

INTRODUCTION	xiii
STUDY GOAL AND OBJECTIVES	xiii
SCOPE AND FORMAT	xiii
METHODOLOGY AND INFORMATION SOURCES.....	xiv
ABOUT THE AUTHOR.....	xiv
RELATED BCC REPORTS	xiv
BCC ONLINE SERVICES.....	xv
DISCLAIMER	xv
SUMMARY.....	xvi
IMAGING REAGENTS	xvi
<i>SUMMARY TABLE U.S. MARKET FORECAST FOR IMAGING</i>	
<i>REAGENTS AND ANALYSIS TOOLS BY SEGMENT, THROUGH</i>	
<i>2011 (\$ MILLIONS)</i>	xvi
<i>SUMMARY FIGURE U.S. MARKET FOR IMAGING REAGENTS AND</i>	
<i>ANALYSIS TOOLS BY SEGMENT, 2002-2011 (\$ MILLIONS)</i>	xvii
IMAGE ANALYSIS SOFTWARE.....	xvii
MEDICAL IMAGE MANAGEMENT SYSTEMS	xvii
OVERVIEW	1
INTRODUCTION TO MEDICAL IMAGING	1
THE ROLE OF IMAGING REAGENTS	1
THE ROLE OF IMAGE ANALYSIS	2
THE ROLE OF IMAGE ARCHIVING AND MANAGEMENT	2
OVERVIEW OF IMAGING MODALITIES	3
ULTRASOUND IMAGING.....	3
3D Ultrasound Imaging.....	4
Doppler Ultrasound.....	4
COMMON MEDICAL USES OF ULTRASOUND IMAGING	5
Obstetrics	5
Oncology.....	5
Cardiovascular Imaging	6
Gastrointestinal and Other.....	6
<i>TABLE 1 COMMON MEDICAL USES OF ULTRASOUND</i>	6
MAGNETIC RESONANCE IMAGING	6
Safety	7
COMMON MEDICAL USES OF MRI.....	7
Cardiovascular.....	7
Oncology.....	8
Central Nervous System	9
<i>TABLE 2 COMMON MEDICAL USES OF MRI</i>	9
Functional MRI.....	9
<i>TABLE 3 ADVANTAGES OF FUNCTIONAL MRI</i>	10
X-RAY AND FLUOROSCOPY.....	10

COMMON MEDICAL USES	11
<i>TABLE 4 COMMON MEDICAL USES OF X-RAY AND FLUOROSCOPY.....</i>	<i>12</i>
COMPUTED TOMOGRAPHY.....	13
COMMON MEDICAL USES OF COMPUTER TOMOGRAPHY	
IMAGING	13
Cranial CT	13
Chest CT	13
Cardiac CT	14
Abdominal CT.....	14
Trauma.....	14
Oncology.....	15
<i>TABLE 5 COMMON MEDICAL USES OF COMPUTED TOMOGRAPHY.....</i>	<i>15</i>
IMAGE ANALYSIS	16
NUCLEAR MEDICINE	16
COMMON MEDICAL USES OF NUCLEAR MEDICINE	17
Oncology.....	17
Neurology	18
Cardiology	18
Cognitive Science.....	19
Pharmacology.....	19
<i>TABLE 6 COMMON MEDICAL USES OF NUCLEAR MEDICINE</i>	<i>19</i>
TECHNOLOGY	20
IMAGING REAGENTS	20
REPLACING MORE INVASIVE PROCEDURES.....	20
Brachytherapy	20
REDUCING COSTS.....	21
SAFETY	21
EARLY DETECTION.....	22
IMAGE ANALYSIS AND COMMUNICATION	23
DIGITALIZATION	23
EFFICIENT DATA FLOW WITHIN HOSPITAL.....	24
ACCESS TO SPECIALIZED CARE	24
REDUCING ERRORS AND LOST DATA	25
Reduced Cost of Archiving	25
RECENT ADVANCES IN IMAGING REAGENTS.....	25
NANOPARTICLES FOR ULTRASOUND IMAGING	25
NANOPARTICLES FOR MRI IMAGING.....	26
RECENT ADVANCES IN IMAGE ANALYSIS.....	26
ALGORITHMS FOR IMAGE-GUIDED SURGERY	26
PORTABLE AND HANDHELD IMAGING	27
RECENT ADVANCES IN IMAGE MANAGEMENT.....	27
PATENT ANALYSIS	28
PATENTS BY TECHNOLOGY	28

