

INTRODUCTION .....	xxiii
STUDY GOALS AND OBJECTIVES .....	xxiii
REASONS FOR DOING THE STUDY .....	xxiii
CONTRIBUTION OF THE STUDY AND FOR WHOM .....	xxiii
SCOPE AND FORMAT .....	xxiv
METHODOLOGY .....	xxiv
ANALYST CREDENTIALS .....	xxv
RELATED BCC PUBLICATIONS .....	xxv
BCC ONLINE SERVICES .....	xxv
DISCLAIMER .....	xxvi
SUMMARY .....	xxvii
<i>SUMMARY TABLE GLOBAL VALUE OF EPIGENOMICS PRODUCTS</i>	
<i>BY MARKET SEGMENT, THROUGH 2012 (\$ MILLIONS)</i> .....	XXVII
<i>SUMMARY FIGURE GLOBAL VALUE OF EPIGENOMICS PRODUCTS</i>	
<i>BY MARKET SEGMENT, 2005-2012 (\$ MILLIONS)</i> .....	XXVIII
OVERVIEW .....	1
INTRODUCTION .....	1
THE NEW PARADIGM OF EPIGENOMICS .....	1
<i>FIGURE 1 EPIGENOMICS: A NEW PARADIGM</i> .....	2
HOW EPIGENOMICS FITS WITHIN THE GENOMICS FIELD .....	3
<i>TABLE 1 GENOMICS PLATFORMS</i> .....	3
ELEMENTS OF THE EPIGENOME COVERED IN THIS REPORT .....	4
<i>TABLE 2 ELEMENTS OF THE EPIGENOME COVERED IN THIS</i>	
<i>REPORT</i> .....	5
MARKET POTENTIAL OF EPIGENOMICS .....	6
<i>TABLE 3 GLOBAL VALUE OF EPIGENOMICS PRODUCTS BY</i>	
<i>MARKET SEGMENT, THROUGH 2012 (\$ MILLIONS)</i> .....	6
KEY EPIGENOMICS PRODUCTS .....	7
RESEARCH TOOLS AND REAGENTS .....	7
DIAGNOSTICS .....	7
DRUGS .....	8
DRIVING FORCES FOR GROWTH IN EPIGENOMICS .....	8
IMPORTANCE OF EPIGENETIC TECHNOLOGY .....	9
<i>FIGURE 2 EPIGENETIC PROCESSES CAN GENERATE ABNORMAL</i>	
<i>CELLS DURING CELL DEVELOPMENT</i> .....	10
LIFE CYCLE STATUS OF EPIGENOMICS TECHNOLOGIES .....	11
HISTORICAL BACKGROUND .....	12
<i>TABLE 4 HISTORICAL OVERVIEW OF EPIGENETICS</i> .....	12
THE EPIGENOMICS INDUSTRY .....	13
<i>TABLE 5 EPIGENOMICS INDUSTRY</i> .....	13

THE EPIGENOMICS INDUSTRY (CONTINUED) .....	14
EPIGENETIC TECHNOLOGY .....	15
INTRODUCTION .....	15
TWO MAIN EPIGENOMIC ANALYSIS TECHNOLOGIES .....	15
<i>TABLE 6 TWO TYPES OF EPIGENOMIC ANALYSIS TECHNOLOGIES</i> .....	16
STATUS OF DNA AND HISTONE ANALYSIS TECHNOLOGIES .....	16
<i>TABLE 7 STATUS OF DNA AND HISTONE ANALYSIS     TECHNOLOGIES</i> .....	16
DNA AND HISTONE ANALYSIS WORKFLOW .....	17
<i>FIGURE 3 UPSTREAM AND DOWNSTREAM STEPS IN EPIGENETIC     ANALYSIS</i> .....	18
DNA METHYLATION .....	18
METHYLATED CYTOSINE—A FIFTH BASE .....	18
<i>FIGURE 4 EPIGENETIC CHANGES TO DNA AFFECT GENE     EXPRESSION</i> .....	19
BIOLOGICAL ROLE OF DNA METHYLATION .....	19
<i>TABLE 8 BIOLOGICAL ROLES OF DNA METHYLATION</i> .....	20
<i>TABLE 8 (CONTINUED)</i> .....	21
DNA METHYLTRANSFERASE ENZYMES .....	21
CPG ISLANDS .....	22
<i>TABLE 9 CPG ISLANDS: SUBJECT TO DNA METHYLATION</i> .....	23
HISTONE METHYLATION AND ACETYLATION .....	24
HISTONES .....	24
<i>FIGURE 5 HISTONE TAIL REGIONS MODIFIED BY HAT AND HDAC</i> .....	25
HISTONE ACETYLATION AND METHYLATION ENZYMES .....	26
<i>FIGURE 6 HISTONE ACETYLATION AND METHYLATION ENZYMES</i> .....	26
Histone Acetyl Transferases (HAT Enzymes) .....	27
Histone Deacetylases (HDAC Enzymes) .....	27
<i>TABLE 10 HDAC ENZYMES CLASSES</i> .....	27
Histone Methyltransferases and Demethylases .....	28
INAPPROPRIATE METHYLATION AND ACETYLATION .....	28
