

Table of Contents

Executive Summary	6
Chapter 1: Pre-Clinical Through Commercial Manufacturing	8
Manufacturing at a Glance	8
Manufacturing Begins at Institutions.....	8
The Transition To Commercial Manufacturing	10
The Role of Contract Manufacturing Organizations	11
Factors Determining Outsourcing versus In-House Manufacturing.....	13
Chapter 2: The Manufacturing Process	15
Manufacturing Methods.....	15
Closed, Automated Systems	18
Chapter 3: Emerging in Manufacturing	21
Key Factors Driving Change.....	21
Looking Forward in Manufacturing	23
Chapter 4: Near-Term Manufacturing Opportunities	25
Mesenchymal Stem Cells	25
Dendritic Cell Derived Cancer Vaccines.....	26
Immunotherapies.....	28
Manufacturing Requirements for Immunotherapies	30
Autologous: Where Small-Scale is Full Scale	31
Chapter 5: Adoption of New Systems and Services	32
Chapter 6: Summary and Key Take-Aways	33
Appendix I: Selected Automated and Closed Manufacturing Systems	35
Appendix II: Glossary of Terms	39
References	42
Figures	
Figure 1: Cell Therapy Bioprocessing Production Flow.....	8
Figure 2: Manufacturing Decisions During Clinical Development.....	11
Figure 3: Trends in MSC and Stem Cell Clinical Trials.....	25
Figure 4: Trends in Dendritic Cell Clinical Trials.....	27
Figure 5: Trends in Immunotherapy Clinical Trials	28
Figure 6: Venture Capital Investment	29
Tables	
Table 1: Select Institutional Manufacturing Facilities	10
Table 2: Factors Influencing Manufacturing Decisions by Clinical Stage of Development	13
Table 3: Select Cell Manufacturing Solutions	16
Table 4: Automated Features of Closed Manufacturing Systems.....	19
Table 5: Specifications of Closed Manufacturing Systems.....	20
Table 6: Voice-of-Customer on Key Unmet Needs.....	22
Table 7: Pharma Partnerships With Immunotherapy Companies.....	29