

# Contents

|                             |      |
|-----------------------------|------|
| <i>Preface</i>              | ix   |
| <i>List of Contributors</i> | xv   |
| <i>About the Editors</i>    | xvii |

## SECTION 1 FUNDAMENTALS OF MOLECULAR AND CELLULAR BIOLOGY

|                                                                                                   |    |
|---------------------------------------------------------------------------------------------------|----|
| <b>1 The Central Dogma: From DNA to RNA, and to Protein</b>                                       | 3  |
| <i>Takashi Ohtsuki, Masahiko Sisido</i>                                                           |    |
| <b>2 Genomes to Proteomes</b>                                                                     | 21 |
| <i>Ellen A. Panisko, Igor Grigoriev, Don S. Daly, Bobbie-Jo Webb-Robertson and Scott E. Baker</i> |    |

## SECTION 2 ANALYSIS VIA AUTOMATION

|                                                                                                      |    |
|------------------------------------------------------------------------------------------------------|----|
| <b>3 High-Throughput DNA Sequencing</b>                                                              | 49 |
| <i>Tarjei S. Mikkelsen</i>                                                                           |    |
| <b>4 Modeling a Regulatory Network Using Temporal Gene Expression Data: Why and How?</b>             | 69 |
| <i>Sophie Lèbre and Gaëlle Lelandais</i>                                                             |    |
| <b>5 Automated Prediction of Protein Attributes and Its Impact on Biomedicine and Drug Discovery</b> | 97 |
| <i>Kuo-Chen Chou</i>                                                                                 |    |

|          |                                                                                     |            |
|----------|-------------------------------------------------------------------------------------|------------|
| <b>6</b> | <b>Molecular Interaction Networks: Topological and Functional Characterizations</b> | <b>145</b> |
|          | <i>Xiaogang Wu and Jake Y. Chen</i>                                                 |            |

### SECTION 3 DESIGN VIA AUTOMATION

|           |                                                                                                             |            |
|-----------|-------------------------------------------------------------------------------------------------------------|------------|
| <b>7</b>  | <b>DNA Synthesis</b>                                                                                        | <b>177</b> |
|           | <i>Jingdong Tian</i>                                                                                        |            |
| <b>8</b>  | <b>Computational and Experimental RNA Nanoparticle Design</b>                                               | <b>193</b> |
|           | <i>Isil Severcan, Cody Geary, Luc Jaeger, Eckart Bindewald, Wojciech Kasprzak and Bruce A. Shapiro</i>      |            |
| <b>9</b>  | <b>New Paradigms in Droplet-Based Microfluidics and DNA Amplification</b>                                   | <b>221</b> |
|           | <i>Michael L. Samuels, John Leamon, Jonathan Rothberg, Ronald Godiska, Thomas Schoenfeld and David Mead</i> |            |
| <b>10</b> | <b>Synthetic Networks</b>                                                                                   | <b>251</b> |
|           | <i>Jongmin Kim</i>                                                                                          |            |

### SECTION 4 INTEGRATION

|           |                                                                                        |            |
|-----------|----------------------------------------------------------------------------------------|------------|
| <b>11</b> | <b>Molecular Modeling of CYP Proteins and its Implication for Personal Drug Design</b> | <b>275</b> |
|           | <i>Jing-Fang Wang, Cheng-Cheng Zhang, Jing-Yi Yan, Kuo-Chen Chou and Dong-Qing Wei</i> |            |
| <b>12</b> | <b>Recent Progress of Bioinformatics in Membrane Protein Structural Studies</b>        | <b>293</b> |
|           | <i>Hong-Bin Shen, Jun-Feng Wang, Li-Xiu Yao, Jie Yang and Kuo-Chen Chou</i>            |            |
| <b>13</b> | <b>Trends in Automation for Genomics and Proteomics</b>                                | <b>309</b> |
|           | <i>Gil Alterovitz, Roseann Benson, Marco Ramoni and Dmitriy Sonkin</i>                 |            |
|           | <b>Index</b>                                                                           | <b>315</b> |