<i>TABLE 11 MECHANISMS FOR INAPPROPRIATE METHYLATION     AND ACETYLATION</i> .....	29
EPIGENOMIC ANALYSIS TECHNOLOGIES .....	30
ROLE OF EPIGENOMIC RESEARCH TOOLS .....	30
DNA METHYLATION RESEARCH TOOLS .....	31
<i>TABLE 12 DNA METHYLATION ANALYSIS ASSAYS</i> .....	31
DNA METHYLATION ANALYSIS WORKFLOW .....	32
<i>FIGURE 7 METHYLATED DNA ANALYSIS WORKFLOW</i> .....	33
ANALYSIS TYPES BY WORKFLOW .....	33
<i>TABLE 13 EXAMPLES OF DNA METHYLATION ASSAYS</i> .....	33
DNA METHYLATION ANALYSIS: UPSTREAM TECHNOLOGIES .....	34

<i>TABLE 14 COMPARISON OF UPSTREAM EPIGENOMIC RECOGNITION TECHNOLOGIES</i> .....	34
RESTRICTION ENZYME-BASED METHODS.....	35
<i>FIGURE 8 ANALYSIS OF DNA METHYLATION BY RESTRICTION ENZYMES</i> .....	36
BISULFITE-BASED METHODS .....	36
Bisulfite-Based Methods (Continued).....	37
<i>FIGURE 9 BISULFITE CONVERSION OF DNA</i> .....	38
Analysis of Low Complexity DNA—A Unique Challenge for Bisulfite Methods.....	39
ANTIBODY-BASED METHODS.....	40
CHALLENGE OF HIGH BACKGROUND METHYLATED DNA.....	41
DNA METHYLATION ANALYSIS: DOWNSTREAM TECHNOLOGIES.....	42
GENOME WIDE DNA METHYLATION ANALYSIS.....	42
<i>TABLE 15 DNA METHYLATION ANALYSIS TECHNIQUES BY GENOME RESOLUTION</i> .....	42
GENOME WIDE DNA ... (CONTINUED).....	43
HIGH THROUGHPUT PLATFORMS .....	44
HISTONE EPIGENOMIC ANALYSIS TECHNOLOGIES.....	44
CHROMATIN IMMUNOPRECIPITATION .....	44
CHIP-ON-CHIP .....	45
<i>FIGURE 10 CHIP-ON-CHIP PROCEDURE</i> .....	46
<i>TABLE 16 CHIP ASSAYS</i> .....	47
<i>TABLE 17 TECHNOLOGIES FOR MAPPING GENOMIC LOCATION OF CHROMATIN PROTEINS AND ENZYMES</i> .....	47
MICROARRAYS.....	48
FEATURE DENSITY.....	48
<i>FIGURE 11 MICROARRAY FEATURE DENSITY</i> .....	48
RESOLUTION.....	49
<i>FIGURE 12 MICROARRAY RESOLUTION</i> .....	49
GENOME CONTENT .....	49
<i>TABLE 18 MICROARRAY GENOME CONTENT</i> .....	50
<i>TABLE 19 PLATFORMS FOR HIGH DENSITY OLIGONUCLEOTIDE EPIGENETICS ARRAYS</i> .....	51
SERIAL ANALYSIS OF GENE EXPRESSION .....	51
ANTIBODIES.....	52
ALTERNATIVES TO ANTIBODIES IN UPSTREAM STEP .....	53
DNA ADENINE METHYLTRANSFERASE IDENTIFICATION (DAM ID) .....	53
DNA Adenine Methyltransferase ... (Continued) .....	54
DNA METHYLATION BIOMARKERS .....	55
FROM ANALYSIS TO BIOMARKERS.....	55

OPPORTUNITIES FOR BIOTECHNOLOGY COMPANIES IN DIAGNOSTICS .....	56
WHAT IS A BIOMARKER? .....	57
DNA METHYLATION AS A CANCER BIOMARKER .....	57
DNA METHYLATION IN CANCER ETIOLOGY .....	57
<i>TABLE 20 BIOLOGICAL RATIONALE FOR DNA METHYLATION</i> .....	58
<i>CANCER BIOMARKERS</i> .....	58
<i>TABLE 21 CANCER-RELATED CELL PATHWAYS AND GENES AFFECTED BY HYPER-METHYLATION</i> .....	59
Cell Cycle Control.....	59
Cell Invasion and Adhesion .....	59
DNA Damage Repair .....	59
Growth Factor Response .....	60
Regulation of Apoptosis.....	60
Hormonal Response.....	60
Cytokine Signaling .....	60
<i>TABLE 22 CANCER-RELATED EPIGENETIC CHANGES</i> .....	61
MOLECULAR BIOMARKER TECHNOLOGY COMPARISON.....	62
<i>TABLE 23 COMPARISON OF KEY CANCER BIOMARKER TECHNOLOGY PLATFORMS</i> .....	62
