

# TISSUE ENGINEERING AND REGENERATION: TECHNOLOGIES AND GLOBAL MARKETS



HLC101C  
September 2016

Yojana Jeevane  
*Project Analyst*

ISBN: 1-62296-367-9



**BCC Research**  
49 Walnut Park, Building 2  
Wellesley, MA 02481 USA  
866-285-7215 (toll-free within the USA),  
or (+1) 781-489-7301  
[www.bccresearch.com](http://www.bccresearch.com)  
[info@bccresearch.com](mailto:info@bccresearch.com)

**TABLE OF CONTENTS**

<b>TOPIC</b>	<b>PAGE NO.</b>
CHAPTER 1 INTRODUCTION	2
STUDY GOALS AND OBJECTIVES	2
SCOPE OF THE REPORT	2
INTENDED AUDIENCE	3
SOURCE OF INFORMATION AND METHODOLOGY	3
ANALYST'S CREDENTIALS	3
RELATED BCC RESEARCH REPORTS	4
BCC RESEARCH WEBSITE	4
DISCLAIMER	4
CHAPTER 2 EXECUTIVE SUMMARY	6
<i>SUMMARY TABLE GLOBAL MARKET FOR TISSUE ENGINEERING AND REGENERATION, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	7
<i>SUMMARY FIGURE GLOBAL MARKET FOR TISSUE ENGINEERING AND REGENERATION, BY REGION, 2015-2021 (\$ MILLIONS)</i>	8
CHAPTER 3 TISSUE ENGINEERING AND REGENERATION MARKET OVERVIEW	10
PROGRESS AND PROMISES FOR TISSUE ENGINEERING INDUSTRY	11
<i>FIGURE 1 TISSUE ENGINEERING STRATEGIES</i>	12
BODY PARTS THAT CAN BE REPLACED BY TISSUE ENGINEERING	13
NANOTECHNOLOGY FOR TISSUE REGENERATION	13
<i>FIGURE 2 NANOTECHNOLOGY AND TISSUE REGENERATION</i>	14
EFFECTS OF NANOTECHNOLOGY ON STEM CELL BEHAVIOR FOR TISSUE REGENERATION	14
Nanoparticles	14
Nanoscaffolds	15
NANOTECHNOLOGY IN TISSUE REGENERATION APPLICATIONS	15
Bone and Cartilage Regeneration	15
Vascular Tissue Regeneration	15
Neural Tissue Regeneration	16
GENE THERAPIES: THE FUTURE OF TISSUE ENGINEERING	16
PROGRESS	16
PROSPECTS	17
STEM CELL TECHNOLOGIES BOON TO TISSUE ENGINEERING	17
GOVERNMENT REGULATIONS AND LEGISLATIONS	18
REGULATIONS FOR TISSUE ENGINEERING PRODUCTS IN EUROPE AND THE U.S.	18
CHINESE REGULATIONS FOR TISSUE ENGINEERING	19
REGULATORY DIFFERENCES	20
<i>TABLE 1 U.S. AND EUROPEAN DIFFERENCES IN REGULATORY APPROVAL</i>	21
ETHICAL ISSUES OF STEM CELL THERAPIES AND CORD BLOOD BANKING	21
Ethical Issues Regarding Cord Blood Banking	21
Ethical Issues in Cord Blood Stem Cell Therapies	22
IMPACT OF HEALTHCARE SYSTEM ON TISSUE ENGINEERING MARKET DEVELOPMENT	22
<i>TABLE 2 MAIN ASPECTS OF HEALTHCARE PROVISIONS IN DIFFERENT COUNTRIES</i>	23

<b>TOPIC</b>	<b>PAGE NO.</b>
BIOPRINTING TECHNOLOGY IN REGENERATIVE MEDICINE	24
PORTER'S FIVE FORCES ANALYSIS OF TISSUE ENGINEERING AND REGENERATION MARKET	25
<i>FIGURE 3 PORTER'S FIVE FORCES MODEL FOR TISSUE ENGINEERING AND REGENERATIVE MEDICINE MARKET</i>	26
MODERATE BARGAINING POWER OF SUPPLIER	26
LOW BARGAINING POWER OF BUYER	26
MODERATE TO LOW-LEVEL OF THREATS FROM SUBSTITUTE PRODUCTS	27
CLINICAL TRIALS	27
U.S. CLINICAL TRIALS FOR TISSUE ENGINEERING	27
<i>TABLE 3 U.S. CLINICAL TRIALS FOR TISSUE ENGINEERING, BY COMPANY, 2010-2016</i>	28
<i>TABLE 4 COMPLETED U.S. CLINICAL TRIALS CONDUCTED FOR TISSUE ENGINEERING, 2004-2015</i>	29
Terminated Clinical Trials for Tissue Engineering	34
<i>TABLE 5 TERMINATED U.S. CLINICAL TRIALS, 2012-2018</i>	34
EUROPEAN CLINICAL TRIALS FOR TISSUE ENGINEERING	36
<i>TABLE 6 EUROPEAN CLINICAL TRIALS CONDUCTED FOR TISSUE ENGINEERING, 2009-2019</i>	36
MARKET DYNAMICS	39
DRIVERS	39
Emergence of Stem Cell Technology	39
<i>FIGURE 4 GROWTH IN DISEASE TREATED VERSUS CLINICAL TRIALS, 2011-2016 (NO. OF STUDIES)</i>	39
Prominent Potential of Nanotechnology	40
Rise in Prevalence of Trauma Emergencies and Chronic Diseases	41
Advancement in Surgical Technologies and Monitoring Devices	41
RESTRAINTS	42
Operational Inefficiency	42
Stringent Regulatory Policies and Ethical Issues	42
High Cost of Treatments	43
OPPORTUNITIES IN STEM CELL APPLICATIONS	43
Core Competency in Emerging Economies	44
Increasing Gap in Donors to Patients for Organ Transplantation	44
CHAPTER 4 TISSUE ENGINEERING AND REGENERATION MARKET ANALYSIS BY COMPONENTS	46
<i>TABLE 7 GLOBAL MARKET FOR TISSUE ENGINEERING AND REGENERATION, BY COMPONENTS, THROUGH 2021 (\$ MILLIONS)</i>	46
<i>TABLE 8 GLOBAL MARKET FOR TISSUE ENGINEERING AND REGENERATION, BY THERAPEUTIC PRODUCT, THROUGH 2021 (\$ MILLIONS)</i>	47
CELL THERAPY	47
AUTOLOGOUS CELL THERAPIES	47
ALLOGENIC CELL THERAPIES	48
XENOGENEIC CELL THERAPIES	48
<i>TABLE 9 GLOBAL CELL THERAPY MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	49
STEM CELL THERAPY	49
STEM CELL SOURCES	50

