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Books

Hydrolases in Organic Synthesis. By U. T. Bornscheuer and R. J. Kazlauskas. WILEY-VCH, Weinheim, 1999. xiv, 338 pp., 214 figs., 20 tables, hardcover DM 198,00. – ISBN 3-527-30104-6

Because of their high selectivity and mild reaction conditions, biotransformations are enjoying increasing popularity in organic synthesis, especially for the preparation of enantiomerically pure synthetic building blocks. Among the currently used enzymes, hydrolases occupy a prominent place because they are relatively easy to use. The most popular of the hydrolytic enzymes are the lipases, which are readily available as common reagents on the shelves of many laboratories.

New applications are continually being reported, and it is therefore not surprising that further publications emphasizing and explaining the importance of enzymatic transformations for organic synthesis continue to appear. This book on the use of hydrolases is yet another example. Lipase- und esterase-catalyzed reactions naturally occupy the greatest proportion of the book in view of their importance. There are also detailed treatments of amide-breaking enzymes, epoxide hydrolases, nitrile-hydrolyzing enzymes, and glycosidases.

A short introduction is followed by a chapter on the sources and structures of lipases, esterases, and proteases – enzymes with closely similar catalytic functions. A further chapter is devoted mainly to practical aspects of the use of these three classes of enzymes. For example, in the case of lipase-catalyzed acylations the authors discuss factors that are important for obtaining the best results, such as the choice of organic solvent, its water content or water activity, and the nature of the acyl donor. Special techniques such as performing reactions in reverse micelles and in supercritical solvents are also discussed. This chapter is especially worth reading for the practical help that it gives for planning reactions. The next chapter describes many examples of lipase-catalyzed enantioselective reactions, and gives typical applications for particular lipases. The figures in this chapter are very clear and informative. The authors also discuss attempts to develop models for describing and predicting selectivity and reactivity. Some special reactions are also discussed, such as dynamic kinetic methods for the separation of racemates, or double stereoselection techniques. The commercial uses of lipases for synthesizing enantiomerically pure building blocks and pharmaceutical products are also mentioned.

A separate chapter is devoted to a detailed treatment of regioselective lipase-catalyzed reactions, which are especially important for selective transformations of sugars and lipids. This is followed by shorter chapters on the applications of phospholipases, protea-

ses and amidases, and esterases. Next come chapters dealing with epoxide hydrolases, a class of enzymes with great potential for kinetic separation of racemates and for the desymmetrization of *meso*-epoxides to give enantiomerically pure 1,2-diols and epoxides. Epoxide hydrolases of microbial origin are often not very stable and/or are difficult to isolate, and therefore they are generally used in the form of whole cells, which is an obstacle to their use as routine synthetic reagents. The same also applies to nitrile-hydrolyzing enzymes, but despite that they have great advantages over purely chemical methods for the hydrolysis of nitriles. Examples of the capabilities of nitrile hydratases are the large-scale industrial processes for producing acrylamide from acrylonitrile and nicotinamide from 3-cyanopyridine, with practically no unwanted side-products.

The book is an indispensable source of information on the use of hydrolases in organic synthesis. The subject matter ist very well set out, and the chapters are clearly written and presented from a critical viewpoint. The book is suitable for synthetic chemists in both academic and industrial research, whether they already have experience in using enzymes or are planning to begin such work. Bornscheuer and Kazlauskas have succeeded admirably in describing the capabilities and limitations of the use of hydrolytic enzymes and in critically evaluating them. No library should be without the book.

Fritz Theil
WITEGA Angewandte Werkstoff-Forschung GmbH
Berlin-Adlershof