Occurrence within the Genome.....	62
Inheritance in Progenitor Cells.....	63
DNA Base Mutation .....	63
Binary Signal.....	63
Presence of Background Signal.....	63
Stable Change in Biomarker Status .....	64
Stability of Sample Material .....	64
Detection of First Hit.....	64
Occurrence in Early or Pre-Cancers .....	65
Tissue Sample Range .....	65
Test Complexity .....	65
ASSESSMENT OF DNA METHYLATION BIOMARKER COMPETITIVE POSITION .....	66
EPIGENETIC BIOMARKER CANCER GENES.....	67
<i>TABLE 24 PUBLISHED DNA METHYLATION BIOMARKER GENES FOR CANCERS</i> .....	68
EPIGENETIC BIOMARKERS FOR NON-CANCER DISEASES .....	68
<i>TABLE 25 DIFFERENTIALLY METHYLATED GENES IN NEUROLOGIC AND CARDIOVASCULAR DISORDERS</i> .....	69
BIOMARKER DISCOVERY PROCESS.....	69
METHYLATION BIOMARKER DISCOVERY TECHNOLOGIES .....	70
<i>TABLE 26 DNA METHYLATION ANALYSIS TECHNOLOGIES</i> .....	70
<i>IN BIOMARKER DISCOVERY</i> .....	70
<i>TABLE 26 (CONTINUED)</i> .....	71

GENOME-WIDE SCANNING TO HUNT FOR BIOMARKERS .....	71
LARGE SCALE REGIONAL EPIGENOMICS PROJECTS .....	72
TABLE 27 REGIONAL EPIGENOMICS INITIATIVES .....	73
TABLE 27 (CONTINUED).....	74
EUROPE.....	74
UNITED STATES .....	75
ASIA.....	75
HUMAN EPIGENOME PROJECT WILL AID IN THE DISCOVERY OF NEW METHYLATION MARKERS.....	76
TABLE 28 METHYL VARIABLE POSITIONS - MVPS .....	76
TABLE 29 HUMAN EPIGENOME PROJECT: METHYL VARIABLE POSITION ANALYSIS OBJECTIVES.....	77
CASE STUDY: FROM RESEARCH TOOLS TO BIOMARKERS.....	77
CASE STUDY (CONTINUED) .....	78
DEVELOPMENT STAGES FOR AN <i>IN VITRO</i> DIAGNOSTIC .....	79
PHASE 1: BIOMARKER DISCOVERY.....	79
PHASE 2: BIOMARKER VALIDATION.....	79
PHASE 3: FORMAL KIT DEVELOPMENT .....	80
PHASE 4: CLINICAL VALIDATION.....	80
TYPES OF CANCER METHYLATION MARKERS .....	81
FUTURE STATUS OF DNA METHYLATION BIOMARKERS.....	81
TABLE 30 TECHNICAL HURDLES FOR DEVELOPMENT OF METHYLATION EPIGENETIC CANCER BIOMARKERS.....	82
EPIGENETIC CANCER THERAPIES.....	83
INTRODUCTION .....	83
EPIGENETICS IN TUMORIGENESIS.....	83
EPIGENETIC DRUG TARGETS .....	84
TABLE 31 EPIGENETIC GENES ALTERED IN HUMAN CANCERS.....	84
TABLE 31 (CONTINUED).....	85
HISTONE METHYLATION AND ACETYLATION ENZYME DRUG TARGETS .....	86
FIGURE 13 HISTONE DEACETYLASE REACTION.....	87
TABLE 32 STATUS OF EPIGENETIC ENZYMES THAT TARGET HISTONES.....	88
HISTONE DEACETYLASE INHIBITORS .....	88
HDAC ENZYMES AS DRUG TARGETS.....	89
HDAC INHIBITOR DRUG CLASSES .....	90
TABLE 33 HDAC INHIBITOR CLASSES AND RELATIVE POTENCY.....	91
HYDROXAMATES.....	91
FIGURE 14 TRICHOSTATIN A, A HYDROXAMATE CLASS HDAC INHIBITOR.....	92
ALIPHATIC ACIDS .....	92
FIGURE 15 PHENYLBUTYRIC ACID, AN ALIPHATIC ACID CLASS HDAC INHIBITOR.....	93

CYCLIC TETRAPEPTIDES .....	93
FIGURE 16 APICIDIN A, A CYCLIC TETRAPEPTIDE CLASS HDAC INHIBITOR.....	93
BENZAMIDES .....	94
TABLE 34 MS-275, A BENZAMIDE CLASS HDAC INHIBITOR.....	94
KEY HDAC INHIBITOR TECHNOLOGY TRENDS.....	94
TABLE 35 KEY HDAC INHIBITOR DRUG TRENDS .....	95
ENZYME SELECTIVITY .....	95
Enzyme Selectivity (Continued).....	96
