

FOREWORD	XIII
BIOCOMPATIBLE MATERIALS FOR THE HUMAN BODY.....	1
INTRODUCTION	2
STUDY GOAL AND OBJECTIVES	2
REASONS FOR DOING THE STUDY	2
INTENDED AUDIENCE.....	2
SCOPE OF REPORT	3
INFORMATION SOURCES	3
ANALYST'S CREDENTIALS.....	4
RELATED BCC REPORTS	4
BCC ONLINE SERVICES.....	4
DISCLAIMER	4
SUMMARY.....	5
<i>TABLE 1 U.S. MARKET FORECAST FOR BIOCOMPATIBLE</i>	
<i>MATERIALS BY SEGMENT, THROUGH 2012 (\$ MILLIONS)</i>	5
<i>FIGURE 1 U.S. MARKET FOR BIOCOMPATIBLE MATERIALS, BY</i>	
<i>SEGMENT 2004-2012 (\$ MILLIONS)</i>	6
OVERVIEW	7
INTRODUCTION TO BIOCOMPATIBLE MATERIALS	7
TYPES OF MATERIALS	7
CERAMICS.....	7
Ceramics (Continued).....	8
<i>TABLE 2 COMMON BIOCOMPATIBLE CERAMICS</i>	9
METALS	9
Titanium	10
Gold	10
Platinum	10
<i>TABLE 3 COMMON BIOCOMPATIBLE METALS</i>	11
POLYMERS.....	11
PLA and PGA.....	12
PTFE	12
<i>TABLE 4 COMMON BIOCOMPATIBLE POLYMERES</i>	13
NATURAL MATERIALS	13
Collagen	14
Chitosan.....	14
Alginate.....	15
<i>TABLE 5 COMMON BIOCOMPATIBLE NATURAL MATERIALS</i>	15
TECHNOLOGY	16
ADVANCES IN BIOACTIVE MATERIALS	16

GROWTH FACTORS	16
DRUG-ELUTING SURFACES	17
HYDROGELS	17
Hydrogels for Growth Factor Delivery	18
Mechanoresponsive Hydrogels.....	19
Poly(HEMA).....	19
DEGRADABLE OR BIORESORBABLE MATERIALS.....	19
Chitosan	20
Polyethylene Oxide	20
Ethylene-vinyl Acetate	21
THE CHALLENGES OF BIOCOMPATIBILITY	21
BLOOD COMPATIBILITY AND PROTEIN ADSORPTION	21
Albumin.....	22
Immunoglobulins	22
Fibrinogen	22
CALCIFICATION.....	23
INFECTION AND BIOFILMS	23
HOST IMMUNE RESPONSE	24
Wound Healing and Inflammation	24
Foreign Body Immune Reaction and Rejection	25
Complement Immune Response	26
RECENT ADVANCES IN ENABLING TECHNOLOGIES	27
BIOMIMETICS	27
NANOTECHNOLOGY.....	28
TISSUE ENGINEERING	29
STEM CELLS.....	30
BIOREACTOR TECHNOLOGY	30
IMPLANTABLE MEDICAL DEVICES	31
<i>TABLE 6 U.S. MARKET FORECAST FOR IMPLANTABLE MEDICAL</i>	
<i>DEVICES BY SEGMENT, THROUGH 2012 (\$ MILLIONS).....</i>	<i>31</i>
<i>FIGURE 2 U.S. MARKET FOR IMPLANTABLE MEDICAL DEVICES,</i>	
<i>BY SEGMENT 2004-2012 (\$ MILLIONS).....</i>	<i>32</i>
SURFACE COATINGS.....	32
<i>TABLE 7 U.S. MARKET FORECAST FOR BIOCOMPATIBLE SURFACE</i>	
<i>COATINGS BY SEGMENT, THROUGH 2012</i>	<i>(\$</i>
<i>MILLIONS).....</i>	<i>33</i>
<i>FIGURE 3 U.S. MARKET FOR BIOCOMPATIBLE SURFACE</i>	
<i>COATINGS BY SEGMENT, 2004-2012 (\$ MILLIONS).....</i>	<i>33</i>
SURFACE COATINGS (CONTINUED)	34
ADVANCED ORTHOPEDIC TECHNOLOGIES, IMPLANTS AND	
 REGENERATIVE PRODUCTS	35
INTRODUCTION	36
STUDY GOALS AND OBJECTIVES.....	36