<i>TABLE 7 IMAGING PRODUCT PATENTS ISSUED BY TECHNOLOGY, 2003–2006</i>	28
<i>FIGURE 1 IMAGING PRODUCT PATENTS BY TECHNOLOGY, 2003–2006 (%)</i>	29
PATENTS BY IMAGING MODALITY.....	29
<i>TABLE 8 IMAGING PRODUCT PATENTS BY IMAGING MODALITY 2003–2006</i>	29
<i>FIGURE 2 IMAGING PRODUCT PATENTS BY TECHNOLOGY, 2003–2006 (%)</i>	30
PATENTS BY MEDICAL APPLICATION.....	30
<i>TABLE 9 IMAGING PRODUCT PATENTS BY MEDICAL APPLICATION 2003–2006</i>	30
<i>FIGURE 3 IMAGING PRODUCT PATENTS BY MEDICAL APPLICATION, 2003–2006 (%)</i>	31
PATENTS BY COUNTRY	31
<i>TABLE 10 IMAGING PRODUCT PATENTS BY COUNTRY, 2003–2006</i>	32
<i>FIGURE 4 IMAGING PRODUCT PATENTS, 2003–2006 (%)</i>	32
PATENTS BY ASSIGNEE.....	33
<i>TABLE 11 IMAGING PRODUCT PATENTS BY ASSIGNEE AFFILIATION, 2003–2006</i>	33
<i>FIGURE 5 IMAGING PRODUCT PATENTS BY ASSIGNEE AFFILIATION, 2003–2006 (%)</i>	33
PATENTS OF INTEREST	34
Significant Patents in Image Processing	34
Significant Patents in Imaging Reagents	35
Significant Patents in Image Archiving/Communicating/Management	36
Significant Patents in ... (Continued).....	37
Significant Patents in ... (Continued).....	38
REGULATORY ASPECTS	39
REGULATION OF IMAGING REAGENTS	39
REGULATION OF IMAGING MANAGEMENT SYSTEMS	39
REGULATION OF IMAGING ... (CONTINUED).....	40
MARKET FOR MEDICAL IMAGING BY TECHNOLOGY	41
<i>TABLE 12 U.S. MARKET FOR IMAGING AGENTS AND ANALYSIS TOOLS BY SEGMENT, THROUGH 2011, (\$ MILLIONS)</i>	41
IMAGING REAGENTS	41
<i>TABLE 13 U.S. MARKET FOR MEDICAL IMAGING REAGENTS BY SEGMENT, THROUGH 2011 (\$ MILLIONS)</i>	41
<i>FIGURE 6 U.S. MARKET FOR MEDICAL IMAGING REAGENTS BY SEGMENT, 2002-2011 (\$ MILLIONS)</i>	42
REAGENTS FOR ULTRASOUND IMAGING.....	42