TABLE 36 HDAC INHIBITOR CLASS I AND II SELECTIVITY ( $IC_{50}$ RATIO).....	97
POTENCY.....	97
IMPROVEMENTS IN DRUG-LIKE PROPERTIES.....	97
SELECTIVE HDAC COMPOUNDS CAN PROVIDE COMPETITIVE ADVANTAGE .....	98
FIGURE 17 DISEASE HDAC ISOFORM PROFILE .....	98
CHEMICAL DESIGN IS THE KEY TO SELECTIVITY.....	99
FIGURE 18 STRUCTURAL COMPONENTS MOTIFS OF HDAC INHIBITORS .....	99
HDAC INHIBITORS IN COMBINATION THERAPIES.....	100
HDAC INHIBITORS IN ... (CONTINUED) .....	101
TABLE 37 HDAC INHIBITOR DRUG COMPANIONS.....	102
HDAC INHIBITORS IN ... (CONTINUED) .....	103
HDAC INHIBITORS AS THERAPIES FOR NON-CANCER DISEASES .....	104
CARDIAC DISEASE .....	104
DERMATOLOGICAL DISORDERS.....	105
PARASITIC DISEASES.....	106
NEURODEGENERATIVE DISEASES.....	106
DIABETES .....	106
INFLAMMATORY DISEASES.....	107
DNA METHYLTRANSFERASE INHIBITORS (DNMT).....	107
FIGURE 19 LEAD DNMT INHIBITOR COMPOUNDS.....	107
NUCLEOSIDE ANALOGUES.....	108
FIGURE 20 DNMT INHIBITORS AND MODE OF ACTION.....	108
NON-NUCLEOSIDE ANALOGUES.....	109
ANTISENSE OLIGONUCLEOTIDES .....	109
FUTURE CHALLENGES FOR EPIGENETIC DRUG DEVELOPMENT.....	109
TABLE 38 FUTURE CHALLENGES FOR EPIGENETIC DRUG DEVELOPMENT.....	110
EPIGENETICS ASSISTED REPRODUCTIVE TECHNOLOGIES .....	111
SOMATIC CELL NUCLEAR TRANSFER .....	111
FIGURE 21 SOMATIC CELL NUCLEAR TRANSFER.....	111

TABLE 39 TECHNOLOGY OPPORTUNITIES IN SOMATIC CELL NUCLEAR TRANSFER .....	112
TABLE 40 EPIGENETIC ALTERATIONS IN ASSISTED REPRODUCTIVE DISORDERS.....	112
APPLICATIONS OF EPIGENOMICS IN CLONING.....	113
REPROGRAMMING FACTORS .....	113
FIGURE 22 EPIGENETIC PROGRAMMING OF STEM CELLS.....	113
CELLULAR IDENTIFICATION AND QUALITY CONTROL ASSAYS.....	114
Cellular Identification ... (Continued).....	115
MARKET GROWTH DRIVING FORCES .....	116
INTRODUCTION .....	116
TABLE 41 GROWTH IN SCIENTIFIC PUBLICATIONS RELATED TO EPIGENETICS .....	116
KEY GROWTH DRIVERS.....	116
TABLE 42 PRIMARY FORCES DRIVING EPIGENOMICS PRODUCTS GROWTH.....	117
DEVELOPMENT OF NOVEL EPIGENOMICS RESEARCH TOOLS.....	117
CREATION OF EPIGENETIC MAPS .....	117
SCOPE OF EPIGENETIC ANALYSIS .....	118
NEED FOR EARLY CANCER DETECTION .....	118
NEED FOR BETTER CANCER THERAPIES .....	119
GROWTH IN LIFE SCIENCE RESEARCH BUDGETS.....	119
PERSONALIZED MEDICINE TRENDS .....	119
RESEARCH IN EPIGENETIC PROCESSES.....	120
EPIGENOMIC RESEARCH TOOLS MARKETS .....	121
PRODUCTS WITHIN RESEARCH TOOLS.....	121
EPIGENOMIC KITS.....	121
REAGENTS .....	121
MICROARRAYS.....	121
GLOBAL SALES BY TECHNOLOGY .....	121
TABLE 43 GLOBAL MARKET FORECAST FOR EPIGENOMICS RESEARCH TOOL KITS BY TYPE THROUGH 2012 (\$ MILLION).....	122
GLOBAL SALES BY PRODUCT .....	123
TABLE 44 GLOBAL MARKET FORECAST FOR EPIGENOMIC ANALYSIS RESEARCH TOOLS BY TECHNOLOGY THROUGH 2012 (\$ MILLIONS).....	123
EPIGENOMIC KIT SALES BY TECHNOLOGY .....	124
TABLE 45 GLOBAL MARKET FORECAST FOR EPIGENETIC ANALYSIS KITS BY TECHNOLOGY THROUGH 2012 (\$ MILLIONS).....	125
DNA METHYLATION ANALYSIS KIT MARKET .....	125
DNA METHYLATION ... (CONTINUED).....	126