<b>TOPIC</b>	<b>PAGE NO.</b>
EXISTING AND DEVELOPMENT-STAGE STEM CELL PRODUCTS	51
CLINICAL APPLICATION OF STEM CELL TECHNOLOGIES IN THE COMMERCIAL MARKET	51
Cardiovascular Repair	51
Neural Repair	52
Bone Repair	52
Skeletal Muscle Repair	52
Urologic Repair	53
TISSUE VASCULARIZATION	53
CELL CULTURING	54
<i>TABLE 10 PROJECTS AND THEIR ASSESSMENT STAGES (£)</i>	55
SMALL MOLECULES AND BIOLOGICS	55
<i>TABLE 11 GLOBAL SMALL MOLECULES AND BIOLOGICS MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	55
SMALL MOLECULES	56
BIOLOGICS	56
TISSUE ENGINEERING	57
<i>TABLE 12 GLOBAL TISSUE ENGINEERING MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	57
GENE THERAPY	59
<i>TABLE 13 GLOBAL GENE THERAPY MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	59
CELL ELIMINATION	60
GENE ADDITION	60
GENE CORRECTION	61
GENE SILENCING	61
REPROGRAMMING	61
CHAPTER 5 TISSUE ENGINEERING AND REGENERATION MARKET ANALYSIS BY MATERIAL	64
<i>TABLE 14 GLOBAL MARKET FOR TISSUE ENGINEERING AND REGENERATION, BY THERAPEUTIC MATERIAL, THROUGH 2021 (\$ MILLIONS)</i>	64
SYNTHETIC MATERIALS	64
<i>TABLE 15 GLOBAL SYNTHETIC MATERIAL MARKET, BY TYPE, THROUGH 2021 (\$ MILLIONS)</i>	65
<i>TABLE 16 GLOBAL SYNTHETIC MATERIAL MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	66
BIODEGRADABLE SYNTHETIC POLYMERS	66
<i>TABLE 17 BIODEGRADABLE POLYMER CLASSIFICATION</i>	66
<i>TABLE 18 GLOBAL BIODEGRADABLE SYNTHETIC POLYMER MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	67
SCAFFOLDS: MEDICAL POLY LACTIC ACID	67
<i>TABLE 19 COMMERCIAL POLYMERIC SCAFFOLD PRODUCTS</i>	69
<i>TABLE 20 GLOBAL SCAFFOLD MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	70
ARTIFICIAL VASCULAR GRAFT MATERIALS	70
Integration of Stem Cell in Vascular Tissue Engineering	70
ECM-Based Vascular Grafts	70
Cell Sheets Without Scaffold Support	71

<b>TOPIC</b>	<b>PAGE NO.</b>
<i>TABLE 21 GLOBAL ARTIFICIAL VASCULAR GRAFT MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	71
HYDROGEL TECHNOLOGY	71
<i>TABLE 22 GLOBAL HYDROGEL TECHNOLOGY MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	72
BIOLOGICALLY DERIVED MATERIALS	72
<i>TABLE 23 GLOBAL BIOLOGICALLY DERIVED MARKET, BY TYPE, THROUGH 2021 (\$ MILLIONS)</i>	73
<i>TABLE 24 GLOBAL BIOLOGICALLY DERIVED MATERIAL MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	73
COLLAGEN	73
<i>TABLE 25 GLOBAL BIOLOGICALLY DERIVED COLLAGEN MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	74
Animal-Derived	74
Recombinant	75
XENOGENIC TISSUE	75
<i>TABLE 26 GLOBAL BIOLOGICALLY DERIVED XENOGENIC TISSUE MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	75
Polypeptides	76
Fibrins	76
Glycosaminoglycans	76
GENETICALLY ENGINEERED MATERIALS	77
<i>TABLE 27 GLOBAL GENETICALLY ENGINEERED MATERIAL MARKET, BY TYPE, THROUGH 2021 (\$ MILLIONS)</i>	77
<i>TABLE 28 GLOBAL GENETICALLY ENGINEERED MATERIAL MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	78
DEOXYRIBONUCLEIC ACID TRANSFECTION VECTORS	78
<i>TABLE 29 GLOBAL DEOXYRIBONUCLEIC ACID TRANSFECTION VECTOR MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	79
GENETICALLY MANIPULATED CELLS	79
<i>TABLE 30 GLOBAL GENETICALLY MANIPULATED CELL MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	80
THREE-DIMENSIONAL POLYMER TECHNOLOGY	80
<i>TABLE 31 GLOBAL THREE-DIMENSIONAL POLYMER TECHNOLOGY MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	81
TRANGENICS	81
<i>TABLE 32 GLOBAL TRANSGENIC MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	81
FIBROBLASTS	82
<i>TABLE 33 GLOBAL FIBROBLAST MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	82
NEURAL STEM CELLS	82
<i>TABLE 34 GLOBAL NEURAL STEM CELL MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	83
GENE-ACTIVATED MATRICES	83
<i>TABLE 35 GLOBAL GENE-ACTIVATED MATRIX MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	84
SMALL MOLECULES AND BIOLOGICS	84
<i>TABLE 36 GLOBAL MARKET FOR SMALL MOLECULES AND BIOLOGICS, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	85
CHAPTER 6 TISSUE ENGINEERING AND REGENERATION MARKET BY APPLICATION	87

