
SYSTEMS BIOLOGY AND SYNTHETIC BIOLOGY

Edited by

Pengcheng Fu

China University of Petroleum Beijing, China

Sven Panke

ETH Zurich, Institute of Process Engineering Zurich, Switzerland



WILEY

A JOHN WILEY & SONS, INC., PUBLICATION

CONTENTS

Foreword	ix
Contributors	xi
1 Introduction	1
<i>Pengcheng Fu</i>	
2 Basics of Molecular Biology, Genetic Engineering, and Metabolic Engineering	9
<i>Michael X. Wang and Huidong Shi</i>	
3 High-Throughput Technologies and Functional Genomics	67
<i>Xiu-Feng Wan and Dorothea K. Thompson</i>	
4 Genomic Signal Processing of DNA Microarray Data for the Enhanced Prediction of Axillary Lymph Node Status of Breast Cancer Tumors	115
<i>Gordon S. Okimoto</i>	
5 Recombinant Genomes: Novel Resources for Systems Biology and Synthetic Biology	155
<i>Mitsuhiro Itaya</i>	
6 <i>In silico</i> Genome-Scale Metabolic Models: The Constraint-Based Approach and its Applications	193
<i>Andrew R. Joyce and Bernhard Ø. Palsson</i>	
7 Mathematical Modeling of Genetic Regulatory Networks: Stress Responses in <i>Escherichia coli</i>	235
<i>Delphine Ropers, Hidde de Jong, and Johannes Geiselmann</i>	
8 Synthetic Life: Ethobricks for a New Biology	273
<i>Jordi Vallverdú and Claes Gustafsson</i>	

9	Yeast as a Prototype for Systems Biology	287
	<i>Goutham Vemuri and Jens Nielsen</i>	
10	Construction and Applications of Genome-Scale <i>in silico</i> Metabolic Models for Strain Improvement	355
	<i>Sang Yup Lee, Jin Sik Kim, Hongseok Yun, Tae Yong Kim, Seung Bum Sohn, and Hyun Uk Kim</i>	
11	Synthetic Biology: Putting Engineering into Bioengineering	387
	<i>Matthias Heinemann and Sven Panke</i>	
12	Rationales of Gene Design and <i>de novo</i> Gene Construction	411
	<i>Marcus Graf, Thomas Schoedl, and Ralf Wagner</i>	
13	Self-Replication in Chemistry and Biology	439
	<i>Philipp Holliger and David Loakes</i>	
14	The Synthetic Approach for Regulatory and Metabolic Circuits	467
	<i>Wilson W. Wong and James C. Liao</i>	
15	Synthetic Gene Networks	489
	<i>David Greber and Martin Fussenegger</i>	
16	The Theory of Biological Robustness and its Implication to Cancer	529
	<i>Hiroaki Kitano</i>	
17	Nucleic Acid Engineering	549
	<i>Wenlong Cheng, Liang Ding, Hisakage Funabashi, Nokyung Park, Soong Ho Um, Jianfeng Xu, and Dan Luo</i>	
18	Potential Applications of Synthetic Biology in Marine Microbial Functional Ecology and Biotechnology	577
	<i>Guangyi Wang and Juanita Mathews</i>	
19	On Fundamental Implications of Systems and Synthetic Biology	593
	<i>Cliff Hooker</i>	
20	Outstanding Issues in Systems and Synthetic Biology	615
	<i>Pengcheng Fu and Cliff Hooker</i>	
	Index	647