

INTRODUCTION	xvi
STUDY GOAL AND OBJECTIVES	xvi
REASON FOR DOING THE STUDY.....	xvi
CONTRIBUTION OF THE STUDY AND FOR WHOM	xvi
SCOPE AND FORMAT	xvi
METHODOLOGY	xvii
INFORMATION SOURCES	xvii
ANALYST CREDENTIALS.....	xvii
RELATED BCC PUBLICATIONS	xviii
BCC ONLINE SERVICES.....	xviii
DISCLAIMER	xviii
 SUMMARY.....	 xix
<i>SUMMARY TABLE U.S. MARKET FORECAST FOR UF MEMBRANES,</i> <i>THROUGH 2011 (\$ MILLIONS).....</i>	 <i>XX</i>
<i>SUMMARY FIGURE VALUE OF U.S. MARKET FOR UF MEMBRANES,</i> <i>2000-201 (\$ MILLIONS).....</i>	 <i>XX</i>
 OVERVIEW	 1
MEMBRANE TECHNOLOGY	1
ULTRAFILTRATION MEMBRANE SPECIFICATIONS	1
RETAINED FEEDSTREAM COMPONENTS.....	2
UF MEMBRANE MATERIALS, MANUFACTURING	2
COMPARISON OF MEMBRANE PROCESSES	2
<i>TABLE 1 COMPARATIVE PARAMETERS OF MEMBRANE</i> <i>PROCESSES.....</i>	 <i>3</i>
BRIEF HISTORY OF THE INDUSTRY	3
EARLY APPLICATIONS.....	3
COMMERCIALIZATION.....	4
INNOVATION.....	4
<i>TABLE 2 A HISTORY OF UF MEMBRANES</i>	 <i>5</i>
 INDUSTRY STRUCTURE	 6
INDUSTRY STRUCTURE	6
GROWTH THROUGH ACQUISITION.....	7
OTHER STRATEGIES FOR STAYING COMPETITIVE	8
THE DIALYSIS INDUSTRY	9
BARRIERS TO GROWTH	10
MAJOR UF MEMBRANE MANUFACTURERS.....	11
<i>TABLE 3 PRIMARY PLAYERS AND SHARE OF THE UF MARKET.....</i>	 <i>11</i>
<i>TABLE 3 (CONTINUED).....</i>	 <i>12</i>
<i>FIGURE 1 PRIMARY PLAYERS AND SHARE OF THE UF MARKET (%).....</i>	 <i>13</i>
DISTRIBUTION CHANNELS	13
UPSTREAM SUPPLIERS	13

MARKETING AND SALES	14
CUSTOMERS	14
Downstream Manufacturing Customers	14
Distributors or Partnership-Type Customers	15
Health Care Customers.....	15
Government Clients.....	15
PRICING.....	15
<i>TABLE 4 MEMBRANE COST BY CONFIGURATION</i>	16
COMPANY PROFILES	16
ALFA LAVAL GROUP	16
ASAHI KASEI	17
Asahi Kasei (Continued)	18
ATECH INNOVATIONS GMBH.....	19
BAXTER INTERNATIONAL.....	19
CANTEL MEDICAL.....	20
CERAMEM	21
CORNING, INC.....	22
DAICEL CHEMICAL INDUSTRIES, LTD.....	23
DONALDSON CO.	23
ECO CERAMICS BV.....	24
ENTEGRIS INC.	25
FRESENIUS AG	26
GAMBRO AB.....	27
GENERAL ELECTRIC CO.....	27
GE Water Technologies	28
GE Healthcare	29
INGE AG.....	30
ITT CORP.	31
KOCH MEMBRANE SYSTEMS	31
KURARAY CO, LTD.	32
MARMON GROUP.....	33
MEISSNER FILTRATION	34
MILLENNIUMPORE, LTD.	34
MILLIPORE CORP.	35
MICRODYN-NADIR GMBH.....	36
NEW LOGIC INTERNATIONAL.....	37
NITTO DENKO CORP.....	37
NORIT NV	38
NOVASEP GROUP	39
NYSA MEMBRANE TECHNOLOGIES	40
PALL CORP.....	41