<i>TABLE 14 U.S. MARKET FOR ULTRASOUND IMAGING REAGENTS BY PRODUCT, THROUGH 2011 (\$ MILLIONS)</i>	43
Microbubble Contrast Media.....	43
Liposome Contrast Media	44
Ultrasound Gels.....	45
<i>TABLE 15 MAJOR ULTRASOUND REAGENTS AND MANUFACTURERS</i>	45
REAGENTS FOR MRI IMAGING.....	45
<i>TABLE 16 MAJOR MANUFACTURERS OF MRI CONTRAST AGENTS</i>	46
<i>TABLE 17 U.S. MARKET FOR MRI IMAGING REAGENTS BY PRODUCT, THROUGH 2011 (\$ MILLIONS)</i>	46
Gadolinium Contrast	47
Iron Oxide	47
Manganese Chelates.....	48
REAGENTS FOR X-RAY IMAGING.....	48
<i>TABLE 18 U.S. MARKET FOR X-RAY/FLUOROSCOPY REAGENTS BY PRODUCT, THROUGH 2011 (\$ MILLIONS)</i>	48
Barium	48
Iodine.....	49
<i>TABLE 19 MAJOR X-RAY REAGENTS AND MANUFACTURERS</i>	50
REAGENTS FOR COMPUTED TOMOGRAPHY	50
<i>TABLE 20 U.S. MARKET FOR COMPUTED TOMOGRAPHY REAGENTS BY PRODUCT, THROUGH 2011 (\$ MILLIONS)</i>	50
<i>TABLE 21 MAJOR COMPUTED TOMOGRAPHY REAGENTS AND MANUFACTURERS</i>	51
REAGENTS FOR NUCLEAR MEDICINE IMAGING.....	51
<i>TABLE 22 U.S. MARKET FOR NUCLEAR MEDICINE IMAGING REAGENTS BY PRODUCT, THROUGH 2011 (\$ MILLIONS)</i>	52
<i>TABLE 23 MAJOR NUCLEAR MEDICINE REAGENTS AND USES</i>	53
<i>TABLE 23 (CONTINUED)</i>	54
MARKET FOR MEDICAL IMAGING ANALYSIS TOOLS.....	55
<i>TABLE 24 U.S. MARKET FOR IMAGING ANALYSIS BY SEGMENT, THROUGH 2011 (\$ MILLIONS)</i>	55
<i>FIGURE 7 U.S. MARKET FOR IMAGING ANALYSIS BY SEGMENT, 2002-2011 (\$ MILLIONS)</i>	56
ANALYTICAL TOOLS FOR ULTRASOUND IMAGING	56
Contrast-enhanced Doppler imaging.....	56
Contrast Harmonic Imaging	57
Intermittent Imaging	57
Doppler Ultrasonography.....	57
Gray-scale Enhancement	58
Transcranial Ultrasound.....	59
ANALYTICAL TOOLS FOR MRI IMAGING	59
Neurosurgical Planning	59

Functional Mapping for Chronic Pain	60
Physiological Basis of Neurological Disorders	60
Cognitive Science	61
ANALYTICAL TOOLS FOR X-RAY/CT IMAGING	61
Analytical Tools for X-Ray/CT ... (Continued)	62
Segmentation and Deconvolution	63
Skeletonization and Noise-reduction	63
Feature Recognition Algorithms	63
Statistical quantification of measured parameters.....	64
ANALYTICAL TOOLS FOR NUCLEAR MEDICINE	64
PET Standardization.....	64
MARKET FOR IMAGE MANAGEMENT SYSTEMS	65
<i>TABLE 25 U.S. MARKET FOR IMAGING MANAGEMENT SYSTEMS</i>	
<i>BY SEGMENT, THROUGH 2011 (\$ MILLIONS)</i>	66
<i>FIGURE 8 U.S. MARKET FOR IMAGING MANAGEMENT SYSTEMS</i>	
<i>BY SEGMENT, 2002-2011 (\$ MILLIONS)</i>	66
MARKET FOR IMAGE ... (CONTINUED).....	67
MARKET FOR IMAGE ... (CONTINUED).....	68
U.S. MARKET FOR IMAGING PRODUCTS, BY MEDICAL APPLICATION	69
<i>TABLE 26 U.S. MARKET FOR IMAGING REAGENTS AND ANALYSIS</i>	
<i>TOOLS BY APPLICATION, THROUGH 2011 (\$ MILLIONS)</i>	69
<i>FIGURE 9 U.S. MARKET FOR IMAGING REAGENTS AND ANALYSIS</i>	
<i>TOOLS BY APPLICATION, 2002-2011</i>	69
<i>(\$ MILLIONS)</i>	69
<i>FIGURE 10 U.S. MARKET SHARE FOR IMAGING REAGENTS AND</i>	
<i>ANALYSIS TOOLS BY APPLICATION, 2002-2011 (%)</i>	70
ONCOLOGY	70
LUNG CANCER AND CT.....	71
VIRTUAL COLONOSCOPY	72
<i>TABLE 27 COMMON IMAGING PROCEDURES IN ONCOLOGY</i>	73
CARDIOVASCULAR IMAGING	73
<i>TABLE 28 COMMON PROCEDURES FOR IMAGING THE</i>	
<i>CARDIOVASCULAR SYSTEM</i>	74
CENTRAL NERVOUS SYSTEM	74
<i>TABLE 29 COMMON PROCEDURES FOR IMAGING THE CENTRAL</i>	
<i>NERVOUS SYSTEM</i>	75
GASTROINTESTINAL IMAGING	75
<i>TABLE 30 COMMON PROCEDURES FOR IMAGING THE</i>	
<i>GASTROINTESTINAL SYSTEM</i>	75
OBSTETRICS.....	76
<i>TABLE 31 COMMON IMAGING PROCEDURES IN OBSTETRICS</i>	76
MUSCULOSKELETAL SYSTEM	76
MUSCULOSKELETAL SYSTEM (CONTINUED).....	77