<i>TABLE 46 GLOBAL MARKET FORECAST FOR DNA METHYLATION RESEARCH TOOL KITS BY ANALYSIS OBJECTIVE THROUGH 2012 (\$ MILLIONS)</i> .....	127
<i>TABLE 47 GLOBAL MARKET FORECAST FOR DNA METHYLATION RESEARCH TOOLS KITS BY TECHNOLOGY THROUGH 2012 (\$ MILLIONS)</i> .....	128
<i>TABLE 48 GLOBAL MARKET FORECAST FOR DNA METHYLATION SINGLE LOCI RESEARCH TOOLS KITS BY TECHNOLOGY THROUGH 2012 (\$ MILLIONS)</i> .....	129
<i>TABLE 49 GLOBAL MARKET FORECAST FOR DNA METHYLATION GENOME-WIDE RESEARCH TOOLS KITS BY TECHNOLOGY THROUGH 2012 (\$ MILLIONS)</i> .....	130
HISTONE ANALYSIS KIT MARKET.....	130
<i>TABLE 50 GLOBAL MARKET FORECAST FOR VALUE OF HISTONE ANALYSIS KITS BY TECHNOLOGY THROUGH 2012 (\$ MILLIONS)</i> .....	131
MICROARRAY MARKET.....	131
MICROARRAYS AS DOWNSTREAM ANALYSIS TOOL .....	131
Microarray Differentiation .....	132
<i>FIGURE 23 MICROARRAYS ENHANCE MULTIPLEX CAPABILITIES OF EPIGENETICS ASSAYS</i> .....	132
<i>TABLE 51 MICROARRAY PROBES</i> .....	132
Microarray ... (Continued).....	133
MICROARRAY ANALYSIS PLATFORMS IN THE CLINIC .....	134
<i>TABLE 52 CLINICAL STATUS OF MICROARRAY PLATFORMS</i> .....	134
Microarray Analysis ... (Continued) .....	135
FUTURE MARKET POSITION OF MICROARRAYS .....	136
EPIGENOMIC MICROARRAY MARKET .....	136
<i>TABLE 53 GLOBAL VALUE OF EPIGENOMIC MICROARRAYS BY MARKET THROUGH 2012 (\$ MILLIONS)</i> .....	137
<i>TABLE 54 GLOBAL VALUE OF EPIGENOMIC RESEARCH TOOLS MICROARRAYS BY ANALYSIS THROUGH 2012 (\$ MILLIONS)</i> .....	137
<i>TABLE 55 GLOBAL VALUE OF DIAGNOSTIC MICROARRAYS BY MARKET THROUGH 2012 (\$ MILLIONS)</i> .....	138
REAGENTS MARKET .....	139
<i>TABLE 56 GLOBAL VALUE OF EPIGENOMIC REAGENTS BY MARKET THROUGH 2012 (\$ MILLIONS)</i> .....	139
<i>TABLE 57 GLOBAL VALUE OF RESEARCH TOOLS EPIGENOMIC REAGENTS BY TECHNOLOGY THROUGH 2012 (\$ MILLIONS)</i> .....	139
REAGENTS MARKET (CONTINUED) .....	140
EPIGENETIC BIOMARKER AND DIAGNOSTICS MARKETS .....	141
OVERVIEW OF CANCER DIAGNOSTICS MARKET .....	141
<i>TABLE 58 VALUE OF GLOBAL MOLECULAR DIAGNOSTICS MARKETS BY SEGMENT THROUGH 2012 (\$ MILLIONS)</i> .....	141
CANCER MOLECULAR DIAGNOSTICS GROWTH DRIVERS .....	142



<i>TABLE 59 TARGETED THERAPY CANCER DRUG COMPOUNDS IN DEVELOPMENT</i> .....	143
METHYLATION BIOMARKERS CLINICAL DEVELOPMENT STATUS .....	143
<i>TABLE 60 DEVELOPMENT STATUS OF SELECTED METHYLATION BIOMARKERS BY CANCER TYPE</i> .....	144
CANCER DIAGNOSTIC MARKET SEGMENTS .....	144
ATTRACTIVE CANCER INDICATIONS FOR SCREENING MARKETS .....	145
<i>FIGURE 24 CANCER SCREENING OPPORTUNITY MATRIX FOR EPIGENETIC TESTS IN DEVELOPMENT</i> .....	146
<i>FIGURE 25 NEW EPIGENETIC SCREENING PARADIGM</i> .....	147
SENSITIVITY AND SPECIFICITY .....	148
<i>FIGURE 26 SENSITIVITY AND SPECIFICITY</i> .....	148
STATUS OF DIAGNOSTICS TESTS FOR SELECTED CANCER INDICATIONS .....	149
COLORECTAL CANCER .....	149
Colorectal Cancer Screening Tests .....	149
<i>TABLE 61 CURRENT SCREENING AND DIAGNOSTIC TESTS FOR COLORECTAL CANCER</i> .....	150
DNA-based Colorectal Screening Tests .....	151
Epigenetics-based Colorectal Screening Tests .....	151