PERMIONICS	42
POLYMEM SA	42
POLYPORE INTERNATIONAL	43

PORES TECHNOLOGIES.....	44
PRIME WATER INTERNATIONAL NV	44
ROCHEM UF-SYSTEME GMBH.....	44
SARTORIUS AG.....	45
SEPRO, INC.	46
SIEMENS AG.....	47
SPECTRUM LABORATORIES	47
SPINTEK.....	48
SUEZ.....	49
SYNDER FILTRATION.....	50
TAMI INDUSTRIES	50
TORAY INDUSTRIES	51
TRISEP CORP.....	52
WHATMAN	53
ZUNDEL HOLDING GMBH & CO. KG	53
Zundel Holding Gmbh & Co. KG (Continued).....	54
PATENT ACTIVITY	55
PATENTS BY APPLICATION	55
<i>TABLE 5 PATENT SURVEY BY APPLICATION (OCTOBER 2, 2001 TO</i>	
<i>OCTOBER 3, 2006).....</i>	<i>56</i>
<i>FIGURE 2 PATENT SURVEY BY APPLICATION (OCTOBER 2, 2001 TO</i>	
<i>OCTOBER 3, 2006) (%).....</i>	<i>57</i>
PATENTS BY COMPANY.....	57
<i>TABLE 6 PATENT SURVEY BY COMPANY (OCTOBER 2, 2001 TO</i>	
<i>OCTOBER 3, 2006).....</i>	<i>58</i>
<i>FIGURE 3 PATENT SURVEY BY COMPANY (OCTOBER 2, 2001 TO</i>	
<i>OCTOBER 3, 2006) (%).....</i>	<i>59</i>
ULTRAFILTRATION MEMBRANE MARKET BY APPLICATION	60
<i>TABLE 7 U.S. MARKET FORECAST FOR UF MEMBRANES BY</i>	
<i>APPLICATION, THROUGH 2011 (\$ MILLIONS).....</i>	<i>60</i>
<i>FIGURE 4 VALUE OF THE U.S. MARKET FOR UF MEMBRANES, BY</i>	
<i>APPLICATION, 2000-2011 (\$ MILLIONS).....</i>	<i>61</i>
<i>TABLE 8 SHARE OF THE U.S. UF MARKET, BY APPLICATION, 2006</i>	
<i>(%).....</i>	<i>61</i>
<i>FIGURE 5 SHARE OF THE U.S. UF MARKET, BY APPLICATION, 2006</i>	
<i>(%).....</i>	<i>62</i>
FOOD AND BEVERAGE PRODUCTION.....	63
MARKET SIZE AND GROWTH	63
MARKET SIZE AND GROWTH (CONTINUED)	64
MARKET SIZE AND GROWTH (CONTINUED)	65
<i>TABLE 9 U.S. MARKET FORECAST FOR UF MEMBRANES IN FOOD</i>	
<i>AND BEVERAGE PROCESSING, THROUGH 2011 (\$ MILLIONS).....</i>	<i>66</i>

<i>FIGURE 6 U.S. MARKET FORECAST FOR UF MEMBRANES IN U.S.</i>	
<i>FOOD AND BEVERAGE PROCESSING, 2000-2011 (\$ MILLIONS)</i>	66
OVERVIEW.....	67
<i>TABLE 10 APPLICATIONS FOR UF IN THE FOOD AND BEVERAGE</i>	
<i>INDUSTRY</i>	67
<i>TABLE 10 (CONTINUED)</i>	68
CONCENTRATION	68
CLARIFICATION.....	68
MICROBIOLOGICAL STABILIZATION	68
FRACTIONATION	69
WASTEWATER TREATMENT	69
<i>TABLE 11 TYPICAL WATER USE RATES FOR THE FOOD AND</i>	
<i>BEVERAGE PROCESSING INDUSTRY (GALLONS PER TON OF</i>	
<i>PRODUCE)</i>	69
WASTEWATER REUSE.....	70
Zero Discharge/Zero Emissions.....	71
FOOD AND BEVERAGE MARKET BY INDUSTRY SECTOR	71
GRAIN AND OILSEED MILLING.....	71
UF APPLICATIONS	71
Corn Wet Milling	72