*TABLE 32 COMMON PROCEDURES IN MUSCULOSKELETAL
IMAGING*

	78
COMPANY PROFILES	79
ACUSPHERE	79
ADVANCED MAGNETICS, INC.	80
ADVANCED MAGNETICS, INC. (CONTINUED).....	81
AGFA-GEVAERT CORP.	82
ALLIANCE PHARMACEUTICAL CORP.....	83
ALOKA CO., LTD.	84
BARCO, INC.	85
BERLEX LABORATORIES.....	85
BRACCO DIAGNOSTICS, INC.....	86
BRACCO DIAGNOSTICS, INC. (Continued)	87
CMT MEDICAL SYSTEMS.....	88
CYTOGEN CORPORATION	89
DALSA CORPORATION	90
DENDRITIC NANOTECHNOLOGY	91
DIGIRAD CORP.....	92
DRAXIS PHARMACEUTICALS	92
E-Z-EM, INC.....	93
EPIX, INC.....	94
ESAOTE/BIOSOUND ESAOTE, INC.....	95
FUJIFILM MEDICAL SYSTEMS.....	96
GENERAL ELECTRIC HEALTHCARE/GE HEALTHCARE BIO- SCIENCES CORP.....	97
GENERAL ELECTRIC HEALTHCARE ...(CONTINUED).....	98
ICAD	99
IMAGING DIAGNOSTIC SYSTEMS, INC.....	100
KEY EXECUTIVES	100
IMARX THERAPEUTICS	101
INSITEONE, INC.	101
EASTMAN KODAK CO.....	102
EASTMAN KODAK CO. (CONTINUED)	103
LIVEDATA, INC.	104
MALLINCKRODT MEDICAL	104
MCKESSON PROVIDER TECHNOLOGIES.....	105
MEDRAD, INC.....	106
MERGE EMED, INC.	107
MIRABEL MEDICAL SYSTEMS, INC.....	107
POINT BIOMEDICAL	108
R2 TECHNOLOGY, INC./HOLOGIC, INC.....	109
RIS CONCEPTS, INC.	110
SCANIS	111
SCHERING AG.....	112

SECTRA	113
SIEMENS MEDICAL SOLUTIONS	114
SWISSRAY INTERNATIONAL, INC.	115
VIATRONIX, INC.	115
VIDAR SYSTEMS CORP.	116
VITAL IMAGES	117
VITAL IMAGES (Continued).....	118
MARKET SHARE	119
U.S. MARKET SHARE OF IMAGING REAGENTS.....	119
<i>TABLE 33 U.S. MARKET SHARE OF COMPANIES IN IMAGING</i>	
<i>REAGENTS, 2006 (%)</i>	<i>119</i>
<i>FIGURE 11 U.S. MARKET SHARE OF COMPANIES IN IMAGING</i>	
<i>REAGENTS, 2006 (%)</i>	<i>120</i>
MARKET SHARE OF IMAGING ANALYSIS TOOLS	120
<i>TABLE 34 U.S. MARKET SHARE OF COMPANIES IN IMAGE</i>	
<i>ANALYSIS TOOLS, 2006 (%)</i>	<i>121</i>
<i>FIGURE 12 U.S. MARKET SHARE OF COMPANIES IN IMAGE</i>	
<i>ANALYSIS TOOLS, 2006 (%)</i>	<i>121</i>
MARKET SHARE OF IMAGE MANAGEMENT SYSTEMS.....	121
<i>TABLE 35 U.S. MARKET SHARE OF COMPANIES IN IMAGE</i>	
<i>MANAGEMENT SYSTEMS, 2006 (%).....</i>	<i>122</i>
<i>FIGURE 13 U.S. MARKET SHARE OF COMPANIES IN IMAGE</i>	
<i>MANAGEMENT SYSTEMS, 2006 (%)</i>	<i>122</i>