<b>TOPIC</b>	<b>PAGE NO.</b>
<i>TABLE 37 GLOBAL TISSUE ENGINEERING AND REGENERATION MARKET, BY APPLICATION, THROUGH 2021 (\$ MILLIONS)</i>	87
TISSUE ENGINEERING AND REGENERATIVE MEDICINE FOR CARDIOVASCULAR DISORDERS	87
<i>TABLE 38 GLOBAL TISSUE ENGINEERING AND REGENERATION MARKET FOR CARDIOVASCULAR APPLICATIONS, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	89
PERIPHERAL VASCULAR DISEASE APPLICATIONS	89
CORONARY ARTERY DISEASE APPLICATIONS	90
Heart Valves and Tissue Engineering	90
Mechanical Heart Valves	91
Biological Heart Valves	91
<i>TABLE 39 CELL THERAPIES BY DIFFERENT COMPANIES TO TREAT CADIOVASULAR DISEASES</i>	92
TISSUE ENGINEERING AND REGENERATIVE MEDICINE FOR ONCOLOGY	93
<i>FIGURE 5 T-CELL THERAPY TECHNIQUE</i>	93
<i>TABLE 40 GLOBAL TISSUE ENGINEERING AND REGENERATION MARKET FOR ONCOLOGY APPLICATION, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	94
TISSUE ENGINEERING AND REGENERATIVE MEDICINE FOR DERMATOLOGY	94
<i>TABLE 41 GLOBAL AND U.S. STATISTICS FOR SKIN DAMAGE MEDICAL CONDITIONS, 2011</i>	95
<i>TABLE 42 ACELLULAR SKIN TISSUE-ENGINEERED PRODUCTS IN THE MARKET</i>	96
<i>TABLE 43 CELLULAR SKIN TISSUE-ENGINEERED PRODUCTS IN THE MARKET</i>	96
<i>TABLE 44 GLOBAL TISSUE ENGINEERING AND REGENERATION MARKET FOR DERMATOLOGY APPLICATION, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	98
TISSUE ENGINEERING AND REGENERATIVE MEDICINE FOR MUSCULOSKELETAL APPLICATIONS	98
ORTHOPEDIC APPLICATIONS	98
<i>TABLE 45 GLOBAL TISSUE ENGINEERING AND REGENERATION MARKET FOR MUSCULOSKELETAL APPLICATIONS, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	99
<i>TABLE 46 ORTHOPEDIC DISEASES BY REGION: KEY FACTS</i>	99
BONE REPAIR AND REPLACEMENT	100
<i>TABLE 47 BONE DAMAGE AND RELATED DISEASE STATISTICS, 2011 (NO. OF PEOPLE)</i>	100
TREATMENT FOR CARTILAGE AND CONNECTIVE TISSUE DAMAGE	101
CURRENT TISSUE-ENGINEERED PRODUCTS FOR BONE DEFECTS	102
CARTILAGE REPAIR AND REPLACEMENT	103
<i>TABLE 48 GLOBAL STATISTICS FOR CARTILAGE DAMAGE, 2007</i>	104
MENISCUS REPAIR AND REPLACEMENT	105
TENDON AND LIGAMENT REPAIR AND REPLACEMENT	105
MUSCLE REGENERATION	106
<i>TABLE 49 IN VITRO VERSUS IN VIVO SKELETAL MUSCLE TISSUE ENGINEERING</i>	107
PERIPHERAL NERVE REPAIR	107
HERNIA AND SOFT TISSUE REPAIR	108
TISSUE ENGINEERING AND REGENERATIVE MEDICINE FOR WOUND HEALING	108
<i>TABLE 50 GLOBAL TISSUE ENGINEERING AND REGENERATION MARKET FOR WOUND HEALING APPLICATIONS, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	108
BURN TREATMENT	109
ULCER TREATMENT	110
ANTI-AGING THERAPIES	110
TISSUE ENGINEERING AND REGENERATIVE MEDICINE FOR OPHTHALMOLOGY	111

<b>TOPIC</b>	<b>PAGE NO.</b>
<i>TABLE 51 GLOBAL TISSUE ENGINEERING AND REGENERATION MARKET FOR OPHTHALMOLOGY APPLICATION, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	111
TISSUE ENGINEERING AND REGENERATIVE MEDICINE FOR NEUROLOGY	112
CENTRAL NERVOUS SYSTEM	112
<i>TABLE 52 GLOBAL TISSUE ENGINEERING AND REGENERATION MARKET FOR NEUROLOGY APPLICATION, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	113
TISSUE ENGINEERING FOR CENTRAL NERVOUS SYSTEM DISEASES	113
NEUROSURGICAL	114
Cell Implants for Parkinson's Diseases	115
<i>TABLE 53 GLOBAL STATISTICS FOR NEURODEGENERATIVE DISEASES, 2015</i>	116
Cell Transplants for Epilepsy Treatment	116
Stem Cell Therapy for Multiple Sclerosis	116
SPINAL CORD INJURY: SPINAL DISC REPAIR AND REPLACEMENT	117
<i>TABLE 54 U.S. STATISTICS FOR SPINAL CORD INJURIES, 2015</i>	117
Spinal Cord Injury Treatments	117
Tissue Engineering for Spinal Cord Injury	118
Cell Therapy for Spinal Cord Injuries	118
Scaffold Approach for Spinal Cord Injury Treatment	119
OTHERS	120
Dental Tissue Engineering	120
<i>TABLE 55 GLOBAL MARKET FOR OTHER APPLICATIONS, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	121
INTERNAL ORGAN REGENERATION	121
LIVER REGENERATION	122
<i>TABLE 56 U.S. STATISTICS FOR LIVER FAILURE, 2011</i>	123
<i>TABLE 57 ARTIFICIAL LIVER SUPPORT SYSTEMS</i>	123
PANCREAS AND ISLET CELL REGENERATION	124
<i>TABLE 58 U.S. STATISTICS FOR PANCREATIC CANCER AND DIABETES, 2010</i>	125
KIDNEY AND RENAL TUBULE REGENERATION	127
<i>TABLE 59 U.S. STATISTICS FOR KIDNEY DISEASES, 2013</i>	127
CHAPTER 7 TISSUE ENGINEERING AND REGENERATION MARKET BY REGION	129
<i>FIGURE 6 REGENERATIVE MEDICINE COMPANIES BY SIZE AND REGION (NO. OF COMPANIES)</i>	129
<i>TABLE 60 GLOBAL TISSUE ENGINEERING AND REGENERATION MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)</i>	130
NORTH AMERICA	130
U.S.	130
<i>TABLE 61 NORTH AMERICAN COMMERCIALIZED TISSUE ENGINEERING PRODUCTS</i>	130
<i>TABLE 62 NORTH AMERICAN TISSUE ENGINEERING AND REGENERATION MARKET, BY COMPONENTS, THROUGH 2021 (\$ MILLIONS)</i>	134
U.S. Market for Skin Tissue Engineering Products	134
<i>TABLE 63 U.S. STATISTICS FOR SKIN DAMAGE CONDITIONS REQUIRING WOUND CARE, 2011</i>	134
U.S. MARKET FOR CARTILAGE AND BONE TISSUE ENGINEERING PRODUCTS	135
<i>TABLE 64 U.S. STATISTICS FOR BONE DAMAGE AND RELATED DISEASES, 2010</i>	136
U.S. MARKET FOR TISSUE ENGINEERING PRODUCTS FOR CARDIOVASCULAR DISEASE	137
<i>TABLE 65 U.S. STATISTICS FOR CARDIOVASCULAR DISEASE, 2014</i>	137

