

All researchers/workers in the field of polysaccharide technology should have at least access to a copy of this book: a truly useful and scholarly text.

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Enzymes in Synthetic Organic Chemistry. Edited by Chi-Huey Wong and George M. Whitesides, Tetrahedron Organic Chemistry Series, Vol 12, Pergamon, Oxford, 1994, 346 pp and subject index. ISBN 0-08-035941-8, \$38.00.

With this book, G. Whitesides and C.-H. Wong provide chemists interested in using enzymes with an essential reference work. Although these authors have already published several reviews on the subject, this comprehensive book, containing more than 1200 references covers the literature up to the end of 1993.

The book begins with a brief general chapter on enzymes (enzymatic kinetics, enzyme inhibition, specificity, enantioselectivity, stabilization, catalysis in organic solvents, rational design of new enzymatic catalysts), which provides a summary of information regarding the application of enzymes in organic chemistry.

The subsequent five chapters are organized on the basis of reaction types. Each chapter deals with a group of enzymes carrying out the same type of transformations. The first topic covered is the large group of hydrolytic enzymes including amidases, proteases, esterases, lipases, nitrilases, epoxide hydrolases, and phosphatases. A large section is devoted to protease-catalysed peptide synthesis, but also covers the esterase activity of proteases. The broad range of enantio- and regio-selective reactions catalysed by esterases and lipases in organic solvents is discussed in detail as a function of enzyme source. This chapter is extremely well documented, with 361 references. Of special interest to carbohydrate chemists is the discussion of the regioselective acylation of sugars using subtilisin, protease N or porcine pancreatic lipase, or on the contrary the regioselective removal of acyl groups in sugars catalysed by different lipases.

The next chapter turns to oxidoreduction reactions. Regeneration systems for NAD(P)H and NAD(P) cofactors are presented. The stereochemistry and stereoselectivity of the dehydrogenases are very clearly discussed. Four tables list the oxidation or reduction reactions catalysed by horse liver alcohol dehydrogenase, the most useful enzyme, particularly for the preparation of cyclic chiral lactones or alcohols. In addition to other alcohol dehydrogenases, especially yeast enzymes and the thermostable enzyme from *Thermobacterium brockii*, other specific dehydrogenases with more limited applications are also reviewed. This chapter ends with metalloenzymes such as galactose oxidase, lipooxygenase, monooxygenases catalysing Baeyer–Villiger reactions, other monooxygenases and peroxidases. This chapter is once again very well referenced.

Both of the next two chapters are particularly useful to carbohydrate chemists: the first dealing with C–C bond formation and mainly utilizing the aldolases and transketolase involved in sugar metabolism and the second with the synthesis of glycosidic bonds.

Among the aldolases mentioned, considerable attention is paid to the one most widely used in synthesis, the fructose-1,6-diphosphate aldolase which catalyses the stereoselective addition reaction between dihydroxyacetone phosphate and D-glyceraldehyde 3-phosphate. One table lists 75 products which can be prepared with this aldolase. As well as fructose-1,6-diphosphate aldolase, other aldolases also using dihydroxyacetone phosphate (fuculose-1-phosphate, rhamnulose-1-phosphate, tagatose-1,6-diphosphate aldolases) but exhibiting different stereochemistries relative to the C3–C4 bond, are also discussed in terms of their synthetic applications. Of particular interest is the use of such aldolases in the synthesis of azasugars which turn out to be potent glycosidase inhibitors. This section also covers pyruvate-dependent aldolases, such as sialic acid aldolase, which is very useful in the preparative synthesis of sialic acid derivatives, and KDO aldolase. Deoxyribose aldolase, transketolase and oxynitrilase are also discussed. Many of the references listed at the end of this chapter come from book authors, this attesting to the major contribution of Whitesides and Wong's group in this area.

The next chapter provides the reader with a review of oligosaccharides and glycoside synthesis involving both classes of enzymes: glycosyltransferases or glycosidases. This chapter is introduced by a short presentation of glycoprotein and glycoconjugate biosynthesis. Thereafter the enzymatic synthesis of each sugar nucleotide phosphate is very well detailed. The scale of synthesis that could be achieved with each type of glycosyltransferase and glycosidase appears clearly on tables listing all data. The *in situ* cofactor regeneration and a general scheme explaining the approach to the cloning of glycosyltransferases are also discussed.

In the final chapter, the authors have collected together a miscellany of addition, elimination and other group transfer reactions which can be achieved using enzymes such as fumarase, ammonia lyases, aminotransferases, kinases.

This well written, thorough and concise book is a mine of information for those interested in the use of enzymes in organic chemistry. References listed at the end of each chapter allow the investigator to turn to the original paper for a more detailed description. The entire text is generously illustrated by figures and tables which are clear and very informative, both for practical use (as, for example, the table listing the microbial lipases commonly used in organic synthesis) and from the mechanistic point of view, such as the figures showing active-site models for lipases enabling the prediction of the selectivity. Most but not all figures have a legend, and the only criticism I would make is that the chapter on oxidoreductions contains figures without legends.

Since much of this book is devoted to sugars it is evident that it will be of great interest to carbohydrate chemists who need to be aware of the recent advances achieved with the help of enzymes in the expanding area of glycobiology and glycotchnology. More generally this book will be immensely useful to students, newcomers to the field and for teaching purposes.

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