

Preface

Biotechnology industrialization is the result of basic life science progress plus engineering science contribution. Without doubt, without the good integration of biology and engineering, it is unbelievable that today's biotechnology becomes so popular and important to our human beings and the whole society of the world. The two special volumes entitled "Advances in Bioreactor Engineering Research and Application: I. Cell Factories" and "Advances in Bioreactor Engineering Research and Application: II. Bioreactors" are striving to reflect the recent advances in biology and engineering related researches with their significant impact on academic and industrial R&D.

Microbial cell factories are the basis to establishment of economical biomanufacturing processes, which provide various kinds of antibiotics, enzymes, vitamins, amino acids, pharmaceutical proteins, etc. With the progresses in metabolic engineering, metabolism in wild-type microbial strains can be well altered and metabolic flux can be effectively directed to target products, to meet the requirements for efficient production of interested metabolites. This special volume on Cell Factories is dedicated to establishment of bioconversion systems for efficient production of chiral chemicals, organic acids, biofuels, and other useful metabolites.

The complicated metabolic network in microbial cells is highly ordered and precisely regulated to adapt the changing environment and to survive under unfavorable conditions. In the review by Shimizu [1], various regulations in cells are presented. Understanding of these regulatory characteristics is very important to construction of more efficient cell factories for metabolite production.

Chiral chemicals are important building blocks for the synthesis of many pharmaceuticals, pesticides and food additives. Compared with chemical synthesis, biochemical processes have the advantages of better selectivity, higher productivity, and less environmental impact. The chapter by Zhang et al. [2] reviews the efficient synthesis of chiral chemical blocks by enzyme-mediated reactions. With the development of microbial genomics, efficient discovery of enzymes with special stereoselectivity and robust performance can be realized by genome mining which

is much more efficient than traditional strain selection and breeding from soil samples. Many interesting case studies are presented.

With the constantly increasing consumption of huge amounts of fossil feedstock, the supply of fossil resources will become limited, while continuous use of such resources has caused serious environmental pollution. For sustainable development, researchers all over the world have been exploring production of fuels and bulk chemicals using microorganisms with renewable, alternative feedstocks as substrates. Some organic acids and alcohols such as citrate, lactate, gluconate and ethanol are commercially produced by fermentation, but some organic acids and alcohols cannot be produced economically by microorganisms. The chapter by Liu et al. [3] summarizes the principles of constructing efficient cell factories and reviews the progresses of *Escherichia coli* cell factories for the production of organic acids and alcohols. *n*-Butanol is an excellent biofuel whose performance is better than ethanol as a transpotation fuel. Traditionally *n*-butanol is commercially produced by *Clostridium* in acetone-butanol-ethanol (ABE) fermentation, but the titer is low and genetic manipulation is difficult. The chapter by Dong et al. [4] reviews the researches on construction of *E. coli* cell factories for production of *n*-butanol and methods of theoretical prediction. Diols have wide applications and microbial production of such diols has attracted the interest of many researchers. The chapter by Sabra et al. [5] shows the recent progress in construction of microbial cell factories for production of low molecular weight diols including 1,3-propanediol, 1,2-propanediol, 2,3-butanediol, 1,3-butanediol and 1,4-butanediol.

Higher fungi are important sources of many secondary metabolites which have excellent pharmaceutical and physiological properties or can be potential lead compounds for new drug development. However, the production levels of such metabolites are usually low due to the low content in cells. In the chapter by Qin et al. [6], the methodology of genetic manipulation in higher fungi and omics analysis are described, and various useful metabolites produced by higher fungi are also summarized.

We hope this volume can provide some basic principles and current status in construction of efficient microbial cell factories, especially in the field of industrial biotechnology. Here, we would like to thank all the contributing authors and referees for their superior collaboration, the Managing Editor Prof. Dr. Thomas Scheper, and the publisher and the book-series editorial staffs at Springer for their constructive suggestions, constant support and kind help during the entire process for this special volume.

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