

Preface

During the early to mid 1990s Professor Stan Roberts was chief editor of a series of loose-leaf laboratory protocols detailing the use of biotransformations in synthetic organic chemistry that were collected together and published in book form (*Preparative Biotransformations*, Wiley, Chichester, 1999). This led to the publication of the series of books *Catalysts for Fine Chemical Synthesis*, volumes 1–5, by the same publisher which covered the application of chemo- and bio-catalytic procedures for the synthesis of fine chemicals; for this series, Dr John Whittall became co-editor on the homogeneous catalysis volumes. Following the format of this series, *Practical Methods in Biocatalysis and Biotransformations* has been prepared. In keeping with these earlier formats, we aim to provide the readership with enough information to understand when a biocatalytic or biotransformation method would be a suitable practical method to carry out their synthetic transformation.

In recent times, the employment of enzymes and whole cells to perform a range of organic reactions has become much more commonplace, and biotransformation has become accepted as a powerful method for application in synthetic organic chemistry. However, for chemists developing synthetic methods for a particular target molecule, the understanding of the advantages and limitations of biocatalysis and biotransformation is not always clear. Therefore, this book intends to review the industrial background to when biotransformations are used and introduce the nonmicrobiologist to the background of how biocatalysts are discovered and developed and then give detailed experimental procedures for a comprehensive range of useful biotransformation methods.

In order to place the later chapters in proper context, Chapter 1 offers a comprehensive review of biotransformation from the perspective of a large pharmaceutical company (GSK) and Chapter 2 gives an introduction that allows an appreciation of molecular biology for scientists with no formal training in this area.

In the remaining chapters, key biotransformations have been identified from the recent primary literature (learned journals) and the respective authors have amplified the disclosure of their methodologies in this volume. These disclosures often contain additional equipment and experimental details to those found in the experimental section of most journals, allowing the reader to decide whether these methods are suitable for addressing their needs.

Chapter 3 describes the application of lipases, proteases and sulfatases for the kinetic resolution of a range of interesting molecules. A selection of dynamic kinetic resolution (DKR) procedures is disclosed in Chapter 4. DKRs are attracting a significant amount of

interest as they allow access to >50 % yields of single enantiopure products from racemates. Other useful synthetic applications of hydrolase enzymes are covered in Chapter 5, including desymmetrization and regio- and chemo-selective transformations.

Chapters 6 and 7 cover sugar-type chemistry, focusing on aldol and glycosylation methods which can offer substantial advantages over traditional chemical approaches.

Chapter 8 describes the application of hydroxyl nitrile lyases to the synthesis of new chiral cyanohydrins and α -hydroxy acids and includes new approaches to the transformation of 'difficult' aldehyde and ketone substrates using substrate engineering and immobilization techniques.

The latter part of the book is dedicated to redox biotransformation application, with Chapter 9 disclosing several methods for the synthesis of chiral secondary alcohols using a range of commercially available ketoreductases (alcohol dehydrogenases) which are now being applied regularly on a large scale.

Chapter 10 covers reductive enzymes with an emphasis on transaminase enzymes, which are enjoying widespread application in the synthesis of nonnatural amino acids which are key building blocks for several products of industrial importance.

The use of a range of oxidative enzymes in synthesis is covered in Chapter 11, whilst the very powerful technique of regio- and stereo-specific biohydroxylation of even complex molecules by fermenting whole-cell methods is covered in Chapter 12.

The Editors are most grateful to the authors who have submitted details of their procedures in the prescribed format for inclusion in this book. We hope that this book will increase the exposure of these methods to the chemical community and contribute to the expanded employment of biocatalysis in organic synthesis.

John Whittall, Manchester

Peter Sutton, Stevenage

2009