<b>TOPIC</b>	<b>PAGE NO.</b>
CANADA	137
TABLE 66 TISSUE ENGINEERING RESEARCH CONDUCTED AS PER DIFFERENT UNIVERSITIES	137
TABLE 67 TISSUE ENGINEERING PRODUCTS OFFERED BY DIFFERENT COMPANIES	138
TABLE 68 CANADA STATISTICS FOR CARDIOVASCULAR DISEASE, 2014	139
TABLE 69 CANADA STATISTICS FOR SPINAL CORD INJURY, 2014	139
MEXICO	139
TABLE 70 MEXICO STATISTICS FOR CARDIOVASCULAR DISEASE, 2011-2014	140
TABLE 71 MEXICO STATISTICS FOR OTHER DISEASES AND INJURIES, 2012	140
EUROPE	141
TABLE 72 TISSUE ENGINEERING FIRMS, BY BUSINESS TYPE, 2014 (%)	141
TABLE 73 TISSUE ENGINEERING FIRMS IN FEW EUROPEAN COUNTRIES (%)	142
TABLE 74 EUROPEAN TISSUE ENGINEERING AND REGENERATION MARKET, BY COMPONENTS, THROUGH 2021 (\$ MILLIONS)	142
GERMANY	143
TABLE 75 GERMANY STATISTICS FOR MORTALITY CAUSES, 2013	144
TABLE 76 COMPANIES THAT TARGET DIFFERENT TISSUE ENGINEERING AREAS	145
U.K.	145
TABLE 77 DIFFERENT CAUSES OF DEATH: U.K. STATISTICS, 2013	146
TABLE 78 COMPANIES THAT TARGET DIFFERENT TISSUE ENGINEERING AREAS	146
FRANCE	146
TABLE 79 COMPANIES THAT TARGET DIFFERENT TISSUE ENGINEERING AREAS	147
OTHER EUROPEAN COUNTRIES	147
TABLE 80 STATISTICS FOR COST OF BONE DAMAGE REPAIR AND RELATED DISORDERS IN EUROPE	149
TABLE 81 CARDIOVASCULAR DISEASE HEALTHCARE COST, BY COUNTRY, 2014 (\$ BILLIONS)	149
TABLE 82 EUROPEAN STEM CELL POLICIES, BY COUNTRY	151
TABLE 83 EUROPEAN COMPANIES DEVELOPING PRODUCTS IN TISSUE ENGINEERING AND REGENERATION FOR CENTRAL NERVOUS SYSTEM DISORDERS AND INJURIES	152
ASIA-PACIFIC	153
JAPAN	154
CHINA	154
AUSTRALIA	155
FIGURE 7 PATHWAY FOR DISSEMINATION OF REGENERATIVE MEDICINE	155
TABLE 84 ASIA-PACIFIC TISSUE ENGINEERING AND REGENERATION MARKET, BY COMPONENTS, THROUGH 2021 (\$ MILLIONS)	156
REST OF WORLD	157
TABLE 85 GLOBAL STATISTICS FOR SKIN-RELATED MEDICAL CONDITIONS, 2014	158
TABLE 86 REST OF WORLD TISSUE ENGINEERING AND REGENERATION MARKET, BY COMPONENTS, THROUGH 2021 (\$ MILLIONS)	159
REST OF WORLD MARKET FOR CARTILAGE AND BONE TISSUE ENGINEERING PRODUCTS	159
REST OF WORLD MARKET FOR TISSUE ENGINEERING CARDIOVASCULAR DISEASE PRODUCTS	160
REST OF THE WORLD MARKET FOR TISSUE ENGINEERING PRODUCTS FOR CENTRAL NERVOUS SYSTEM-RELATED INJURIES AND DISEASES	160
TABLE 87 GLOBAL STATISTICS FOR CENTRAL NERVOUS SYSTEM DISORDERS AND INJURIES, 2015	161