<i>FIGURE 7 MEMBRANE APPLICATIONS IN CORN WET MILLING</i>	73
Chemical Starch Modification	74
Fermentation	74
Saccharification.....	74
Functional Soy Proteins	74
SUGAR AND CONFECTIONERY	75
UF APPLICATIONS	75
Sugar Clarification	75
Honey Manufacture.....	76
Press Water Clarification	76
FRUIT AND VEGETABLE PRESERVING	76
UF APPLICATIONS	76
Juice Clarification.....	76
Wastewater Treatment/Water Recycling	77
DAIRY	77
UF APPLICATIONS	77
UF APPLICATIONS	78
Whey Processing.....	78
Cheese Production	79
<i>TABLE 12 WHEY PROTEIN CONCENTRATE</i>	79
Milk Standardization	80
Other	80
MEAT AND POULTRY.....	80
UF APPLICATIONS	80

Wastewater	81
SEAFOOD.....	81
UF APPLICATIONS	81
Protein Processing	82
BAKERY PRODUCTS	82
UF APPLICATIONS	82
OTHER FOODS	83
UF APPLICATIONS	83
Gelatin.....	83
Blood.....	84
<i>TABLE 13 AVERAGE TOTAL BLOOD YIELDS, PER SLAUGHTERED</i>	
<i>ANIMAL (KG).....</i>	<i>84</i>
Blood Protein Recovery.....	84
Egg.....	85
Vinegar	85
Polysaccharides, Gums, and Other Colloids.....	85
MSG.....	86
Wastewater	86
Lysozyme Production.....	86
IgY Extraction.....	87
COMPANIES ACTIVE IN THE FOOD AND BEVERAGE MARKET	87
<i>TABLE 14 MANUFACTURERS AND PRODUCTS, FOOD AND</i>	
<i>BEVERAGE.....</i>	<i>87</i>
<i>TABLE 14 (CONTINUED).....</i>	<i>88</i>
MARKET SHARE, FOOD AND BEVERAGE.....	88
<i>TABLE 15 MARKET SHARE, FOOD AND BEVERAGE, 2006 (%).....</i>	<i>88</i>
<i>FIGURE 8 MARKET SHARE, FOOD AND BEVERAGE, 2006 (%).....</i>	<i>89</i>
BIOPROCESSING.....	90
MARKET SIZE AND GROWTH	90
MARKET SIZE AND GROWTH (CONTINUED)	91
<i>TABLE 16 SALES AND PROJECTIONS FOR UF MEMBRANES IN U.S.</i>	
<i>BIOPROCESSING, THROUGH 2011</i>	<i>92</i>
<i>FIGURE 9 SALES AND PROJECTIONS FOR UF MEMBRANES IN U.S.</i>	
<i>BIOPROCESSING, 2000-2011.....</i>	<i>93</i>
OVERVIEW.....	93
THE BIOPHARMACEUTICALS INDUSTRY	94
COMMERCIAL BIOTECH DRUGS.....	95
<i>TABLE 17 NEW DRUG APPROVALS IN RELATION TO R&D</i>	
<i>SPENDING, 1995-2005 (\$ BILLIONS).....</i>	<i>95</i>
<i>FIGURE 10 NEW DRUG APPROVALS IN RELATION TO R&D</i>	
<i>SPENDING, 1995-2005 (\$ BILLIONS).....</i>	<i>95</i>
<i>TABLE 18 TOP TEN BIOPHARMACEUTICALS, GLOBAL SALES, 2005.....</i>	<i>96</i>
DRUG DISCOVERY, DEVELOPMENT AND MANUFACTURING	96
LAB-SCALE MEMBRANE SEPARATIONS	97

Molecular Separations Systems.....	97
Stirred Cell Systems	97
Centrifugal Devices.....	98
TFF Systems	98
PROCESS-SCALE MEMBRANE SEPARATIONS	99
