Preface

The title of this volume may appear a bit too ambitious to some readers. Biotechnology has been developing so fast in recent decades and has had a great impact on our life and society by addressing various problems including environmental pollution, ecological protection, energy issues, and public health. It is therefore almost impossible for a single volume to provide topics covering the current development and future trends in all aspects of biotechnology. Nevertheless, for this volume we have selected a number of interesting topics from a few important areas of biotechnology. These contributions are based on talks which were held at the 1st Asian Congress on Biotechnology (ACB) in 2011 which was organized under Asian Federation of Biotechnology (AFOB) (http://www.afob.org/) [1] to acknowledge the significant advances in biotechnology innovation and applications.

In order to establish a sustainable society, not reliant on using fossil resources, bioconversion technologies which turn biomass resources into valuable materials have received great attention in recent years. To improve cellular properties for high productivity and high yield production of desired products, the metabolic engineering approach is very useful [2]. Here, optimization of metabolic pathways of cells and creation of stress tolerant cells are important [3]. Prof. Hiroshi Shimizu and his coworkers from Osaka University describe multi-omics information analyses and rational design methods for molecular breeding ("Systems Metabolic Engineering: The Creation of Microbial Cell Factories by Rational Metabolic Design and Evolution").

Recent studies indicate that bacteria usually coordinate their behaviors at population level by producing, sensing, and responding to small signal molecules. This so-called quorum sensing regulation enables bacteria to live in a 'society' with cell–cell communication, and controls many important bacterial behaviors [4]. Profs. Jian-Jiang Zhong and Yang-Chun Yong from Shanghai Jiao Tong University and Jiangsu University review quorum sensing signals and their impacts on microbial metabolism and human health ("Impacts of Quorum Sensing on Microbial Metabolism and Human Health"). Quorum sensing plays an important role both in bacteria

directly and human beings, and a better understanding of this phenomenon would lead to better control of bacteria.

The next two chapters are related to biomanufacturing, which is defined as the manufacture of desired products using living biological organisms (e.g., bacteria, yeasts, animal cells) or some components from one or several biological organisms [5]. Chinese hamster ovary (CHO) cells are the current industrial workhorse for manufacturing the majority of leading recombinant biologics. Glycosylation is an important characteristic of CHO cells, which decorate protein or lipid backbones by carbohydrate moieties, leading to a wide range of bioactive end products. Dr. Zhiwei Song and his colleagues from the Bioprocessing Technology Institute of Singapore describe CHO glycosylation mutants as potential host cells to produce therapeutic proteins with enhanced efficacy ("CHO Glycosylation Mutants as Potential Host Cells to Produce Therapeutic Proteins with Enhanced Efficacy"). In light of the critical impact of glycosylation on biopharmaceutical performances (safety and efficacy), the CHO glycosylation mutants have enormous potential in producing glycoprotein therapeutics with optimal glycosylation profiles, which result in improved safety profile and enhanced efficacy [6].

Another type of biomanufacturing platform is the cell-free biosystem, which is very different from those of the above three chapters. Prof. Y.-H. Percival Zhang and Mr. Chun You from Virginia Tech summarize cell-free biosystems for biomanufacturing ("Cell-Free Biosystems for Biomanufacturing"). Cell-free biosystems are becoming an emerging biomanufacturing platform in the production of low-value biocommodities, fine chemicals, and high-value protein and carbohydrate drugs and their precursors. They believe that cell-free biosystems could become a disruptive technology to microbial fermentation, especially in the production of high-impact low-value biocommodities. This is mainly due to very high product yields and potential low-production costs [7].

"Lipid Bilayer Membrane Arrays: Fabrication and Applications" is a contribution describing the lipid bilayer of biomembranes, which is a universal component of all cell-based biological systems, forming the barrier between cytosol and the cell's exterior, as well as mediating many biological functions by providing a defined interface for cell-surface recognition, signaling, and transport. The importance of the lipid bilayer has raised much interest in fabricating artificial membrane as both free standing lipid membranes and solid supported lipid bilayer membranes. Prof. Xiaojun Han and his coworkers from the Harbin Institute of Technology describe the formation of bilayer lipid membrane arrays. The applications of lipid bilayer arrays are reviewed in the account of biosensors, protein binding studies, and lipid bilayer-based 2D electrophoresis [8].

The last chapter is about RNA aptamers, which are RNA molecules binding target molecules. Those small oligonucleotides derived from the in-vitro selection process are important candidates for therapeutics and diagnostics due to their high affinity and specificity against their target molecules. Prof. Yoon-Sik Lee and Dr. Kyung-Nam Kang from Seoul National University summarize recent trends and applications of RNA aptamers ("RNA Aptamers: A Review of Recent Trends and Applications"). As the global market for aptamers is expected to grow (about

$1.8 billion by 2014), research into the therapeutic and diagnostic applications of RNA aptamers seems to be increasing continuously [9].

Finally, I would like to thank all the authors for their excellent contributions to this book. The kind advice from Professor Thomas Scheper and great assistance from Ms. Karin Bartsch (Project Coordinator), Ms. Elizabeth Hawkins (Editor Chemistry), and other related staff at Springer are certainly appreciated. I do hope readers will enjoy this volume and provide suggestions and comments to me and the other authors.

Shanghai, 2012 Jian-Jiang Zhong

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