TOPIC	PAGE NO.
CHAPTER 8 COMPETITIVE LANDSCAPE	163
FIGURE 8 KEY COMPETITIVE STRATEGIES, 2012-2016* (%)	163
APPROVAL	164
FIGURE 9 APPROVAL STRATEGY BY COMPANY*, 2012-2016 (%)	165
TABLE 88 KEY APPROVALS, 2012-2016	166
AGREEMENT, EXPANSION AND COLLABORATION	167
FIGURE 10 AGREEMENT, EXPANSION AND COLLABORATION STRATEGIES BY COMPANY*, 2012-2016	168
TABLE 89 KEY ANNOUNCED AGREEMENTS, EXPANSIONS AND COLLABORATIONS, 2012-2016	169
PRODUCT LAUNCHES AND PATENT APPROVALS	170
FIGURE 11 PRODUCT LAUNCH AND PATENT APPROVAL STRATEGIES BY COMPANY*, 2012-2016 (%)	170
TABLE 90 KEY ANNOUNCED PRODUCT LAUNCHES AND PATENT APPROVALS, 2012-2016	171
ACQUISITIONS AND MERGERS	172
FIGURE 12 ACQUISITIONS AND MERGERS STRATEGIES BY COMPANY*, 2012-2016	172
TABLE 91 KEY ANNOUNCED ACQUISITIONS AND MERGERS, 2012-2016	173
CHAPTER 9 PATENT ANALYSIS	176
FIGURE 13 GLOBALLY REGISTERED AND APPROVED PATENTS, 2016 (%)	176
FIGURE 14 U.S., EUROPE AND JAPAN REGISTERED AND APPROVED PATENTS, 2012-2016 (%)	177
FIGURE 15 U.S. PATENT ANALYSIS BY MARKET PARTICIPANT, 2011-2016 (%)	177
FIGURE 16 U.S. PATENT ANALYSIS BY APPLICATION, 2012-2016 (%)	179
FIGURE 17 EUROPE PATENT ANALYSIS BY MARKET PARTICIPANT, 2011-2016 (%)	180
FIGURE 18 EUROPE PATENT ANALYSIS BY APPLICATION, 2011-2016 (%)	180
FIGURE 19 JAPAN PATENT ANALYSIS BY APPLICATION, 2011-2016 (%)	181
FIGURE 20 JAPAN PATENT ANALYSIS BY MARKET PARTICIPANT, 2011-2016 (%)	181
CHAPTER 10 COMPANY PROFILES	184
ARTERIOCYTE MEDICAL SYSTEMS INC.	184
TABLE 92 ARTERIOCYTE MEDICAL SYSTEMS INC.: RECENT DEVELOPMENTS	184
TISSUE ENGINEERING PRODUCT PORTFOLIO	184
ATHERSYS INC.	185
TABLE 93 ATHERSYS INC. FINANCIALS, 2013-2015 (\$ MILLIONS/%)	185
TABLE 94 ATHERSYS INC.: RECENT DEVELOPMENTS	186
TISSUE ENGINEERING PRODUCT PORTFOLIO	186
CERAPEDICS INC.	186
TABLE 95 CERAPEDICS INC.: RECENT DEVELOPMENTS	186
TISSUE-ENGINEERING PRODUCT PORTFOLIO	187
CO.DON AG	187
TABLE 96 CO.DON AG: RECENT DEVELOPMENTS	188
TISSUE ENGINEERING PRODUCT PORTFOLIO	188
COOK MEDICAL INC.	188
TABLE 97 COOK MEDICAL INC.: RECENT DEVELOPMENTS	188
TISSUE ENGINEERING PRODUCT PORTFOLIO	189

<b>TOPIC</b>	<b>PAGE NO.</b>
CRYOLIFE INC.	189
<i>TABLE 98 CRYOLIFE INC. FINANCIALS, 2013-2015 (\$ MILLIONS/%)</i>	190
<i>TABLE 99 CRYOLIFE INC.: RECENT DEVELOPMENTS</i>	190
TISSUE ENGINEERING PRODUCT PORTFOLIO	190
CYTORI THERAPEUTICS INC.	191
<i>TABLE 100 CYTORI THERAPEUTICS FINANCIALS, 2013-2015 (\$ MILLIONS/%)</i>	191
<i>TABLE 101 CYTORI THERAPEUTICS INC.: RECENT DEVELOPMENTS</i>	191
TISSUE ENGINEERING PRODUCT PORTFOLIO	192
GENZYME CORP.	192
<i>TABLE 102 GENZYME CORP. FINANCIALS, 2013-2015 (\$ MILLIONS/%)</i>	192
<i>TABLE 103 GENZYME: RECENT DEVELOPMENTS</i>	193
TISSUE ENGINEERING PRODUCT PORTFOLIO	193
KINETIC CONCEPTS INC.	193
<i>TABLE 104 KINETIC CONCEPTS INC.: RECENT DEVELOPMENTS</i>	194
TISSUE ENGINEERING PRODUCT PORTFOLIO	194
MESOBLAST LTD.	194
<i>TABLE 105 MESOBLAST LTD. FINANCIALS, 2013-2015 (\$ MILLIONS/%)</i>	195
<i>TABLE 106 MESOBLAST LTD.: RECENT DEVELOPMENTS</i>	195
TISSUE ENGINEERING PRODUCT PORTFOLIO	195
NUO THERAPEUTICS INC. (CYTOMEDIX INC.)	196
<i>TABLE 107 NUO THERAPEUTICS INC. FINANCIALS, 2013-2015 (\$ MILLIONS/%)</i>	196
<i>TABLE 108 NUO THERAPEUTICS INC.: RECENT DEVELOPMENTS</i>	196
TISSUE ENGINEERING PRODUCT PORTFOLIO	197
OCATA THERAPEUTICS INC. (ASTELLAS PHARMA INC.)	197
<i>TABLE 109 ADVANCED CELL TECHNOLOGY INC.: RECENT DEVELOPMENTS</i>	197
TISSUE-ENGINEERING PRODUCT PORTFOLIO	198
ORGANOGENESIS INC. (ADVANCED BIOHEALING)	198
<i>TABLE 110 ORGANOGENESIS INC.: RECENT DEVELOPMENTS</i>	198
TISSUE ENGINEERING PRODUCT PORTFOLIO	199
ORTHOPEUTICS L.P.	199
<i>TABLE 111 ORTHOPEUTICS: RECENT DEVELOPMENTS</i>	199
U.S. STEM CELL INC. (BIOHEART INC.)	199
<i>TABLE 112 U.S. STEM CELL INC. FINANCIALS, 2013-2015 (\$ MILLIONS/%)</i>	200
<i>TABLE 113 U.S. STEM CELL INC.: RECENT DEVELOPMENTS</i>	200
TISSUE ENGINEERING PRODUCT PORTFOLIO	200
VERICEL CORP. (AASTROM BIOSCIENCES INC.)	201
<i>TABLE 114 VERICEL CORP. FINANCIALS, 2013-2015 (\$ MILLIONS/%)</i>	201
<i>TABLE 115 VERICEL CORP.: RECENT DEVELOPMENTS</i>	201
TISSUE ENGINEERING PRODUCT PORTFOLIO	202
WRIGHT MEDICAL GROUP N.V	202
<i>TABLE 116 WRIGHT MEDICAL GROUP N.V. FINANCIALS, 2013-2015 (\$ MILLIONS/%)</i>	203
<i>TABLE 117 WRIGHT MEDICAL TECHNOLOGY INC.: RECENT DEVELOPMENTS</i>	203
TISSUE ENGINEERING PRODUCT PORTFOLIO	204

