Preface

In recent decades, biochemical science and technology has made tremendous progress. A recent survey among US universities has revealed that nearly half of academic funding is devoted to the life sciences [1], and a similar situation prevails in most other industrialized countries. In spite of this massive investment, the share of biotechnology in the production of energy and chemicals is small – educated estimates are in the range of 3% (R Diercks, BASF AG, personal communication). Thus, much remains to be done to develop the "biorefinery" concept (see, e.g. ref. [2]) from vision into reality.

To date, enzyme technology in industry has been mostly restricted to selective hydrolyses or ester/amide bond formations. Important unit operations in chemical synthesis such as C-C bond formation or selective oxidations have remained the domain of the synthetic organic chemist, who can find in his or her textbooks a vast number of protocols for the transformation of many, if not most types of possible structures. Enzymatic methods have been less successful in these domains, major stumbling blocks being the lack of enzymes with the required selectivity and the need for expensive cofactors such as NADH or ATP.

More recently, techniques such as protein engineering, directed evolution, cofactor regeneration, and metabolic engineering have opened up new avenues to remove these bottlenecks. In addition, new types of enzymes have appeared on the stage of enzyme technology. Thus, among the oxidizing enzymes cytochrome and flavine monooxygenases, a class of enzymes hitherto unknown in the context of enzyme technology, are now being hotly investigated for use in fine chemical selective oxidation. Also laccases, mostly known for their potential as bleaching agents for paper pulp, are just being rediscovered as candidates for selective biooxidation.

Research in advanced enzyme technology is global. In fact, a Japanese program on "Green Biotechnology", inaugurated as early as 2000 and now in its second 5-year cycle (S Shimizu, Coordinator of METI project "Green Biotechnology", personal communication), has made significant advances towards the design of selective oxidative enzymes.

It is thus our great privilege to have collected 12 contributions from leaders in this area of research with pharmaceutical or chemical backgrounds, from

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industry and from academia, working in Europe, the USA and Japan, to provide insight into the state of the art in work to turn oxidizing enzymes into a tool for the pharmaceutical and chemical industries.

At this point we wish to acknowledge the excellent cooperation of the authors of this book, who all submitted manuscripts and corrections on time and without any delay. Thanks are also due to Dr Waltraud Wuest and colleagues at Wiley-VCH Publishers in Weinheim, Germany, who did a proficient job in editing the manuscript, and to Mr Alexander Seifert of our institute who provided us with a fine graph for the cover.

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References

1 Rovner, S.L. Academic R&D spending trends. *Chem Eng News* **2007**, 84:51, 47–51.
2 Ritter, S. Biorefinery gels ready to deliver the goods. *Chem Eng News* **2006**, 84:34, 47.