Asymmetric Organic Synthesis with Enzymes; edited by V. Gotor, I. Alfonso, E. García-Urdiales, Wiley-VCH: Weinheim, **2008**, hardcover, 340 pp., £130/ 156 €, ISBN: 978-3-527-31825-4

The applications of biotransformations in organic synthesis have grown significantly in the recent years and the timely publication "Asymmetric Organic Synthesis with Enzymes" aims to give a comprehensive overview of this area in an easy to use format, particularly targeting chemists from synthetic, fine chemicals and pharmaceutical backgrounds. For the most part, these editorial goals have been more than met in this excellent book.

The book is separated into two sections, the first of which discusses methodologies through which the performance of an enzymatic reaction can be developed and improved. This is a fascinating area which will be unfamiliar to many synthetic chemists. The first chapter discusses optimization of enzymatic reactions using 'medium engineering' – i.e. modification of the medium in which the reaction actually occurs – focusing mainly of lipases. This can have a profound effect on the selectivity and activity of a given enzyme (in some case resulting in complete reversal of stereoselectivity simply by switching solvents). The second chapter is an excellent and approachable overview of directed evolution. This is a powerful technique for enzyme optimization, involving changes in the protein structure of a given enzyme to confer greater selectivity, activity and stability. Techniques discussed include error-prone PCR, DNA shuffling and iterative saturation mutagenesis, and examples from numerous enzyme classes are given. The third chapter discusses the search for enzymes with new activity, and covers the very different strategies of designing an enzyme based on knowledge of the reaction mechanism (e.g. catalytic antibodies, rational enzyme design, and synthetic enzyme models) and mining preexisting but undiscovered biodiversity, particularly through metagenomics.

The second part of the book, Synthetic Applications, moves into more familiar territory for the synthetic chemist, and contains a wealth of examples in which enzymatic reactions have been exploited in the synthesis of natural products and pharmaceutical intermediates. The first chapter discusses enzymatic dynamic kinetic resolution (DKR), a powerful technique for the preparation of chiral products, giving very high conversions. Typical targets include chiral alcohols, amines and amino acids. Chapter 5 compliments the previous chapter, discussing the emerging strategies of deracemization and enantioconvergent synthesis. In the first case, a racemic substrate is converted to its chirally pure form without any net change in its constitution – e.g. selective enzymatic oxidation of one isomer of a racemic amine to an imine, with concurrent in situ non-selective chemical reduction back to a racemic amine (ultimately giving a homochiral non-reactive amine after a number of cycles); in the second case, a racemic substrate is converted into a single enantiomer of the product, using two separate reaction pathways (e.g. using whole cell or two enzyme systems).

The following sections then focus on different enzyme classes in some detail, again giving a lot of informative synthetic schemes and examples. Chapter 6 discusses some of the most established and familiar biotransformations to the synthetic chemist, namely the transesterification and hydrolysis of carboxylic acid derivatives, alcohols and epoxides, focusing on recent developments. It covers a wide range of hydrolytic enzymes such as lipase, amidase, nitrilase, and others, and includes some nice examples where these transformations were utilized en route to natural products. Chapter 7 considers aminolysis and ammonolysis of carboxylic acid derivatives, usually using enzymes better known for their hydrolytic activity, and, again, is very well written with nice examples. After numerous strong contributions, chapter 8, on enzymatic reductions, was a little disappointing. The section is presented in a way that could be a little daunting to the synthetic chemist, making a relatively simple (and powerful) enzymatic transformation seem more complex than it really is. This may be off-putting to those interested in applying this technique, although the synthetic examples give a feel for what can be achieved. The discussion could also have included a wider coverage of the work done by groups other than the authors. Chapter 9, discussing chiral biooxidations, is excellent, covering a wide array of reactions, including the powerful oxidation reactions of unactivated C–H bonds. It also discusses in enzymatic Baeyer–Villiger reactions, enzymatic epoxidations, heteroatom oxidations (e.g. chiral sulfoxidation), arene dioxygenases (which perform the unique dearomatizing *cis*-1,2-dihydroxylation of aromatic systems) and finally enzymatic halogenations. The final chapter discusses aldolase reactions in yet another solid contribution. The synthetic applications focus heavily on carbohydrates and related compounds, giving many examples, including natural product applications.

Overall, the book is very well presented with plenty of schemes to appeal to the synthetic chemist, detailing the highlights of the text nicely. The only significant omission is the emerging field of transaminase enzymes, which convert ketones into chiral amines. There is some overlap between the sections, but this is not really an issue one would be likely to dip into different sections at different times. There are inevitably a small number of errors in schemes and the text, but these are a minor complaint. Overall, this is an excellent book, and is highly recommended to synthetic organic chemists from industry and academia, who wish to learn more about powerful new approaches to the synthetic problems they face.

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