<i>TABLE 62 ACCURACY OF EXISTING COLORECTAL SCREENING TESTS</i> .....	152
Colorectal Cancer Non-screening Tests.....	153
BLADDER CANCER.....	153
BREAST CANCER.....	153
Screening for Breast Cancer .....	154
Relapse Risk Prediction.....	154
Therapy Prediction .....	155
PROSTATE CANCER .....	156
LUNG CANCER .....	157
OVARIAN CANCER .....	158
<i>TABLE 63 OVARIAN CANCER POTENTIAL SCREENING TESTS</i> .....	158
CERVICAL CANCER.....	159
PANCREATIC CANCER .....	159
GASTRIC CANCER .....	160
PEDIATRIC CANCERS.....	160
PERSONALIZED TREATMENT EPIGENETIC-BASED TESTS.....	161
KEY CLINICAL REQUIREMENTS FOR AN EPIGENETIC-BASED DIAGNOSTICS TEST .....	161
<i>TABLE 64 REQUIREMENTS FOR AN EPIGENETICS BISULFITE DIAGNOSTIC KIT</i> .....	162

AVAILABLE MARKET FOR CANCER MOLECULAR DIAGNOSTIC TESTS .....	163
<i>TABLE 65 GLOBAL 2007 POTENTIAL AVAILABLE MARKET FOR CANCER MOLECULAR DIAGNOSTIC TEST KITS BY MARKET SEGMENT (\$ MILLIONS)</i> .....	164
AVAILABLE MARKET FOR ... (CONTINUED).....	165
<i>TABLE 66 GLOBAL 2007 POTENTIAL AVAILABLE MARKET FOR CANCER MOLECULAR DIAGNOSTICS TEST KITS BY INDICATION (\$ MILLIONS)</i> .....	166
<i>TABLE 67</i> .....	166
<i>CANCER INCIDENCE AND ESTIMATED TREATMENT DECISIONS, 2006</i> .....	166
<i>TABLE 67 (CONTINUED)</i> .....	167
<i>TABLE 68 BREAST CANCER DIAGNOSTICS PRODUCT SEGMENTS</i> .....	167
AGING POPULATIONS CONTRIBUTE TO DIAGNOSTICS MARKET POTENTIAL .....	168
<i>TABLE 69 PROJECTED INCREASE IN AGE 65+ POPULATION BY REGION</i> .....	168
DNA METHYLATION DIAGNOSTICS PIPELINE .....	169
<i>TABLE 70 PIPELINE FOR DNA METHYLATION DIAGNOSTICS TESTS</i> .....	169
<i>TABLE 70 (CONTINUED)</i> .....	170
SCREENING TESTS .....	170
Prostate Cancer Screening Tests .....	170
Colorectal Cancer Screening Tests .....	171
Breast Cancer Screening Tests .....	171
Lung Cancer Screening Tests .....	171
Bladder Cancer Screening Tests .....	171
MONITORING, CLASSIFICATION, AND PHARMACODIAGNOSTIC TESTS.....	172
Breast Cancer Classification Tests .....	172
Prostate Cancer Diagnostics Tests .....	172
Bladder Cancer Monitoring Tests.....	173
Other Non-Screening Tests .....	173
EPIGENETICS BASED DIAGNOSTICS KITS MARKET SIZE .....	173
<i>TABLE 71 GLOBAL VALUE OF EPIGENETIC DIAGNOSTIC KITS BY MARKET THROUGH 2012 (\$ MILLIONS)</i> .....	174
<i>TABLE 72 GLOBAL VALUE OF EPIGENETIC DIAGNOSTIC KITS BY INDICATION THROUGH 2012 (\$ MILLIONS)</i> .....	174
<i>TABLE 73 2012 GLOBAL VALUE OF EPIGENETIC DIAGNOSTIC KITS BY INDICATION AND SEGMENT (\$ MILLIONS)</i> .....	175
EPIGENETIC DIAGNOSTICS KITS MARKET BY TECHNOLOGY.....	176
<i>TABLE 74 GLOBAL VALUE OF EPIGENETIC DIAGNOSTIC KITS BY TECHNOLOGY THROUGH 2012 (\$ MILLIONS)</i> .....	177

EPIGENETIC DIAGNOSTICS ... (CONTINUED).....	178
MARKETS FOR EPIGENETIC DRUGS.....	179
OVERVIEW.....	179
THE CANCER DRUG MARKET .....	179
<i>TABLE 75 GLOBAL MARKET FORECAST FOR SELECTED CANCER</i>	
<i>DRUGS BY, THROUGH 2012 (\$ MILLIONS)</i> .....	180
TARGETED THERAPEUTICS .....	180
CANCER DRUG MARKET GROWTH DRIVING FORCES.....	181
