## Contents

List of Contributors  ix  
Preface  xiii  

### Part One  The Molecular Farming/Pharming Landscape  1

1  Current Status and Perspectives of the Molecular Farming Landscape  3  
   Holger Spiegel, Eva Stöger, Richard M. Twyman, and Johannes F. Buyel  

### Part Two  Molecular Biology of Plant Expression Systems and Manipulation of Glycosylation Processes in Plants  25

2  Synthetic Transcription Activator-Like Effector-Activated Promoters for Coordinated Orthogonal Gene Expression in Plants: Applications for Regulatory Circuit and Metabolic Engineering  27  
   Tom Schreiber and Alain Tissier  

3  Contemporary and Emerging Technologies for Precise N-glycan Analyses  43  
   Iain B.H. Wilson, Katharina Paschinger, Jorick Vanbeselaere, and Chunsheng Jin  

4  Production of Functionally Active Recombinant Proteins in Plants: Manipulating N- and O-glycosylation  67  
   Alexandra Castilho and Richard Strasser  

### Part Three  Plant Platforms, Subcellular Targeting, Recovery, and Downstream Processing  91

5  Seeds as Bioreactors  93  
   Jinbo Shen, Xiangfeng Wang, and Liwen Jiang  

6  Strategies to Increase Expression and Accumulation of Recombinant Proteins  119  
   Reza Saberianfar and Rima Menassa
7  The Impact of Six Critical Impurities on Recombinant Protein Recovery and Purification from Plant Hosts  137
   Chelsea Dixon, Lisa R. Wilken, Susan L. Woodard, and Georgia O.F. Barros

8  Plant Recombinant Lysosomal Enzymes as Replacement Therapeutics for Lysosomal Storage Diseases: Unique Processing for Lysosomal Delivery and Efficacy  181
   Allison R. Kermode, Grant McNair, and Owen Pierce

Part Four  Plant-Derived Protein Pharmaceuticals and Case Studies  217

9  Plant-Produced Antibodies and Post-Translational Modification  219
   Andreas Loos and Herta Steinkellner

10 Molecular Pharming: Plant-Made Vaccines  231
   Qiang Chen, Matthew Dent, and Hugh Mason

11 Transgenic Rice for the Production of Recombinant Pharmaceutical Proteins: A Case Study of Human Serum Albumin  275
   Daichang Yang, Jiquan Ou, Jingni Shi, Zhibin Guo, Bo Shi, and Naghmeh Abiri

12 Enzymes for Industrial and Pharmaceutical Applications – From Individual to Population Level Impact  309
   Elizabeth E. Hood and Carole L. Cramer

Part Five  Regulatory Issues  327

13 Biosafety, Risk Assessment, and Regulation of Molecular Farming  329
   Penny A.C. Hundleby (nee Sparrow), Markus Sack, and Richard M. Twyman

Part Six  Emerging Areas: Plant Specialized Metabolites and Small Molecule Drugs  353

14 Harnessing Plant Trichome Biochemistry for the Production of Useful Compounds  355
   Alain Tissier

15 Reconstitution of Medicinally Important Plant Natural Products in Microorganisms  383
   Ozkan Fidan and Jixun Zhan

16 Screening of Epidermal Growth Factor Receptor Inhibitors in Natural Products Derived From Extracts of Traditional Chinese Medicines  417
   Li Feng and Jingwu Kang
17  Target-Directed Evolution of Mutant Transgenic Plant Cells as a Novel Source of Drugs  435
    John Littleton, Dustin Brown, Deane Falcone, Gregory Gerhardt, Samir Gunjan, Dennis T. Rogers, and Jatinder Sambi

18  Plant Thermotolerance Proteins, Misfolded Proteins, and Neurodegenerative Diseases  457
    Indranil Basak and Simon G. Møller

Index  475