REASONS FOR DOING THE STUDY	36
SCOPE OF THE REPORT	36
METHODOLOGY	37
RELATED BCC STUDIES	37
ANALYST CREDENTIALS.....	38
SUMMARY.....	39
<i>TABLE 8 ADVANCED ORTHOPEDIC TECHNOLOGY, IMPLANTS, AND REGENERATIVE PRODUCTS, THROUGH 2012 (\$ MILLIONS)</i>	41
<i>FIGURE 4 ADVANCED ORTHOPEDIC TECHNOLOGY, IMPLANTS AND REGENERATIVE PRODUCTS, 2005-2012 (\$ MILLIONS)</i>	41
MARKETS BY WORLD REGION	42
<i>TABLE 9 WORLDWIDE DISTRIBUTION OF REVENUES FROM CARTILAGE AND OTHER SOFT TISSUE REPAIR AND REGENERATIVE PRODUCTS BY REGION, 2006 (%)</i>	43
<i>FIGURE 5 WORLDWIDE DISTRIBUTION OF REVENUES FROM CARTILAGE AND OTHER SOFT TISSUE REPAIR AND REGENERATIVE PRODUCTS BY REGION, 2006 (%)</i>	43
LEADING SUPPLIERS AND PARTICIPANTS.....	43
<i>TABLE 10 SUMMARY OF CARTILAGE AND OTHER SOFT TISSUE REPAIR AND REGENERATIVE PRODUCTS BY COMPETITOR REVENUES, 2006 (\$ MILLIONS)</i>	45
<i>FIGURE 6 SUMMARY OF CARTILAGE AND OTHER SOFT TISSUE REPAIR AND REGENERATIVE PRODUCTS BY COMPETITOR REVENUES, 2006 (%)</i>	45
<i>TABLE 11 GLOBAL JOINT REPLACEMENT, IMPLANT AND REGENERATIVE PRODUCT MARKET FORECASTS, THROUGH 2012 (\$ MILLIONS)</i>	46
<i>FIGURE 7 GLOBAL JOINT REPLACEMENT, IMPLANT AND REGENERATIVE PRODUCT MARKET FORECASTS, 2005-2012 (\$ MILLIONS)</i>	46
EMERGING TECHNOLOGY AREAS	47
NANOTECHNOLOGY AND MICROPROCESSORS.....	47
DIGITAL X-RAYS	47
BONE DENSITY IMPROVEMENTS.....	48
HIGH-RESOLUTION CARTILAGE IMAGING	48
STEM CELLS.....	48
Government Limitations	49
Embryonic Stem Cells	50
Adult Stem Cells.....	50
New Stem Cell Findings.....	50
Bone Technology and Stem Cells.....	51

SYNTHETIC BONE GRAFTING TECHNOLOGY	51
BONE MODELING FOR OSTEOPOROTIC SPINAL FRACTURE TESTING	51
ADVANCED MECHANICAL IMPLANT CREATION	51
CURRENT TECHNOLOGY USES	52
BONE GROWTH STIMULATORS.....	52
TENS UNITS.....	52
LED THERAPY	52
LIGHT-EMITTING DIODES WITH INFRARED LASERS	53
THERMAL IMAGING	54
BONE REPAIR AND REGENERATIVE PRODUCTS	55
BONE GRAFTS	55
TABLE 12 BONE GRAFT PRODUCTS AND MATERIALS	56
PROCEDURES USING BONE GRAFTS.....	57
MICROELECTRONIC MEDICAL IMPLANTS: PRODUCTS, TECHNOLOGIES & OPPORTUNITIES.....	58
INTRODUCTION	59
MICROELECTRONIC MEDICAL IMPLANTS	59
STUDY BACKGROUND	59
STUDY GOALS AND OBJECTIVES.....	60
INTENDED AUDIENCE.....	60
SCOPE OF THE STUDY	60
METHODOLOGY AND INFORMATION SOURCES.....	61
ANALYST CREDENTIALS.....	62
OTHER RELEVANT BCC REPORTS	62
EXECUTIVE SUMMARY	63
TABLE 13 GLOBAL MARKET FOR MICROELECTRONIC MEDICAL IMPLANTS BY APPLICATION, THROUGH 2012 (\$ BILLIONS).....	63
FIGURE 8 GLOBAL MARKET FOR MICROELECTRONIC MEDICAL IMPLANTS BY APPLICATION, 2006-2012 (\$ BILLIONS)	63
EXECUTIVE SUMMARY (CONTINUED).....	64
OVERVIEW OF MICROELECTRONIC IMPLANTS	65
GENERAL DESCRIPTION	65
DEFINITION.....	65
HISTORY OF MICROELECTRONIC IMPLANTS	65
Early Origins	65
Early Pacemakers.....	66
Advances in Pacemaker Technology	66
First Implantable Defibrillator	67
Neurostimulators.....	67