CANCER DRUG ... (CONTINUED).....	182
EPIGENETIC-BASED DRUGS AS CANCER THERAPIES .....	183
PROOF OF PRINCIPLE OF EPIGENETIC DRUGS ESTABLISHED.....	184
EPIGENETIC THERAPIES BEYOND CANCER.....	184
EPIGENETIC DRUG MARKET FORECAST .....	185
<i>TABLE 76 GLOBAL MARKET FORECAST FOR EPIGENETIC DRUGS</i>	
<i>BY INDICATION, THROUGH 2012 (\$ MILLIONS)</i> .....	185
<i>TABLE 77 GLOBAL MARKET FORECAST FOR EPIGENETIC DRUGS</i>	
<i>BY CLASS, THROUGH 2012 (\$ MILLIONS)</i> .....	186
INITIAL FOCUS ON HEMATOLOGICAL CANCERS.....	186
<i>TABLE 78 OVERVIEW OF MAJOR HEMATOLOGICAL</i>	
<i>MALIGNANCIES</i> .....	187
MARKET SIZE FOR HEMATOLOGICAL CANCER DRUGS .....	187
<i>TABLE 79 GLOBAL MARKET FORECAST OF HEMATOLOGICAL</i>	
<i>CANCER DRUGS BY INDICATION THROUGH 2012 (\$ MILLIONS)</i> .....	188
<i>TABLE 80 COMPARISON OF THREE NEW MDS DRUGS</i> .....	189
MARKET SIZE ... (CONTINUED).....	190
HDAC INHIBITORS MARKETS .....	191
STRATEGIC OPPORTUNITIES IN HDAC INHIBITORS.....	191
<i>TABLE 81 SUMMARY OF HDAC INHIBITOR STRATEGIC</i>	
<i>OPPORTUNITIES FOR CANCER TREATMENT</i> .....	191
HDAC INHIBITORS IN DEVELOPMENT AND CLINICAL	
TRIALS.....	192
<i>TABLE 82 HDAC INHIBITOR DRUG CANDIDATES IN CLINICAL</i>	
<i>TRIALS</i> .....	193
Zolinza.....	194
PXD-101 .....	194
<i>TABLE 83 PXD-101 CLINICAL TRIALS STATUS</i> .....	195
NVP-LAQ824 .....	196
Bacacea, Avugane, Savacol .....	196
Romidepsin .....	196
<i>TABLE 84 ROMIDEPSIN CLINICAL TRIALS STATUS</i> .....	197
MS-275 .....	198
CI 994 .....	198
MGCD0103 .....	198
<i>TABLE 85 MBCD0103 INHIBITS SELECTED HDAC ENZYMES</i> .....	199

PCI-24781 .....	199
SRT-501.....	199
HDAC INHIBITOR DRUG MARKET SIZE BY INDICATION .....	200
TABLE 86 GLOBAL MARKET FORECAST FOR HDAC INHIBITOR	
DRUGS BY INDICATION, THROUGH 2012 (\$ MILLIONS).....	200
HDAC INHIBITOR MARKET SIZE BY TECHNOLOGY.....	201
TABLE 87 GLOBAL VALUE OF HDAC INHIBITOR DRUGS BY	
TECHNOLOGY THROUGH 2012 (\$ MILLIONS).....	202
DNMT INHIBITORS MARKET .....	202
DNMT INHIBITORS IN CLINICAL TRIALS .....	202
TABLE 88 DNMT INHIBITORS IN CLINICAL TRIALS AND UNDER	
DEVELOPMENT .....	202
TABLE 88 (CONTINUED).....	203
Nucleoside Analogues.....	203
5-azacytidine (Vidaza) .....	203
5-aza-2'-deoxycytidine (Decitabine, Dacogen) .....	204
Zebularine .....	205
DHAC (Dihydro-5-azacytidine) .....	205
Non-Nucleoside Analogues.....	206
MG98.....	206
Hydralazine.....	206
Preclinical Non-Nucleosides.....	207
FDA-APPROVED DNMT INHIBITORS.....	207
TABLE 89 FDA APPROVED DNMT INHIBITOR DRUGS .....	207
MARKET SIZE FOR DNMT INHIBITORS .....	208
TABLE 90 GLOBAL VALUE OF DNMT INHIBITOR DRUGS BY	
INDICATION THROUGH 2012 (\$ MILLIONS) .....	208
TABLE 91 GLOBAL VALUE OF DNMT INHIBITOR DRUGS BY	
TECHNOLOGY THROUGH 2012 (\$ MILLIONS).....	209
ALTERNATIVE DEMETHYLATION THERAPEUTIC	
APPROACHES.....	209
CLONING AND TISSUE ENGINEERING MARKETS .....	210
TABLE 92 GLOBAL VALUE OF CLONING AND TISSUE	
ENGINEERING EPIGENETIC KITS THROUGH 2012 (\$ MILLIONS) .....	210
COMPETITIVE DYNAMICS .....	211
RESEARCH TOOLS .....	211
TABLE 93 EPIGENOMIC RESEARCH TOOLS SUPPLIERS .....	212
