

Contents

Part I Boundary Conditions for Microbial Life at Low Temperatures

1 The Climate of Snow and Ice as Boundary Condition for Microbial Life.....	3
Michael Kuhn	
2 Limits for Microbial Life at Subzero Temperatures.....	17
Corien Bakermans	

Part II Microbial Diversity in Cold Ecosystems

3 Bacteria in Snow and Glacier Ice.....	31
Vanya Miteva	
4 Bacteria in Subglacial Environments.....	51
Brent C. Christner, Mark L. Skidmore, John C. Priscu, Martyn Tranter, and Christine M. Foreman	
5 Bacteria in the Deep Sea: Psychropiezophiles.....	73
Yuichi Nogi	
6 Bacteria in Permafrost.....	83
David Gilichinsky, Tatiana Vishnivetskaya, Mayya Petrova, Elena Spirina, Vladimir Mamykin, and Elizaveta Rivkina	
7 Anaerobic Bacteria and Archaea in Cold Ecosystems	103
Kai Finster	
8 Cyanobacteria in Cold Ecosystems	121
Frédéric Zakhia, Anne-Dorothee Jungblut, Arnaud Taton, Warwick F. Vincent, and Annick Wilmotte	

9 Fungi in Cold Ecosystems	137
Jens C. Frisvad	
10 Cold-Active Viruses	157
Llyd E. Wells	

Part III Molecular Adaptations to Cold Habitats

11 Membrane Components and Cold Sensing	177
Nicholas J. Russell	
12 Cold-Shock Proteins	191
Sangita Phadtare and Masayori Inouye	
13 Fundamentals of Cold-Adapted Enzymes	211
Tony Collins, Frédéric Roulling, Florence Piette, Jean-Claude Marx, Georges Feller, Charles Gerday, and Salvino D'Amico	
14 Cryoprotectants and Ice-Binding Proteins	229
Hidehisa Kawahara	
15 The Role of Exopolymers in Microbial Adaptation to Sea Ice	247
Christopher Krembs and Jody W. Deming	
16 Genomic Analysis of Psychrophilic Prokaryotes	265
John P. Bowman	
17 Microalgae in Polar Regions: Linking Functional Genomics and Physiology with Environmental Conditions	285
Thomas Mock and David N. Thomas	
18 Metagenomics: Microbial Community Genomes Revealed	313
Sara Sjöling and Don A. Cowan	
19 Proteomic Studies of Psychrophilic Microorganisms	333
Tatsuo Kurihara and Nobuyoshi Esaki	

Part IV Biotechnological Aspects

20 Biotechnological Aspects of Cold-Adapted Enzymes	347
Adrienne L. Huston	

21 Heterologous Protein Expression in Psychrophilic Hosts	365
Ermenegilda Parrilli, Angela Duilio, and Maria Luisa Tutino	
22 Cold-Adapted Fungi as a Source for Valuable Metabolites	381
Jens C. Frisvad	
23 Natural and Stimulated Biodegradation of Petroleum in Cold Marine Environments	389
Odd Gunnar Brakstad	
24 Microbial Adaptation to Boreal Saturated Subsurface: Implications in Bioremediation of Polychlorophenols	409
Jörg H. Langwaldt, Marja Tirola, and Jaakko A. Puhakka	
25 Biological Iron Oxidation and Sulfate Reduction in the Treatment of Acid Mine Drainage at Low Temperatures	429
Anna H. Kaksonen, Mark Dopson, Olia Karnachuk, Olli H. Tuovinen, and Jaakko A. Puhakka	
Index	455