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Editorial

Editorial: Thematic issue on polar and alpine microbiology

The 8th biennial Polar and Alpine Microbiology (PAM 2019 – www.confer.nz/pam2019) conference was held for the first time in the southern hemisphere at the University of Waikato, Hamilton, New Zealand on Feb 4–9th 2019. The conference attracted close to 100 attendees representing over 20 countries. Of these attendees over one third were early career researchers. The conference was hosted at the university by the International Centre for Terrestrial Antarctic Research (ICTAR) that has for the last 18 years focused on studying the microbiology of terrestrial Antarctica. The International Science Committee was chaired by Prof. Carsten Suhr-Jacobsen (Chair of PAM 2017 in Nuuk Greenland, Department of Environmental Science, Aarhus University, Denmark) and included Prof. Don Cowan (Centre for Microbial Ecology and Genomics, University of Pretoria, South Africa), Prof. Andrew McMinn (Institute for Marine and Antarctic Studies, University of Tasmania, Australia), Prof. Belinda Ferrari (School of Biotechnology and Bimolecular Sciences, UNSW Sydney, Australia), Prof. David Pearce (Faculty of Health and Life Sciences, University of Northumbria, United Kingdom), and Prof. Max Häggblom (Department of Biochemistry and Microbiology, Rutgers, The State University of New Jersey, USA).

PAM 2019 hosted four days of science sessions with four keynote addresses, 41 oral presentations, 15 poster presentations, a mid-week full day of field trips to experience some of the local cultural and natural beauty of New Zealand, and a final day of science workshops on some new powerful instrumentation and bioinformatics of metagenomes. The science programme was divided into 8 thematic sessions that included: Glacier Communities, Sea Ice Communities, Permafrost Communities, Microbial Ecology, Sentinels for Change, Physiology and Processes, Biogeography and Patterns, and Polar Microbiomes. A highlight of the meeting was the conference dinner where the attendees experienced New Zealand's Middle Earth with a Hobbit feast at the famous Hobbiton in the Waikato.

As is customary with the past Polar and Alpine Microbiology conferences a special issue of FEMS Microbiology Ecology was commissioned and announced at the meeting. The call for submissions generated 23 successful peer-reviewed papers focusing on the Arctic, the Antarctic, alpine ecosystems, a bi-polar comparison paper, and a mini review on cold physiological adaptation. The ecosystem split was highly representative of the fields of research of those that attended the conference.

Those contributions that focused solely on Arctic ecosystems reported on: denitrifiers in ice-wedge polygon soils (Altshuler *et al.* 2019), freshwater microbial diversity in a high Arctic watershed (Cavaco *et al.* 2019), micro-algal diversity in the White Sea (Chekanov *et al.* 2020), microbial diversity in brines from Arctic sea ice and cryopegs (Cooper *et al.* 2019), microbial activity in Arctic tundra soils communities (Gadkari *et al.* 2020), the rare biosphere of the Greenland Ice Sheet dark zone (Gokul *et al.* 2019), methanogens and long-term permafrost thaw (Holm *et al.* 2020), soil biogeography in the Arctic region (Malard *et al.* 2019), cyanobacterial diversity at the Alaska North Slope (Strunecky *et al.* 2020), microbial diversity in Greenland glaciers and cryconites (Uetake *et al.* 2019), the impact of shrub expansion on tundra soil bacterial communities (Canini *et al.* 2020), the functional metagenomic analysis of Svalbard permafrost (Xue *et al.* 2020) and *Methylobacter* populations in high Arctic peat (Rainer *et al.* 2020). Those papers concentrating on Antarctic ecosystems included: the impacts of a warming world on enzymatic activity in Antarctic soils (Barnard *et al.* 2020), how abiotic factors influence microbial diversity in the McMurdo Dry Valleys (Bottos *et al.* 2020), the diversity, distribution, and role of heterotrophic diazotrophs in Antarctic soils (Coyne *et al.* 2020), and the energetic constraints in benthic microbial mats of an Antarctic Lake (Dillon *et al.* 2020). Those submissions specifically addressing questions in Alpine ecosystems included: resolving the diversity and functional role of the rock varnish microbiome (Esposito *et al.* 2019), microbial succession in Tibetan Plateau glaciers (Kong *et al.* 2019), microbial biogeography in Tibetan Plateau lakes ecosystems (Liu *et al.* 2019), prokaryotic and fungal communities in Tibetan lake sediments (Yang *et al.* 2020), and a comprehensive characterization of two new snow algae (Procházková *et al.* 2019). The special issue also contains one bi-polar study examining the diversity of natural product encoding genes in High Arctic and Antarctic soils (Benaud *et al.* 2019) and a more general mini review on the role of outer membrane glycolipids in bacteria from cold environments (Casillo *et al.* 2019).

The success of this special issue is due largely to the enthusiasm and open exchange that occurred throughout the conference. Those in attendance left New Zealand having experienced great science, a unified polar and alpine community and a touch of New Zealand's cultural and natural beauty. Many of the contributions in this special issue are from our early career attendees, for many of whom this was their first international conference. The editors of this special issue wish to thank all PAM 2019 participants, all of the authors and co-authors of the individual contributions and especially all of the reviewers that lent their wisdom to ensuring the very highest quality outcome.

More than ever before, polar and alpine ecosystems are under threat, particularly from loss of glacial mass and the thaw of permafrost. These changes offer some exciting, even disturbing, opportunities for microbial ecologists, as we focus on the roles that microorganisms play in exacerbating the rate of change (snow algae, for example) and in responding to such

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changes (ecosystem servicing, resilience and more). For better or for worse, we live in interesting times!

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