First Implantable Drug Pump	68
Cardiac Assist/Replacement Devices	68
Ear Implants.....	68
Eye Implants.....	69
TECHNOLOGIES	69
MINIATURIZATION	69
MATERIALS.....	70
SENSORS	71
POWER SUPPLIES	72
RF TECHNOLOGY	73
APPLICATIONS	74
CARDIOVASCULAR DISEASE	74
<i>TABLE 14 HOSPITALIZATIONS, PHYSICIAN OFFICE VISITS, AND</i>	
<i>DEATHS DUE TO HEART DISEASE IN THE U.S., 2001–2002*</i>	75
Brachycardia.....	75
Hypertrophic Cardiomyopathy	76
Tachyarrhythmia.....	77
Syncope	78
Heart Failure	78
NEUROLOGICAL DISEASES/CONDITIONS	79
Chronic Pain	79
Spinal Cord Injuries	80
Parkinson’s Disease.....	81
Epilepsy.....	82
Depression.....	83
Muscle Spasticity.....	84
Urge Incontinence.....	84
Other Conditions	85
Alzheimer’s Disease	85
BONE DAMAGE	86
DIABETES	87
CANCER.....	88
<i>FIGURE 9 TRENDS IN U.S. CANCER DEATHS, 1998–2006.....</i>	<i>89</i>
IMPAIRED HEARING.....	89
BLINDNESS.....	90
BLINDNESS (continued)	91
GLOBAL MARKET FOR MICROELECTRONIC MEDICAL IMPLANTS.....	92
SUMMARY.....	92
<i>FIGURE 10 TRENDS IN GLOBAL MARKET FOR MICROELECTRONIC</i>	
<i>MEDICAL IMPLANTS, 2006–2012 (\$ BILLIONS).....</i>	<i>92</i>
DETAILED MARKET ESTIMATES AND PROJECTIONS, 2002–2009	92
<i>TABLE 15 GLOBAL MARKET FORECAST FOR MICROELECTRONIC</i>	
<i>MEDICAL IMPLANTS BY TYPE OF IMPLANT, THROUGH 2012</i>	
<i>(\$ MILLIONS).....</i>	<i>93</i>

<i>FIGURE 11 TRENDS IN MICROELECTRONIC MEDICAL IMPLANT APPLICATION MARKET SHARES, 2006 AND 2012 (PERCENT OF TOTAL IMPLANT SALES)</i>	94
<i>FIGURE 11 (CONTINUED)</i>	95

THE GLOBAL MARKET FOR PAIN MANAGEMENT DRUGS AND DEVICES..... 96

INTRODUCTION	97
STUDY GOALS AND OBJECTIVES.....	97
REASONS FOR DOING THIS STUDY	97
CONTRIBUTIONS TO THE STUDY AND FOR WHOM.....	97
SCOPE AND FORMAT	97
METHODOLOGY	98
INFORMATION SOURCES.....	98
ABOUT THE AUTHOR.....	98
RELATED BCC REPORTS	98

