

# Contents

<b>List of contributors</b>	<b>ix</b>
<b>Woodhead Publishing Series in Biomaterials</b>	<b>xi</b>
<b>Part One Introduction to biomaterials and medical device-related infections</b>	<b>1</b>
<b>1 Introduction to biomaterials and medical device-associated infections</b>	<b>3</b>
<i>I. R. Cooper</i>	
1.1 History of biomaterials	3
1.2 Overview of current medical devices and applications	5
1.3 Overview of problems associated with medical devices	7
1.4 Introduction to the structure of this book	13
References	14
<b>2 Biofilms and implant-associated infections</b>	<b>19</b>
<i>G. Laverty, S. P. Gorman, B. F. Gilmore</i>	
2.1 Introduction	19
2.2 Microbial profile of implant-associated infections	19
2.3 Relevance of biofilms in implant-associated infections	23
2.4 Structure and composition of biofilms	24
2.5 Pathogenesis of biofilm infection	26
2.6 Future trends	36
2.7 Further information and advice	36
References	37
<b>3 In vivo infection studies</b>	<b>47</b>
<i>Y. Achermann, P. Kerns, M. E. Shirtliff</i>	
3.1 Introduction	47
3.2 Legitimacy of animal studies	48
3.3 Choosing the right animal model to study device-associated infections	49
3.4 Pros and cons of <i>in vivo</i> infection studies	60
3.5 Correlation of outcome between animal and clinical studies	62
3.6 Conclusion and future trends	63
3.7 Sources of further information and advice	63

	Acknowledgments	64
	References	64
<b>4</b>	<b>Diagnosis of biofilm-associated infections in medical devices</b>	<b>71</b>
	<i>S. Bose, A. K. Ghosh</i>	
4.1	Introduction	71
4.2	Importance of detection of biofilm	72
4.3	Sites of biofilm formation	73
4.4	Collection of samples for biofilm detection	73
4.5	Examples of methods for the detection of biofilms associated with infections	74
4.6	Future trends	78
4.7	Conclusion	79
	Acknowledgement	79
	References	79
<b>5</b>	<b>Diagnosis and treatment of implant-associated infections</b>	<b>83</b>
	<i>M. Al-Mayahi, P. Vaudaux, L. Deabate, A. Lomessy, D. Suvà, I. Uçkay</i>	
5.1	Introduction	83
5.2	Risk factors and prevention	84
5.3	Diagnosis	87
5.4	Treatment	88
5.5	Future trends	96
	References	96
<b>Part Two</b>	<b>Technologies and materials for controlling biofilms</b>	<b>101</b>
<b>6</b>	<b>Surface modification of biomaterials for biofilm control</b>	<b>103</b>
	<i>O. Bazaka, K. Bazaka</i>	
6.1	Introduction	103
6.2	Principles of bacterial cell–biomaterial surface interactions	103
6.3	Substrate specific biological response	105
6.4	Looking at nature for inspiration	106
6.5	Modifications to prevent initial stages of bacterial adhesion	107
6.6	Methods to prevent irreversible attachment of microorganisms	109
6.7	Mitigation of biofilm formation by attached organisms	110
6.8	Future trends	123
	References	124
<b>7</b>	<b>Surface nanoengineering for combating biomaterials infections</b>	<b>133</b>
	<i>K. G. Neoh, R. Wang, E. T. Kang</i>	
7.1	Introduction	133
7.2	Modification of surface nano topography to inhibit bacterial adhesion	134
7.3	Surface functionalization with eluting antibacterial agent	136
7.4	Surface functionalization with anti-adhesive polymers	140

7.5	Immobilization of bactericidal moieties on surfaces	146
7.6	Conclusion and future trends	152
7.7	Sources of further information and advice	153
	References	153
<b>8</b>	<b>Bioactive biomaterials for controlling biofilms</b>	<b>163</b>
	<i>B. F. Gilmore, L. Carson</i>	
8.1	Introduction	163
8.2	Definition of medical device	165
8.3	Biomaterials	165
8.4	Biomaterial applications in medical devices	167
8.5	Post-implantation device-associated infections	171
8.6	Development of conventional antimicrobial biomaterials	173
8.7	Conclusion	180
	References	180
<b>9</b>	<b>Antibiotics and cements for the prevention of biofilm-associated infections</b>	<b>185</b>
	<i>G. Massazza, A. Bistolfi, E. Verné, M. Miola, L. Ravera, F. Rosso</i>	
9.1	Introduction	185
9.2	Biomaterials, infections and orthopedics	185
9.3	History of antibiotic-loaded bone cement (ALBC)	186
9.4	Indication of ALBC	186
9.5	Method of mixing the ALBC	187
9.6	The choice of antibiotic, its dosage and associations of different drugs	188
9.7	The antibiotic release	191
9.8	Mechanical properties of ALBC	192
9.9	Toxicity	193
9.10	Conclusion	193
	References	194
<b>10</b>	<b>Antibacterial composite restorative materials for dental applications</b>	<b>199</b>
	<i>I. M. Mehdawi, A. Young</i>	
10.1	Introduction	199
10.2	Current direct aesthetic restorative materials	200
10.3	Antibacterial properties of aesthetic restorative materials	201
10.4	Re-mineralizing dental composites	206
10.5	Antibacterial, re-mineralizing and proteinases inhibiting materials	208
10.6	Conclusion and future trends	213
	References	213
<b>11</b>	<b>Infection resistant biomaterials</b>	<b>223</b>
	<i>Y. Delaviz, J. P. Santerre, D. G. Cvitkovitch</i>	
11.1	Introduction	223
11.2	History	224

11.3	Drug-releasing antimicrobial systems	225
11.4	Antimicrobial cationic systems	231
11.5	Antifouling surfaces	234
11.6	Naturally occurring antifouling surfaces	238
11.7	Silver ions and silver-containing surfaces	240
11.8	Conclusion	242
	References	242
	Appendix: abbreviations	254
<b>Index</b>		<b>255</b>