

Preface

Most scientists in the middle of the twentieth century would probably not have believed that life was possible at extreme values of environmental factors, such as pH values close to 0 (e.g. sulfurous environments) or to 14 (e.g. soda lakes), salinities of 6 M NaCl (e.g. Dead Sea), hydrostatic pressures approaching 0.1 MPa (deep sea) and temperatures exceeding 100°C (thermal vents or hot springs) or as low as −20°C (e.g. polar regions). Of the current studies on extremophiles, approximately 30,000 articles by the year 2007, almost two-thirds have been performed on organisms adapted to outstanding temperatures, but much more attention has been paid to thermophiles than to psychrophiles. However, over the past 10 years, scientific publications on cold-adapted microorganisms have increased by a factor of ten.

If one considers the extent of cold habitats, psychrophiles, i.e. cold-loving organisms, should largely lead in this comparison with thermophiles because a great proportion of the Earth's biosphere never reaches temperatures above 5°C. Nearly three-quarters of the Earth is covered by oceans whose deep water masses, irrespective of latitude, are constantly between 2 and 4°C. The large continent of Antarctica also provides a permanently cold terrestrial environment as well as an aquatic niche in the surrounding ice that melts during the summer. Other examples of cold habitats are permafrost soils, high alpine soils, cold deserts, cold caves, marine sediments, snow, glacier and sea ice. Cold ecosystems host a wide diversity of psychrophiles, including bacteria, archaea, yeasts, filamentous fungi, and algae. These microorganisms have evolved a number of strategies to thrive successfully in cold habitats where they play key roles in nutrient cycling, such as nitrogen fixation, nitrification and denitrification, photosynthesis, sulfur oxidation and reduction, methanogenesis, and transformation of organic compounds.

This book is focused on psychrophiles and describes, at the edge of knowledge, representative groups of cold-adapted microorganisms as well as the habitats in which they live and their strategies to cope with the cold. It is subdivided into four main sections:

- (i) boundary conditions for microbial life at low temperatures
- (ii) biodiversity

- (iii) molecular adaptations
- (iv) biotechnological aspects

thus covering almost all the fields of knowledge in “cold” microbiological research.

It is certainly not by chance that this book is published during the International Polar Year 2007-2008, which is the fourth polar year following those in 1882-1883, 1932-1933 and 1957-1958 and involving over 200 projects, with thousands of scientists from over 60 nations examining a wide range of physical, biological and social research topics. Therefore, this book perfectly matches the current demands and trends and provides an additional source of information to all those scientists who are interested in “cold” microbiology.

Last but certainly not least, the editors of this book want to thank all the authors, who are the leading scientists in the respective field, for having accepted to write a chapter of this book, even though all these persons are also very busy and highly solicited scientists. We also thank Springer - Life Sciences, especially Dr. Dieter Czeschlik and Dr. Jutta Lindenborn, for their continuous support and trust in our capacity to successfully achieve the editing of this book.

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