Preface to the Third Edition

For centuries humans have had a history of using the power of natural catalysts — enzymes. But only in the late 19th century, after the term enzymes had been coined by Kühne, did enzyme-directed research and, subsequently, understanding of enzymes start to develop. It took 50 more years until the concept of enzymes as we know it today had been fully developed. After researchers got the chance to combine observations in the three-dimensional structures with the results of the systematical modification of enzymes by using the tools of molecular biology, our knowledge base has broadened even more, and scientists now understand the function of many enzymes at the atomic level.

The industrial use of enzymes as we know it today started after the German chemist Otto Röhm discovered in 1913 the efficacy of pancreatic trypsin for the removal of proteinaceous stains from clothes. Today, microbial proteases have become the workhorses of the cleaning industry. They are contained in almost every single detergent package and catalyze the removal of stains like blood, milk, and egg from our clothes very efficiently. In other fields, enzymatic processes have completely replaced conventional chemical processes. The best example is the production of high-fructose corn syrup from cornstarch.

The table of contents of this book shows clearly in how many different applications enzymes have become a useful adjuvant. In the food industry enzymes are used to improve dairy products like cheese or to supply us with breads that have the right crumb structure and give us the right mouthfeel while eating. In nonfood applications, we not only benefit from the clean laundry that detergents deliver thanks to enzymes, but we see also the fashionable look of "stone-washed" jeans, which is achieved by treatment of jeans with cellulases. Finally the catalysis of a wide range of reactions in synthetic organic chemistry has been explored. Interestingly, enzymes find their application as parts of the molecular biology toolbox, which is necessary to enable modification of enzymes through protein engineering and in the construction of microbial production hosts for enzymes. Obviously, this book contains many more examples of enzyme usage and I leave it to the curiosity of the interested reader to discover the world of industrial enzyme use.

While writing this preface and reading the table of contents again, I realized that industrial enzyme usage is still a very rapidly emerging field. Since the previous issue of the book, new enzyme application areas have emerged.
production of bio-ethanol from granular cornstarch has become a fast-growing commercial application for industrial enzymes. An interesting aspect of this development is the chance to save energy during the production of high-fructose corn syrup, because the high-temperature liquefaction step is no longer necessary (see Section ((insert xref to Section 5.2.3 Enzymes in Grain Wet-Milling))). At the same time, the production of ethanol via enzyme-enabled fermentations of lignocellulosic raw materials such as corn stover was the subject of two huge research projects sponsored by the National Renewable Energy Lab of the U.S. Department of Energy. This technology has not led to major use of enzymes yet, but might become an interesting field in the near future. I expect many more industrial applications of enzymes to come, mainly because enzyme applications can help us to save energy, which, in times of rising crude oil prices, becomes a more and more interesting valuable benefit of enzyme application.

While planning the book, I strived to achieve a comprehensive overview of all aspects of enzyme usage. This includes almost all applications of enzymes in an industrial environment in its broadest sense; the discovery, modification, and production of technical enzymes; and finally a chapter about enzyme safety and regulatory considerations.

In order to have the most competent authors for each topic, I invited as many authors as possible from the enzyme-applying industry to explain usage, function, and problems of enzyme application in their field and facts about safe enzyme usage. Scientists from academia and industry describe the enabling techniques for discovery, improvement, and production of enzymes.

I would like to thank the authors for their excellent work and their dedication for keeping the information up-to-date. I have received many positive comments on the 2nd completely revised edition of this book. This is certainly a compliment to the numerous authors who contributed to it. It is another compliment to the authors that Prof. Zhanhling Lin took the initiative to find a Chinese publisher and translate the book into Chinese. I think that the authors can be proud of such an achievement.

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