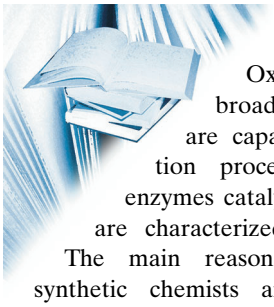


Redox Biocatalysis

Oxidoreductases form a broad class of enzymes that are capable of reduction/oxidation processes. Generally, these enzymes catalyze redox reactions that are characterized by electron transfer. The main reason for the interest of synthetic chemists and biotechnologists in oxidoreductases is the ability of these enzymes to catalyze regio-, chemo-, and stereoselective reactions where chemical catalysts often fail. Besides that, oxidoreductases are often considered as ideal systems for "green" chemistry. Depending on their three-dimensional structure and on the cofactors involved, oxidoreductases follow diverse and complex mechanisms of electron transfer that have been the focus of numerous biochemical and mechanistic studies for several decades. The class of oxidoreductases includes a huge variety of biotechnologically relevant enzyme groups, such as dehydrogenases, oxygenases, oxidases, and peroxidases. For each of these groups (and even for individual enzymes) numerous books, book articles, and journal reviews have appeared in recent years, including those that focus particularly on biocatalysis. These reports often describe very specific aspects of individual redox enzymes from an expert point of view. Moreover, this research area is undergoing rapid development, and consequently the reviews of progress quickly become outdated.

The authors of the book *Redox Biocatalysis: Fundamentals and Applications*—D. Gamenara, G. A. Seoane, P. Saenz-Méndez, and P. Domínguez de María—have taken up the challenge to summarize the knowledge gained during the past three decades about the main groups of redox enzymes. They present an overview that is mainly focused on reactions catalyzed by these redox enzymes, covering the functional mechanisms and industrial applications, starting with very early reports and ending with recent achievements in this field of research.

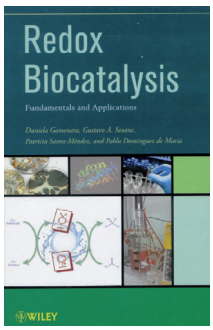
The book is composed of 8 chapters. The introductory Chapter 1 briefly describes the basic chemical principles and biochemical properties of redox enzymes, along with their molecular mechanisms. The enzymes are classified according to the cofactors and prosthetic groups which they use.

Since most redox enzymes are dependent on nicotinamide cofactors, redox processes require regeneration of these cofactors to be economically feasible. Thus, Chapter 2 covers the various aspects of cofactor regeneration and describes general approaches that have been developed to avoid or minimize the use of expensive cofactors. The issues of cofactor regeneration and reaction mechanisms of particular redox enzymes in relation to certain reactions and biocatalytic processes are also further discussed in Chapters 3, 4, 5, and 8.

Chapters 3–5 form the main part of the book. Here, the authors have managed to introduce a clear hierarchical structure whereby individual groups of redox enzymes are described in the corresponding dedicated chapters, while within each chapter the enzymes are classified according to the chemical reactions that they catalyze. Thus, these chapters summarize the reactions performed by various dehydrogenases, oxygenases, oxidases, and peroxidases. Although the depth of coverage varies for different enzyme groups, from very detailed to being only briefly mentioned, the reader is provided with a wealth of information on biocatalytic redox reactions and processes that are chosen from the viewpoint of organic chemists and on the basis of the synthetic applicability of these processes. Therefore, one of the main advantages of the book is that it provides the opportunity to compare the effectiveness and suitability of various redox enzymes for certain redox reactions (for example, laccases and peroxidases for phenolic coupling reactions, monooxygenases and peroxidases for epoxidations of alkenes, etc.).

Chapter 6 focuses on hydrolase-mediated oxidations. Although it is somewhat apart from the book's main structure, this chapter provides interesting information about enzyme promiscuity with regard to substrates and reaction mechanisms, and describes the design of completely new chemical activities based on known enzymes. Less informative, and somewhat confusing in my opinion, is Chapter 7, which deals with many different aspects of biocatalysis. These include directed evolution of enzymes, high-throughput screening, choosing the optimum medium for redox reactions, and multistep enzyme processes. All these aspects are barely touched upon in this chapter, and could better be included in the previous chapters with regard to specific enzymes and processes. Chapter 8 describes several recent successful industrial applications of redox enzymes and discusses their prospects.

Unfortunately, careful reading reveals many errors that need to be corrected, including wrong enzyme names, inaccurate formulations, and some incorrect and misleading statements. These errors reduce the quality of the book. Generally, the layout of the book is sensible, and the index is perfectly organized with regard to completeness of the entries. The book contains a large number of tables and figures, which support the text visually and aid the reader. There is some overlapping of content between the individual chapters, but this might be difficult to prevent if a certain level of completeness within each chapter has to be achieved. The book includes altogether 2780 citations,



Redox Biocatalysis
Fundamentals and Applications. By Daniela Gamenara, Gustavo A. Seoane, Patricia Saenz-Méndez and Pablo Domínguez de María. John Wiley & Sons, Hoboken, 2012. 548 pp., hardcover, € 120.00.—ISBN 978-0470874202

which include references to the most important original papers and review articles.

Each chapter begins with an introduction outlining its content and defining the topics that are discussed, and ends with concluding remarks and a comprehensive up-to-date bibliography. Thus, this book can be considered as a collection of independent reviews that is appropriate for experts in the fields of biotechnology and synthetic organic chemistry (at least for Chapters 1–5). It also has some characteristics of a textbook, and therefore can be recommended for young researchers involved in this field.

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