SUMMARY..... 99

<i>TABLE 16 GLOBAL PAIN-MANAGEMENT MARKET, THROUGH 2012 (\$ BILLIONS)</i>	100
---	-----

<i>FIGURE 12 SHARE OF GLOBAL PAIN-MANAGEMENT MARKET, BY SEGMENT 2007 AND 2012 (%)</i>	100
---	-----

PAIN-MANAGEMENT MARKET ANALYSIS 101

<i>TABLE 17 HEALTHCARE DEMOGRAPHICS OF OECD COUNTRIES</i>	101
---	-----

<i>TABLE 17 (CONTINUED)</i>	102
-----------------------------------	-----

METHODS THAT PROVIDE PAIN RELIEF.....	102
---------------------------------------	-----

<i>FIGURE 13 PAIN MANAGEMENT METHODS</i>	103
--	-----

PAIN-MANAGEMENT MARKET.....	103
-----------------------------	-----

<i>TABLE 18 GLOBAL PAIN-MANAGEMENT MARKET, THROUGH 2012 (\$ BILLIONS)</i>	104
---	-----

<i>FIGURE 14 GLOBAL PAIN-MANAGEMENT MARKET, 2005-2012</i>	104
---	-----

PHARMACEUTICALS PAIN MANAGEMENT.....	105
--------------------------------------	-----

<i>TABLE 19 GLOBAL PHARMACEUTICALS PAIN-MANAGEMENT MARKET FORECAST, THROUGH 2012 (\$ BILLIONS)</i>	105
--	-----

<i>FIGURE 15 GLOBAL PHARMACEUTICALS PAIN-MANAGEMENT MARKET FORECAST, 2005-2012 (\$ BILLIONS)</i>	106
--	-----

MEDICAL DEVICES PAIN MANAGEMENT.....	106
--------------------------------------	-----

<i>TABLE 20 GLOBAL MEDICAL DEVICES PAIN-MANAGEMENT MARKET FORECAST, THROUGH 2012 (\$ MILLIONS)</i>	107
--	-----

<i>FIGURE 16 GLOBAL MEDICAL DEVICES PAIN-MANAGEMENT MARKET FORECAST, 2005-2012 (\$ MILLIONS)</i>	107
--	-----

PHARMACEUTICALS PAIN-MANAGEMENT MARKET ANALYSIS 108

GLOBAL PHARMACEUTICAL PAIN-MANAGEMENT MARKET	108
<i>TABLE 21 GLOBAL PHARMACEUTICALS PAIN-MANAGEMENT</i>	
<i>MARKET FORECAST, THROUGH 2012 (\$ BILLIONS)</i>	108
<i>FIGURE 17 GLOBAL PHARMACEUTICALS PAIN-MANAGEMENT</i>	
<i>MARKET FORECAST, 2005-2012 (\$ BILLIONS)</i>	109
<i>TABLE 22 GLOBAL PHARMACEUTICALS PAIN-MANAGEMENT</i>	
<i>MARKET BY TYPE, 2007 AND 2012 (%)</i>	110
<i>FIGURE 18 GLOBAL PHARMACEUTICALS PAIN-MANAGEMENT</i>	
<i>MARKET, 2007 (%)</i>	110
<i>FIGURE 19 GLOBAL PHARMACEUTICALS PAIN-MANAGEMENT</i>	
<i>MARKET, 2012 (%)</i>	111
MARKET ANALYSIS BY APPLICATION	112
<i>TABLE 23 GLOBAL PHARMACEUTICALS PAIN-MANAGEMENT</i>	
<i>MARKET FORECAST BY APPLICATION, THROUGH 2012</i>	
<i>(\$ BILLIONS)</i>	112
<i>TABLE 23 (CONTINUED)</i>	113
<i>TABLE 24 GLOBAL PHARMACEUTICALS PAIN-MANAGEMENT</i>	
<i>MARKET SHARES BY APPLICATION, 2007 AND 2012 (%)</i>	114
<i>FIGURE 20 GLOBAL PHARMACEUTICALS PAIN-MANAGEMENT</i>	
<i>MARKET SHARES BY APPLICATION, 2007 (%)</i>	115
<i>FIGURE 21 GLOBAL PHARMACEUTICALS PAIN-MANAGEMENT</i>	
<i>MARKET SHARES BY APPLICATION, 2012 (%)</i>	115
GEOGRAPHIC MARKET ANALYSIS.....	116
<i>TABLE 25 GLOBAL PHARMACEUTICALS PAIN-MANAGEMENT</i>	
<i>MARKET BY REGION, THROUGH 2012 (\$ BILLIONS)</i>	116
<i>FIGURE 22 GLOBAL PHARMACEUTICALS PAIN-MANAGEMENT</i>	
<i>MARKET BY REGION, 2005-2012 (\$ BILLIONS)</i>	117
GEOGRAPHIC DISTRIBUTION	117
<i>TABLE 26 GLOBAL PHARMACEUTICALS PAIN-MANAGEMENT</i>	
<i>MARKET SHARES, BY REGION, 2007 AND 2012 (%)</i>	118
<i>FIGURE 23 GLOBAL PHARMACEUTICALS PAIN-MANAGEMENT</i>	
<i>MARKET SHARES, BY REGION, 2007 (%)</i>	118
<i>FIGURE 24 GLOBAL PHARMACEUTICALS PAIN-MANAGEMENT</i>	
<i>MARKET SHARES, BY REGION, 2012 (%)</i>	119
MEDICAL IMAGING: EQUIPMENT AND RELATED PRODUCTS	120
INTRODUCTION	121
STUDY GOAL AND OBJECTIVES	121
SCOPE OF REPORT	121
METHODOLOGY AND INFORMATION SOURCES.....	122
ABOUT THE AUTHOR.....	122
RELATED BCC REPORTS	123
SUMMARY.....	124

