Most references are from the 2000s and several references are from as late as 2010. This is what one should expect form a book published in 2013.

It is probably not realistic to expect a book like this to be error free. Thus, it comes as no surprise that some structural errors exist. I found all of these errors to be minor and not to deter from the larger transformational point being made. An example of this can be seen on page 149, where a chiral titanium reagent **3** is depicted as reacting with allyl-Grignard **24** to form homoallylic chiral titanium reagent **25**, which in turn reacts with aldehydes to form homoallylic alcohol **26**. In this example the titanium reagent **25** was drawn with an extra methylene group; it should have been an allylic chiral titanium reagent and not a homoallylic chiral titanium reagent. This typo did not persist in the many other allylic organometallic reagents and was only noticeable upon careful review of the manuscript. Probably my most surprising finding from the text is how smoothly it transitions from one chapter to another chapter. The fact that this was accomplished despite the diverse array of authors is a clear sign of detailed editing.

I was personally pleased to see how the book details the strong role that carbohydrate plays in various aspects of asymmetric synthesis, from chiral reagents and auxiliaries to new chiral ligands. I think this book will be of interest to any organic chemist who is looking to find alternative chiral motifs to use in the development of their next asymmetric reaction. In particular, when there is a need for a stoichiometric chiral auxiliary or a new chiral ligand for a catalytic asymmetric reaction. It is easy to imagine useful inspiration coming from a perusal of this book and for that reason alone this book is highly recommended.

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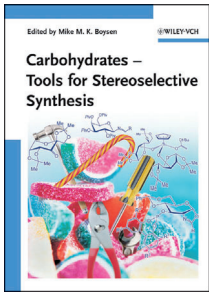

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