**LIST OF TABLES**

<b>TABLE HEADING</b>	<b>PAGE NO.</b>
SUMMARY TABLE GLOBAL MARKET FOR TISSUE ENGINEERING AND REGENERATION, BY REGION, THROUGH 2021 (\$ MILLIONS)	7
TABLE 1 U.S. AND EUROPEAN DIFFERENCES IN REGULATORY APPROVAL	21
TABLE 2 MAIN ASPECTS OF HEALTHCARE PROVISIONS IN DIFFERENT COUNTRIES	23
TABLE 3 U.S. CLINICAL TRIALS FOR TISSUE ENGINEERING, BY COMPANY, 2010-2016	28
TABLE 4 COMPLETED U.S. CLINICAL TRIALS CONDUCTED FOR TISSUE ENGINEERING, 2004-2015	29
TABLE 5 TERMINATED U.S. CLINICAL TRIALS, 2012-2018	34
TABLE 6 EUROPEAN CLINICAL TRIALS CONDUCTED FOR TISSUE ENGINEERING, 2009-2019	36
TABLE 7 GLOBAL MARKET FOR TISSUE ENGINEERING AND REGENERATION, BY COMPONENTS, THROUGH 2021 (\$ MILLIONS)	46
TABLE 8 GLOBAL MARKET FOR TISSUE ENGINEERING AND REGENERATION, BY THERAPEUTIC PRODUCT, THROUGH 2021 (\$ MILLIONS)	47
TABLE 9 GLOBAL CELL THERAPY MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	49
TABLE 10 PROJECTS AND THEIR ASSESSMENT STAGES (£)	55
TABLE 11 GLOBAL SMALL MOLECULES AND BIOLOGICS MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	55
TABLE 12 GLOBAL TISSUE ENGINEERING MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	57
TABLE 13 GLOBAL GENE THERAPY MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	59
TABLE 14 GLOBAL MARKET FOR TISSUE ENGINEERING AND REGENERATION, BY THERAPEUTIC MATERIAL, THROUGH 2021 (\$ MILLIONS)	64
TABLE 15 GLOBAL SYNTHETIC MATERIAL MARKET, BY TYPE, THROUGH 2021 (\$ MILLIONS)	65
TABLE 16 GLOBAL SYNTHETIC MATERIAL MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	66
TABLE 17 BIODEGRADABLE POLYMER CLASSIFICATION	66
TABLE 18 GLOBAL BIODEGRADABLE SYNTHETIC POLYMER MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	67
TABLE 19 COMMERCIAL POLYMERIC SCAFFOLD PRODUCTS	69
TABLE 20 GLOBAL SCAFFOLD MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	70
TABLE 21 GLOBAL ARTIFICIAL VASCULAR GRAFT MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	71
TABLE 22 GLOBAL HYDROGEL TECHNOLOGY MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	72
TABLE 23 GLOBAL BIOLOGICALLY DERIVED MARKET, BY TYPE, THROUGH 2021 (\$ MILLIONS)	73
TABLE 24 GLOBAL BIOLOGICALLY DERIVED MATERIAL MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	73
TABLE 25 GLOBAL BIOLOGICALLY DERIVED COLLAGEN MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	74
TABLE 26 GLOBAL BIOLOGICALLY DERIVED XENOGENIC TISSUE MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	75
TABLE 27 GLOBAL GENETICALLY ENGINEERED MATERIAL MARKET, BY TYPE, THROUGH 2021 (\$ MILLIONS)	77
TABLE 28 GLOBAL GENETICALLY ENGINEERED MATERIAL MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	78