TABLE 19 PROCESS-SCALE PURIFICATIONS.....	99
TABLE 19 (CONTINUED).....	100
Protein Separations/Concentration	100
FIGURE 11 BIOPHARMACEUTICALS MANUFACTURE	101
FIGURE 12 VACCINE MANUFACTURE	102
FIGURE 13 ANTIBIOTIC AND VITAMIN MANUFACTURE.....	103
Virus Removal	103
TABLE 20 MANUFACTURERS USING MEMBRANES IN APPROVED	
BIOTECH DRUG PRODUCTION	104
TABLE 20 (CONTINUED).....	105
COMPANIES ACTIVE IN THE BIOPROCESSING MARKET	105
TABLE 21 MANUFACTURERS AND PRODUCTS, BIOPROCESSING.....	106
TABLE 21 (CONTINUED).....	107
TABLE 21 (CONTINUED).....	108
MARKET SHARE, BIOPROCESSING	109
TABLE 22 MARKET SHARE, BIOPROCESSING, 2006.....	109
FIGURE 14 MARKET SHARE, BIOPROCESSING, 2006 (%).....	109
HEMODIALYSIS.....	110
MARKET SIZE AND GROWTH	110
MARKET SIZE AND GROWTH (CONTINUED)	111
MARKET SIZE AND GROWTH (CONTINUED)	112
TABLE 23 SALES AND PROJECTIONS FOR HEMODIALYZERS IN	
U.S. RENAL CARE, THROUGH 2011 (\$ MILLIONS).....	113
FIGURE 15 SALES AND PROJECTIONS FOR HEMODIALYZERS IN	
U.S. RENAL CARE, 2006-2011 (\$ MILLIONS)	113
OVERVIEW.....	113
DIALYZERS	114
DIALYZER SPECIFICATIONS.....	114
TABLE 24 U.S. DIALYZER MARKET BY MEMBRANE TYPE	115
MODES OF HEMODIALYSIS	115
MEASURING DIALYZER PERFORMANCE.....	116
DIALYZER REUSE.....	116
COMPETITIVE TECHNOLOGIES.....	116
COMPANIES ACTIVE IN THE DIALYZER MARKET	117
MARKET SHARE, HEMODIALYZERS	117
TABLE 25 MARKET SHARE, HEMODIALYZERS, 2006.....	117
FIGURE 16 MARKET SHARE, HEMODIALYZERS, 2006 (%).....	118
POTABLE WATER TREATMENT	119

MARKET SIZE AND GROWTH	119
MARKET SIZE AND GROWTH (CONTINUED)	120
MARKET SIZE AND GROWTH (CONTINUED)	121
<i>TABLE 26 SALES AND PROJECTIONS FOR UF MEMBRANES IN U.S.</i>	
<i>POTABLE WATER TREATMENT, THROUGH 2011 (\$ MILLIONS)</i>	122
<i>FIGURE 17 SALES AND PROJECTIONS FOR UF MEMBRANES IN</i>	
<i>U.S. POTABLE WATER TREATMENT, 2000-2011 (\$ MILLIONS)</i>	122
OVERVIEW	122
CONGRESSIONAL SPENDING FOR WATER PROJECTS	123
NATIONAL CITY WATER SURVEY	124
WATER AVAILABILITY AND USAGE IN THE U.S.	125
PUBLIC WATER SUPPLY	126
Community Water Systems	126
<i>TABLE 27 TRENDS IN U.S. WATER USE, THROUGH 2000 (BILLIONS</i>	
<i>OF GALLONS PER DAY)</i>	127
POTABLE WATER COST	127
CAPITAL COST OF WATER TREATMENT EQUIPMENT	128
<i>TABLE 28 CAPITAL COSTS OF WATER TREATMENT, BY</i>	
<i>TECHNOLOGY TYPE (AVERAGE \$ PER GALLON, BY PLANT SIZE)</i>	128
UF applications	128
COMPANIES ACTIVE IN THE POTABLE WATER MARKET.....	129