TABLE 27 U.S. MARKET PROJECTIONS FOR MEDICAL IMAGING EQUIPMENT BY SEGMENT, THROUGH 2012 (\$ MILLIONS).....	124
FIGURE 25 U.S. MARKET PROJECTIONS FOR MEDICAL IMAGING EQUIPMENT BY SEGMENT, 2004-2012 (\$ MILLIONS)	125
U.S. MARKET FOR MEDICAL IMAGING BY MODALITY/SEGMENT.....	126
TABLE 28 U.S. MARKET PROJECTIONS FOR MEDICAL IMAGING BY SEGMENT, THROUGH 2012 (\$ MILLIONS)	126
ULTRASOUND IMAGING EQUIPMENT	126
TABLE 29 U.S. MARKET PROJECTIONS FOR ULTRASOUND SCANNERS BY TYPE, THROUGH 2012 (\$ MILLIONS).....	127
FIGURE 26 U.S. MARKET PROJECTIONS FOR ULTRASOUND SCANNERS BY TYPE, 2004-2012 (\$ MILLIONS).....	128
TABLE 30 U.S. MARKET PROJECTIONS FOR ULTRASOUND SCANNERS BY TYPE, THROUGH 2012 (\$ MILLIONS).....	128
FIGURE 27 U.S. MARKET PROJECTIONS FOR ULTRASOUND SCANNERS BY TYPE, 2004-2012 (\$ MILLIONS)	129
MRI SCANNERS	129
TABLE 31 U.S. MARKET PROJECTIONS FOR MRI IMAGING EQUIPMENT BY PRODUCT, THROUGH 2012 (\$ MILLIONS).....	130
FIGURE 28 U.S. MARKET PROJECTIONS FOR MRI IMAGING EQUIPMENT BY PRODUCT, 2004-2012 (\$ MILLIONS).....	130
MRI SCANNERS (CONTINUED)	131
U.S MARKET FOR RADIOGRAPHIC SCANNERS	132
TABLE 32 U.S. MARKET PROJECTIONS FOR RADIOGRAPHY IMAGING EQUIPMENT BY SUBSEGMENT, THROUGH 2012 (\$ MILLIONS).....	132
FIGURE 29 U.S. MARKET PROJECTIONS FOR RADIOGRAPHY IMAGING EQUIPMENT BY SUBSEGMENT, 2004-2012 (\$ MILLIONS).....	133
U.S MARKET FOR COMPUTED TOMOGRAPHY SCANNERS.....	134
TABLE 33 U.S. MARKET PROJECTIONS FOR CT SCANNERS BY PRODUCT TYPE, THROUGH 2012 (\$ MILLIONS)	135
FIGURE 30 U.S. MARKET PROJECTIONS FOR CT SCANNERS BY PRODUCT TYPE, 2004-2012 (\$ MILLIONS).....	136
FIGURE 31 HIGHEST NUMBER OF DETECTORS REPORTED AT IMAGING FACILITIES IN THE U.S. (%).....	136
FIGURE 31 (CONTINUED)	137
U.S. MARKET FOR PET SCANNERS	137
TABLE 34 U.S. MARKET PROJECTIONS FOR PET SCANNERS BY PRODUCT TYPE, THROUGH 2012 (\$ MILLIONS).....	137
FIGURE 32 U.S. MARKET PROJECTIONS FOR PET SCANNERS BY PRODUCT, 2004-2012 (\$ MILLIONS)	138