<b>TABLE HEADING</b>	<b>PAGE NO.</b>
TABLE 29 GLOBAL DEOXYRIBONUCLEIC ACID TRANSFECTION VECTOR MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	79
TABLE 30 GLOBAL GENETICALLY MANIPULATED CELL MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	80
TABLE 31 GLOBAL THREE-DIMENSIONAL POLYMER TECHNOLOGY MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	81
TABLE 32 GLOBAL TRANSGENIC MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	81
TABLE 33 GLOBAL FIBROBLAST MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	82
TABLE 34 GLOBAL NEURAL STEM CELL MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	83
TABLE 35 GLOBAL GENE-ACTIVATED MATRIX MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	84
TABLE 36 GLOBAL MARKET FOR SMALL MOLECULES AND BIOLOGICS, BY REGION, THROUGH 2021 (\$ MILLIONS)	85
TABLE 37 GLOBAL TISSUE ENGINEERING AND REGENERATION MARKET, BY APPLICATION, THROUGH 2021 (\$ MILLIONS)	87
TABLE 38 GLOBAL TISSUE ENGINEERING AND REGENERATION MARKET FOR CARDIOVASCULAR APPLICATIONS, BY REGION, THROUGH 2021 (\$ MILLIONS)	89
TABLE 39 CELL THERAPIES BY DIFFERENT COMPANIES TO TREAT CADIOVASULAR DISEASES	92
TABLE 40 GLOBAL TISSUE ENGINEERING AND REGENERATION MARKET FOR ONCOLOGY APPLICATION, BY REGION, THROUGH 2021 (\$ MILLIONS)	94
TABLE 41 GLOBAL AND U.S. STATISTICS FOR SKIN DAMAGE MEDICAL CONDITIONS, 2011	95
TABLE 42 ACELLULAR SKIN TISSUE-ENGINEERED PRODUCTS IN THE MARKET	96
TABLE 43 CELLULAR SKIN TISSUE-ENGINEERED PRODUCTS IN THE MARKET	96
TABLE 44 GLOBAL TISSUE ENGINEERING AND REGENERATION MARKET FOR DERMATOLOGY APPLICATION, BY REGION, THROUGH 2021 (\$ MILLIONS)	98
TABLE 45 GLOBAL TISSUE ENGINEERING AND REGENERATION MARKET FOR MUSCULOSKELETAL APPLICATIONS, BY REGION, THROUGH 2021 (\$ MILLIONS)	99
TABLE 46 ORTHOPEDIC DISEASES BY REGION: KEY FACTS	99
TABLE 47 BONE DAMAGE AND RELATED DISEASE STATISTICS, 2011 (NO. OF PEOPLE)	100
TABLE 48 GLOBAL STATISTICS FOR CARTILAGE DAMAGE, 2007	104
TABLE 49 IN VITRO VERSUS IN VIVO SKELETAL MUSCLE TISSUE ENGINEERING	107
TABLE 50 GLOBAL TISSUE ENGINEERING AND REGENERATION MARKET FOR WOUND HEALING APPLICATIONS, BY REGION, THROUGH 2021 (\$ MILLIONS)	108
TABLE 51 GLOBAL TISSUE ENGINEERING AND REGENERATION MARKET FOR OPHTHALMOLOGY APPLICATION, BY REGION, THROUGH 2021 (\$ MILLIONS)	111
TABLE 52 GLOBAL TISSUE ENGINEERING AND REGENERATION MARKET FOR NEUROLOGY APPLICATION, BY REGION, THROUGH 2021 (\$ MILLIONS)	113
TABLE 53 GLOBAL STATISTICS FOR NEURODEGENERATIVE DISEASES, 2015	116
TABLE 54 U.S. STATISTICS FOR SPINAL CORD INJURIES, 2015	117
TABLE 55 GLOBAL MARKET FOR OTHER APPLICATIONS, BY REGION, THROUGH 2021 (\$ MILLIONS)	121
TABLE 56 U.S. STATISTICS FOR LIVER FAILURE, 2011	123
TABLE 57 ARTIFICIAL LIVER SUPPORT SYSTEMS	123
TABLE 58 U.S. STATISTICS FOR PANCREATIC CANCER AND DIABETES, 2010	125
TABLE 59 U.S. STATISTICS FOR KIDNEY DISEASES, 2013	127
TABLE 60 GLOBAL TISSUE ENGINEERING AND REGENERATION MARKET, BY REGION, THROUGH 2021 (\$ MILLIONS)	130
TABLE 61 NORTH AMERICAN COMMERCIALIZED TISSUE ENGINEERING PRODUCTS	130

<b>TABLE HEADING</b>	<b>PAGE NO.</b>
TABLE 62 NORTH AMERICAN TISSUE ENGINEERING AND REGENERATION MARKET, BY COMPONENTS, THROUGH 2021 (\$ MILLIONS)	134
TABLE 63 U.S. STATISTICS FOR SKIN DAMAGE CONDITIONS REQUIRING WOUND CARE, 2011	134
TABLE 64 U.S. STATISTICS FOR BONE DAMAGE AND RELATED DISEASES, 2010	136
TABLE 65 U.S. STATISTICS FOR CARDIOVASCULAR DISEASE, 2014	137
TABLE 66 TISSUE ENGINEERING RESEARCH CONDUCTED AS PER DIFFERENT UNIVERSITIES	137
TABLE 67 TISSUE ENGINEERING PRODUCTS OFFERED BY DIFFERENT COMPANIES	138
TABLE 68 CANADA STATISTICS FOR CARDIOVASCULAR DISEASE, 2014	139
TABLE 69 CANADA STATISTICS FOR SPINAL CORD INJURY, 2014	139
TABLE 70 MEXICO STATISTICS FOR CARDIOVASCULAR DISEASE, 2011-2014	140
TABLE 71 MEXICO STATISTICS FOR OTHER DISEASES AND INJURIES, 2012	140
TABLE 72 TISSUE ENGINEERING FIRMS, BY BUSINESS TYPE, 2014 (%)	141
TABLE 73 TISSUE ENGINEERING FIRMS IN FEW EUROPEAN COUNTRIES (%)	142
TABLE 74 EUROPEAN TISSUE ENGINEERING AND REGENERATION MARKET, BY COMPONENTS, THROUGH 2021 (\$ MILLIONS)	142
TABLE 75 GERMANY STATISTICS FOR MORTALITY CAUSES, 2013	144
TABLE 76 COMPANIES THAT TARGET DIFFERENT TISSUE ENGINEERING AREAS	145
TABLE 77 DIFFERENT CAUSES OF DEATH: U.K. STATISTICS, 2013	146
TABLE 78 COMPANIES THAT TARGET DIFFERENT TISSUE ENGINEERING AREAS	146
TABLE 79 COMPANIES THAT TARGET DIFFERENT TISSUE ENGINEERING AREAS	147
TABLE 80 STATISTICS FOR COST OF BONE DAMAGE REPAIR AND RELATED DISORDERS IN EUROPE	149
TABLE 81 CARDIOVASCULAR DISEASE HEALTHCARE COST, BY COUNTRY, 2014 (\$ BILLIONS)	149
TABLE 82 EUROPEAN STEM CELL POLICIES, BY COUNTRY	151
TABLE 83 EUROPEAN COMPANIES DEVELOPING PRODUCTS IN TISSUE ENGINEERING AND REGENERATION FOR CENTRAL NERVOUS SYSTEM DISORDERS AND INJURIES	152
TABLE 84 ASIA-PACIFIC TISSUE ENGINEERING AND REGENERATION MARKET, BY COMPONENTS, THROUGH 2021 (\$ MILLIONS)	156
TABLE 85 GLOBAL STATISTICS FOR SKIN-RELATED MEDICAL CONDITIONS, 2014	158
TABLE 86 REST OF WORLD TISSUE ENGINEERING AND REGENERATION MARKET, BY COMPONENTS, THROUGH 2021 (\$ MILLIONS)	159
TABLE 87 GLOBAL STATISTICS FOR CENTRAL NERVOUS SYSTEM DISORDERS AND INJURIES, 2015	161
TABLE 88 KEY APPROVALS, 2012-2016	166
TABLE 89 KEY ANNOUNCED AGREEMENTS, EXPANSIONS AND COLLABORATIONS, 2012-2016	169
TABLE 90 KEY ANNOUNCED PRODUCT LAUNCHES AND PATENT APPROVALS, 2012-2016	171
TABLE 91 KEY ANNOUNCED ACQUISITIONS AND MERGERS, 2012-2016	173
TABLE 92 ARTERIOCYTE MEDICAL SYSTEMS INC.: RECENT DEVELOPMENTS	184
TABLE 93 ATHERSYS INC. FINANCIALS, 2013-2015 (\$ MILLIONS/%)	185
TABLE 94 ATHERSYS INC.: RECENT DEVELOPMENTS	186
TABLE 95 CERAPEDICS INC.: RECENT DEVELOPMENTS	186
TABLE 96 CO.DON AG: RECENT DEVELOPMENTS	188
TABLE 97 COOK MEDICAL INC.: RECENT DEVELOPMENTS	188
TABLE 98 CRYOLIFE INC. FINANCIALS, 2013-2015 (\$ MILLIONS/%)	190
TABLE 99 CRYOLIFE INC.: RECENT DEVELOPMENTS	190