<i>TABLE 29 MANUFACTURERS AND PRODUCTS, POTABLE WATER</i>	
<i>TREATMENT</i>	130
MARKET SHARE, POTABLE WATER TREATMENT	130
<i>TABLE 30 MARKET SHARE, POTABLE WATER TREATMENT, 2006</i>	
<i>(%)</i>	130
<i>FIGURE 18 MARKET SHARE, POTABLE WATER TREATMENT, 2006</i>	
<i>(%)</i>	131
WASTEWATER TREATMENT	132
MARKET SIZE AND GROWTH	132
MARKET SIZE AND GROWTH (CONTINUED)	133
MARKET SIZE AND GROWTH (CONTINUED)	134
<i>TABLE 31 U.S. MARKET FORECAST FOR UF MEMBRANES IN</i>	
<i>WASTEWATER TREATMENT, THROUGH 2011 (\$ MILLIONS)</i>	135
<i>FIGURE 19 SALES AND PROJECTIONS FOR UF MEMBRANES IN</i>	
<i>U.S. WASTEWATER TREATMENT, 2000-2011 (\$ MILLIONS)</i>	136
OVERVIEW	136
U.S. WATER RESOURCES, WITHDRAWALS	136
<i>TABLE 32 U.S. WATER RESOURCES AND WITHDRAWALS</i>	137
DOMESTIC, MUNICIPAL WASTEWATER	137
<i>TABLE 33 TYPICAL CONTAMINANTS IN UNTREATED MUNICIPAL</i>	
<i>WASTEWATER</i>	138
DOMESTIC, MUNICIPAL WASTEWATER TREATMENT	139
INDUSTRIAL WASTEWATER.....	140

<i>TABLE 34 POTENTIAL WASTEWATER COMPONENTS BY INDUSTRY...</i>	141
Heavy Metals	142
Organic Compounds	142
Oily Wastewaters.....	142
INDUSTRIAL WASTEWATER TREATMENT	143
LANDFILL LEACHATE	144
IN BUILDING WATER RECYCLING.....	144
OTHER WASTEWATER	145
SHIPBOARD WASTEWATER	145
Cruise Lines.....	146
U.S. Navy	146
AGRICULTURAL WASTEWATER.....	147
WATER RECLAMATION AND REUSE	147
REUSE IN THE U.S.	148
U.S. REGULATORY EFFORTS.....	148
FEDERAL ASSISTANCE FOR WASTEWATER PLANT	
CONSTRUCTION.....	149
COMPETITIVE TECHNOLOGIES	149
COMPANIES ACTIVE IN WASTEWATER TREATMENT	150
<i>TABLE 35 MANUFACTURERS AND PRODUCTS, WASTEWATER</i>	
<i>TREATMENT.....</i>	<i>150</i>
Market share, wastewater treatment	150
<i>TABLE 36 MARKET SHARE, WASTEWATER TREATMENT, 2006 (%).....</i>	<i>151</i>
<i>FIGURE 20 MARKET SHARE, WASTEWATER TREATMENT, 2006 (%).....</i>	<i>151</i>
INDUSTRIAL PROCESSES	152
MARKET SIZE AND GROWTH	152
MARKET SIZE AND GROWTH (CONTINUED)	153
MARKET SIZE AND GROWTH (CONTINUED)	154
<i>TABLE 37 U.S. MARKET FORECAST FOR UF MEMBRANES IN</i>	
<i>INDUSTRIAL PROCESSES, THROUGH 2011 (\$ MILLIONS).....</i>	<i>155</i>
<i>FIGURE 21 SALES AND PROJECTIONS FOR UF MEMBRANES IN</i>	
<i>U.S. INDUSTRIAL PROCESSES, 2000-2011 (\$ MILLIONS).....</i>	<i>155</i>
OVERVIEW.....	155
COMPETITIVE TECHNOLOGIES.....	155
ULTRAPURE WATER.....	156
Power Production.....	156
UF Systems.....	157
Advantages and Drawbacks.....	157
Semiconductor Manufacture	158