DIAGNOSTICS .....	213
TABLE 94 STRATEGIC ALLIANCE STATUS FOR BIOTECHNOLOGY	
EPIGENETICS DIAGNOSTICS FIRMS.....	213
TABLE 94 (CONTINUED).....	214
TABLE 95 COMPETITIVE LANDSCAPE FOR MOLECULAR	
DIAGNOSTICS TECHNOLOGIES .....	214
EPIGENETIC DRUGS .....	215

<i>TABLE 96 COMPETITIVE LANDSCAPE FOR EPIGENETIC DRUG COMPANIES</i> .....	216
PATENTS.....	217
RESEARCH TOOLS .....	217
<i>TABLE 97 PATENTS AND PATENT APPLICATION STATUS OF EPIGENOMICS AG RESEARCH TOOLS</i> .....	217
BIOMARKERS AND DIAGNOSTICS .....	218
<i>TABLE 98 PATENT STATUS FOR BIOTECHNOLOGY DIAGNOSTICS COMPANIES</i> .....	219
PHARMACEUTICALS .....	220
<i>TABLE 99 HDAC INHIBITOR PATENT CLAIMS: 2004–2006</i> .....	220
<i>TABLE 99 (CONTINUED)</i> .....	221
COMPANY PROFILES .....	222
ABBOTT LABORATORIES.....	222
ABCAM PLC. ....	223
ACTIVE MOTIF.....	223
AFFYMETRIX.....	224
AGILENT TECHNOLOGIES, INC. ....	225
APPLIED BIOSYSTEMS .....	225
AVIVA SYSTEMS BIOLOGY.....	226
BAYER AG .....	227
BIOSERVE BIOTECHNOLOGIES, LTD. ....	227
BIOVISION .....	228
CELLARTIS AB .....	228
CELLCENTRIC LTD.....	229
CHIPSCREEN BIOSCIENCES LTD.....	229
CHROMA THERAPEUTICS .....	230
CURAGEN .....	231
<i>TABLE 100 CURAGEN STRATEGIC ALLIANCES</i> .....	231
EPIGENOMICS AG.....	232
EPIGENOMICS AG (CONTINUED).....	233
EPIGENTEK.....	234
EPIONTIS GMBH .....	235
ELIXIR PHARMACEUTICALS, INC. ....	236
ENTREMED, INC.....	237
ENVIVO PHARMACEUTICALS .....	237
ES CELL INTERNATIONAL PTE LTD .....	238
EXONHIT THERAPEUTICS SA .....	238
F. HOFFMANN-LA ROCHE, LTD.....	239
GENPATHWAY, INC. ....	240
GILEAD SCIENCES (MYOGEN) .....	241
GLOUCESTER PHARMACEUTICALS .....	241
HUYA BIOSCIENCE INTERNATIONAL.....	242

ILLUMINA, INC. ....	243
KALYPSYS, INC. ....	243
KARUS THERAPEUTIC LTD .....	244
LEO PHARMA .....	245
MERCK & CO. INC. ....	245
METHYLGENE .....	246
<i>TABLE 101 METHYLGENE EPIGENETIC PRODUCT PIPELINE</i> .....	<i>247</i>
MGI PHARMA, INC. ....	248
MGI PHARMA, INC. (CONTINUED) .....	249
MILLIPORE (CHEMICON/UPSTATE) .....	250
NIMBLEGEN SYSTEMS, INC. ....	251
NOVARTIS .....	251
ONCOMETHYLOME SCIENCES S.A. ....	252
Biomarker Identification and Development Partners .....	252
Kit Development, Regulatory Review, and Mass Market of Kits .....	252
ORION GENOMICS .....	253
ORION GENOMICS (CONTINUED) .....	254
PANOMICS, INC. ....	255
PHARMACYCLICS .....	256
PHARMION CORPORATION .....	256
<i>TABLE 102 PHARMION EPIGENETIC DRUG COMBINATION THERAPIES IN CLINICAL TRIALS</i> .....	<i>257</i>
<i>TABLE 103 POTENTIAL PHARMION INTRA-PORTFOLIO DRUG COMBINATIONS</i> .....	<i>258</i>
QUIAGEN GMBH .....	258
RUBICON GENOMICS .....	259
S*BIO PTE LTD1 .....	260
SCHERING AG .....	261
SCHERING PLOUGH CORPORATION .....	261
SEQUENOM .....	262
SEQWRIGHT .....	263
SIRTRIS PHARMACEUTICALS .....	263
TAIHO PHARMACEUTICALS .....	264
TAKEDA PHARMACEUTICAL COMPANY LIMITED .....	264
TOPOTARGET A/S .....	265
<i>TABLE 104 TOPOTARGET'S HDAC INHIBITOR PATENT PORTFOLIO</i> .....	<i>265</i>
<i>TABLE 104 (CONTINUED)</i> .....	<i>266</i>
VERIDEX LLC .....	266
ZYMO RESEARCH .....	267