<b>TABLE HEADING</b>	<b>PAGE NO.</b>
TABLE 100 CYTORI THERAPEUTICS FINANCIALS, 2013-2015 (\$ MILLIONS/%)	191
TABLE 101 CYTORI THERAPEUTICS INC.: RECENT DEVELOPMENTS	191
TABLE 102 GENZYME CORP. FINANCIALS, 2013-2015 (\$ MILLIONS/%)	192
TABLE 103 GENZYME: RECENT DEVELOPMENTS	193
TABLE 104 KINETIC CONCEPTS INC.: RECENT DEVELOPMENTS	194
TABLE 105 MESOBLAST LTD. FINANCIALS, 2013-2015 (\$ MILLIONS/%)	195
TABLE 106 MESOBLAST LTD.: RECENT DEVELOPMENTS	195
TABLE 107 NUO THERAPEUTICS INC. FINANCIALS, 2013-2015 (\$ MILLIONS/%)	196
TABLE 108 NUO THERAPEUTICS INC.: RECENT DEVELOPMENTS	196
TABLE 109 ADVANCED CELL TECHNOLOGY INC.: RECENT DEVELOPMENTS	197
TABLE 110 ORGANOGENESIS INC.: RECENT DEVELOPMENTS	198
TABLE 111 ORTHOPEUTICS: RECENT DEVELOPMENTS	199
TABLE 112 U.S. STEM CELL INC. FINANCIALS, 2013-2015 (\$ MILLIONS/%)	200
TABLE 113 U.S. STEM CELL INC.: RECENT DEVELOPMENTS	200
TABLE 114 VERICEL CORP. FINANCIALS, 2013-2015 (\$ MILLIONS/%)	201
TABLE 115 VERICEL CORP.: RECENT DEVELOPMENTS	201
TABLE 116 WRIGHT MEDICAL GROUP N.V. FINANCIALS, 2013-2015 (\$ MILLIONS/%)	203
TABLE 117 WRIGHT MEDICAL TECHNOLOGY INC.: RECENT DEVELOPMENTS	203

**LIST OF FIGURES**

<b>FIGURE TITLE</b>	<b>PAGE NO.</b>
SUMMARY FIGURE GLOBAL MARKET FOR TISSUE ENGINEERING AND REGENERATION, BY REGION, 2015-2021 (\$ MILLIONS)	8
FIGURE 1 TISSUE ENGINEERING STRATEGIES	12
FIGURE 2 NANOTECHNOLOGY AND TISSUE REGENERATION	14
FIGURE 3 PORTER'S FIVE FORCES MODEL FOR TISSUE ENGINEERING AND REGENERATIVE MEDICINE MARKET	26
FIGURE 4 GROWTH IN DISEASE TREATED VERSUS CLINICAL TRIALS, 2011-2016 (NO. OF STUDIES)	39
FIGURE 5 T-CELL THERAPY TECHNIQUE	93
FIGURE 6 REGENERATIVE MEDICINE COMPANIES BY SIZE AND REGION (NO. OF COMPANIES)	129
FIGURE 7 PATHWAY FOR DISSEMINATION OF REGENERATIVE MEDICINE	155
FIGURE 8 KEY COMPETITIVE STRATEGIES, 2012-2016* (%)	163
FIGURE 9 APPROVAL STRATEGY BY COMPANY*, 2012-2016 (%)	165
FIGURE 10 AGREEMENT, EXPANSION AND COLLABORATION STRATEGIES BY COMPANY*, 2012-2016	168
FIGURE 11 PRODUCT LAUNCH AND PATENT APPROVAL STRATEGIES BY COMPANY*, 2012-2016 (%)	170
FIGURE 12 ACQUISITIONS AND MERGERS STRATEGIES BY COMPANY*, 2012-2016	172
FIGURE 13 GLOBALLY REGISTERED AND APPROVED PATENTS, 2016 (%)	176
FIGURE 14 U.S., EUROPE AND JAPAN REGISTERED AND APPROVED PATENTS, 2012-2016 (%)	177
FIGURE 15 U.S. PATENT ANALYSIS BY MARKET PARTICIPANT, 2011-2016 (%)	177
FIGURE 16 U.S. PATENT ANALYSIS BY APPLICATION, 2012-2016 (%)	179
FIGURE 17 EUROPE PATENT ANALYSIS BY MARKET PARTICIPANT, 2011-2016 (%)	180
FIGURE 18 EUROPE PATENT ANALYSIS BY APPLICATION, 2011-2016 (%)	180
FIGURE 19 JAPAN PATENT ANALYSIS BY APPLICATION, 2011-2016 (%)	181
FIGURE 20 JAPAN PATENT ANALYSIS BY MARKET PARTICIPANT, 2011-2016 (%)	181