Scientists, politicians and the general public alike now share the conviction that understanding (micro)biology of polar and alpine systems is of paramount importance to many urgent questions related to global climate, shrinking of polar areas and disappearing of glaciers and other habitats, with the concomitant threat of species extinctions, such as that of the polar bear. Most of the Earth’s biosphere is characterized by low temperatures (below 5 °C) and cold-adapted microorganisms are now known to be widespread in nature. Low temperatures and freezing conditions influence microbial life in multiple ways, e.g. reduced biochemical reaction rates, changes in membrane fluidity and protein conformation, ability to reproduce successfully, and the need for protection against freezing. There is thus considerable interest in understanding the adaptations, activities and survival of microorganisms in cold environments, as well as the ecological interactions of communities active in these environments. However, these issues, now so obvious to most of us, only started to become apparent within the last decade or so. Discoveries made by many individuals, prepared to endure the harsh conditions reigning in polar areas, have revealed the surprisingly high diversity and complexity of microorganisms inhabiting extremely cold environments, previously considered almost sterile. It is now apparent that ice and permafrost do not only contain entrapped microorganisms and particles, fossilized events from our past history, but also active microbial communities with an array of adaptations and roles in the environment.

Research on the microbiology of extremely cold environments gained further momentum with the organization of the first Polar and Alpine Microbiology Conference in 2004 in Rovaniemi, Finland (see June 2005 thematic issue of *FEMS Microbiology Ecology*). Amongst the main themes presented were elemental cycling, biodiversity, the role of microbial communities and microbial adaptations to extreme environmental conditions. This first conference enabled recognition of the most important aspects and research themes and was continued by highly successful meetings held in 2006 in Innsbruck, Austria (see February 2007 thematic issue of *FEMS Microbiology Ecology*), 2008 in Banff, Canada (see January 2009 thematic issue of *Canadian Journal of Microbiology*) and the latest one, in 2011 in Ljubljana, Slovenia. At the Ljubljana meeting, it became obvious that a decade of basic geomicrobiological studies from polar and alpine environments around the world has considerably expanded the scientific community. The meeting brought together 160 leading international researchers and students, who discussed many different aspects of cold-adapted microorganisms, the roles they play in polar and alpine environments and addressed recent developments. The conference also recognized the need to accelerate an ongoing paradigm shift towards a collaboration of a wide variety of disciplines by introducing unifying, multidisciplinary concepts and predictive models that view extremely cold areas of the world as being shaped by the interaction of both biological and abiotic drivers.

This thematic issue of *FEMS Microbiology Ecology* dedicated to Polar and Alpine Microbiology brings you a selection of the reports presented at the 2011 Ljubljana conference, complemented with additional submissions, reflecting the exciting and important questions discussed and the state of the art of the field. Although this focus in the microbiology of extremely cold areas is relatively new, the critical mass of scientists working on this field has by now increased sufficiently to enable moving our attention to regional and global scale models in order to address the impact of geomicrobiological interactions on elemental cycles, environmental change and climate. This is shown by 26 papers in total, representing the broad range of polar and alpine studies all over the world, with a focus on either Arctic issues or Antarctic research, or comparative studies of both areas. An additional set of papers show data from Alpine areas in a broader sense. The habitats of focus are lakes, glaciers, tundra soils and polar deserts, with a broad range of microbes, including bacteria and archaea, yeast, filamentous fungi and lichens in polar and alpine habitats.

We dedicate this issue to David A. Gilichinsky, Head of Soil Cryology Laboratory, Institute for Physicochemical and Biological Problems in Soil Science, Russian Academy of Sciences, our good friend and wonderful colleague, who passed away in February 2012. He was a pioneer and an inspiring leader in the study of microbes in permafrost, which constitute the new sub-discipline Permafrost Microbiology. David was an active participant in all the
four conferences on Polar and Alpine Microbiology. He will be missed by all of us.

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