

12.3.	Bioreactor Considerations for Animal Cell Culture	396
12.4.	Products of Animal Cell Cultures	400
	<i>12.4.1. Monoclonal Antibodies, 400</i>	
	<i>12.4.2. Immunobiological Regulators, 401</i>	
	<i>12.4.3. Virus Vaccines, 401</i>	
	<i>12.4.4. Hormones, 401</i>	
	<i>12.4.5. Enzymes, 401</i>	
	<i>12.4.6. Insecticides, 402</i>	
	<i>12.4.7. Whole Cells and Tissue Culture, 402</i>	
12.5.	Summary	402
	Suggestions for Further Reading	403
	Problems	403

13 BIOPROCESS CONSIDERATIONS IN USING PLANT CELL CULTURES

405

13.1.	Why Plant Cell Cultures?	405
13.2.	Plant Cells in Culture Compared to Microbes	407
13.3.	Bioreactor Considerations	411
	<i>13.3.1. Bioreactors for Suspension Cultures, 411</i>	
	<i>13.3.2. Reactors Using Cell Immobilization, 413</i>	
	<i>13.3.3. Bioreactors for Organized Tissues, 414</i>	
13.4.	Economics of Plant Cell Tissue Cultures	417
13.5.	Summary	417
	Suggestions for Further Reading	418
	Problems	418

14 UTILIZING GENETICALLY ENGINEERED ORGANISMS

421

14.1.	Introduction	421
14.2.	How the Product Influences Process Decisions	421
14.3.	Guidelines for Choosing Host-Vector Systems	424
	<i>14.3.1. Overview, 424</i>	
	<i>14.3.2. Escherichia coli, 424</i>	
	<i>14.3.3. Gram-positive Bacteria, 426</i>	
	<i>14.3.4. Lower Eucaryotic Cells, 427</i>	
	<i>14.3.5. Mammalian Cells, 428</i>	
	<i>14.3.6. Insect Cell-Baculovirus System, 429</i>	
	<i>14.3.7. Transgenic Animals, 430</i>	
	<i>14.3.8. Transgenic Plants and Plant Cell Culture, 432</i>	
	<i>14.3.9. Comparison of Strategies, 432</i>	
14.4.	Process Constraints: Genetic Instability	433
	<i>14.4.1. Segregational Loss, 434</i>	
	<i>14.4.2. Plasmid Structural Instability, 436</i>	
	<i>14.4.3. Host Cell Mutations, 436</i>	
	<i>14.4.4. Growth-rate-dominated Instability, 437</i>	