THE HOME MEDICAL EQUIPMENT MARKET	139
INTRODUCTION	140
STUDY BACKGROUND	140
STUDY GOALS AND OBJECTIVES	140
INTENDED AUDIENCE.....	141
SCOPE OF REPORT	141
INFORMATION SOURCES	142
ANALYST CREDENTIALS.....	142
RELATED BCC RESEARCH	143
EXECUTIVE SUMMARY	144
<i>TABLE 35 GLOBAL SALES OF HOME MEDICAL EQUIPMENT,</i>	
<i>THROUGH 2012 (\$ BILLIONS)</i>	<i>144</i>
<i>FIGURE 33 SALES OF HOME MEDICAL EQUIPMENT BY REGION,</i>	
<i>2006–2012 (%)</i>	<i>145</i>
OVERVIEW	146
GENERAL DESCRIPTION	146
DEFINITIONS	146
PRODUCT SEGMENTS	146
ASSISTIVE DEVICES	147
Wheelchairs and Scooters	147
Wheelchairs.....	148
Scooters	148
Home Care Beds	149
INFUSION PRODUCTS	150
Insulin Pumps.....	150
RESPIRATORY THERAPY PRODUCTS	151
Inhalers	151
Metered Dose Inhalers.....	151
Dry Powder Inhalers.....	151
Nebulizers	152
Oxygen Concentrators	153
Gaseous Oxygen System	153
Continuous Positive Airway Pressure (CPAP) Devices	154
Home Ventilators.....	155
Suction Machines.....	155
DIALYSIS EQUIPMENT.....	156
Hemodialysis.....	156
Dialysis Machine.....	157
Peritoneal Dialysis	157
CCPD Cyclor	157
HOME DEFIBRILLATORS.....	158
MONITORS AND SENSORS	159

Blood Pressure Monitors	159
Aneroid Monitors	159
Digital Blood Pressure Monitors	160
Peak Flow Meters	161
Glucose Monitors	161
Glucose Monitors (Continued)	162
Glucose Monitors (Continued)	162
Glucose Monitors (Continued)	163
Apnea and SIDS Monitors	164
Cholesterol Monitors	165
Fetal Monitors	165
Home Cardiac Monitors	165
New Home Monitoring Technologies	166
Embedded Monitors	166
Wearable Monitors	167
Wearable Monitors (Continued)	168
HME MARKETS	169
SUMMARY	169
GLOBAL MARKET TRENDS	169
<i>TABLE 36 GLOBAL HME SALES BY TYPE OF EQUIPMENT,</i> <i>THROUGH 2012 (\$ MILLIONS).....</i>	<i>169</i>
<i>FIGURE 34 TRENDS IN THE GLOBAL HME MARKET, 2006-2012</i> <i>(\$ BILLIONS).....</i>	<i>170</i>
MARKET BY HME SEGMENT	170
<i>FIGURE 35 HME MARKET BY TYPE OF HME, 2006 AND 2012 (%).....</i>	<i>171</i>
MARKET BY DISEASE/CONDITION TREATED	172
<i>FIGURE 36 HME MARKET BY TYPE OF DISEASE/CONDITION</i> <i>TREATED, 2006 AND 2012</i>	<i>172</i>
<i>FIGURE 36 (CONTINUED)</i>	<i>173</i>
<i>TABLE 37 HME MARKET BY TYPE OF DISEASE/CONDITION</i> <i>TREATED, THROUGH 2012 (\$ MILLIONS).....</i>	<i>174</i>
MARKET BY GEOGRAPHICAL SEGMENT	175
<i>FIGURE 37 HME MARKET BY TYPE OF REGION, 2006 AND 2012 (%)</i>	<i>175</i>
<i>FIGURE 37 (CONTINUED)</i>	<i>176</i>
<i>TABLE 38 MAJOR GEOGRAPHICAL MARKETS FOR HME, THROUGH</i> <i>2012</i>	<i>176</i>
<i>TABLE 38 (CONTINUED).....</i>	<i>177</i>