OTHER PROCESS WATER	158
RO PRETREATMENT	159
WATER RECOVERY, REUSE	159
<i>TABLE 38 RECOVERY/RECYCLE OPPORTUNITIES IN INDUSTRIAL</i>	
<i>PROCESSES.....</i>	<i>160</i>

<i>TABLE 38 (CONTINUED)</i>	161
ELECTROCOAT PAINT.....	161
TEXTILE	161
PULP AND PAPER.....	162
METALWORKING, PLATING.....	163
PRINTING.....	163
TANNING.....	164
COMPANIES ACTIVE IN THE INDUSTRIAL PROCESS MARKET.....	164
<i>TABLE 39 MANUFACTURERS AND PRODUCTS, INDUSTRIAL PROCESSES</i>	164
<i>TABLE 39 (CONTINUED)</i>	165
<i>TABLE 39 (CONTINUED)</i>	166
<i>TABLE 39 (CONTINUED)</i>	167
MARKET SHARE, INDUSTRIAL PROCESSES.....	167
<i>TABLE 40 MARKET SHARE, INDUSTRIAL PROCESSES, 2006 (%)</i>	167
<i>FIGURE 22 MARKET SHARE, INDUSTRIAL PROCESSES, 2006 (%)</i>	168
APPENDIX I.....	169
<i>TABLE 41 PATENT SURVEY (OCTOBER 2, 2001-OCTOBER 3, 2006)</i>	169
<i>TABLE 41 (CONTINUED)</i>	170
<i>TABLE 41 (CONTINUED)</i>	171
<i>TABLE 41 (CONTINUED)</i>	172
<i>TABLE 41 (CONTINUED)</i>	173
<i>TABLE 41 (CONTINUED)</i>	174
<i>TABLE 41 (CONTINUED)</i>	175
<i>TABLE 41 (CONTINUED)</i>	176
<i>TABLE 41 (CONTINUED)</i>	177
<i>TABLE 41 (CONTINUED)</i>	178
<i>TABLE 41 (CONTINUED)</i>	179
<i>TABLE 41 (CONTINUED)</i>	180
<i>TABLE 41 (CONTINUED)</i>	181
<i>TABLE 41 (CONTINUED)</i>	182
<i>TABLE 41 (CONTINUED)</i>	183
<i>TABLE 41 (CONTINUED)</i>	184
<i>TABLE 41 (CONTINUED)</i>	185
<i>TABLE 41 (CONTINUED)</i>	186
<i>TABLE 41 (CONTINUED)</i>	187
<i>TABLE 41 (CONTINUED)</i>	188
<i>TABLE 41 (CONTINUED)</i>	189
<i>TABLE 41 (CONTINUED)</i>	190
<i>TABLE 41 (CONTINUED)</i>	191
<i>TABLE 41 (CONTINUED)</i>	192
<i>TABLE 41 (CONTINUED)</i>	193
<i>TABLE 41 (CONTINUED)</i>	194
<i>TABLE 41 (CONTINUED)</i>	195

<i>TABLE 41 (CONTINUED)</i>	196
<i>TABLE 41 (CONTINUED)</i>	197
APPENDIX II.....	198
<i>TABLE 42 APPROVED BIOTECH DRUGS (AS OF OCTOBER 2006)</i>	198
<i>TABLE 42 (CONTINUED)</i>	199
<i>TABLE 42 (CONTINUED)</i>	200
<i>TABLE 42 (CONTINUED)</i>	201
<i>TABLE 42 (CONTINUED)</i>	202
<i>TABLE 42 (CONTINUED)</i>	203
<i>TABLE 42 (CONTINUED)</i>	204
<i>TABLE 42 (CONTINUED)</i>	205
<i>TABLE 42 (CONTINUED)</i>	206
<i>TABLE 42 (CONTINUED)</i>	207
<i>TABLE 42 (CONTINUED)</i>	208
<i>TABLE 42 (CONTINUED)</i>	209
<i>TABLE 42 (CONTINUED)</i>	210
APPENDIX III.....	211
<i>TABLE 43 FULL-SCALE UF DRINKING WATER INSTALLATIONS IN</i> <i>THE U.S. (COMPLETED AND PROPOSED, SEPTEMBER 2006)</i>	211
<i>TABLE 43 (CONTINUED)</i>	212