A strategy to protect reference sites for future microbiology research in Antarctica

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In addition to iconic animals and birds, Antarctica harbours surprisingly diverse microbial communities that drive important biogeochemical processes in virtually all habitats, including ice-free regions, ice sheets and subglacial habitats. Recent studies have shown that Antarctic microbiomes may have unique compositions and functions, exhibit biogeographic patterns, and include endemic taxa that have survived in refugia since the continent started to glaciate.

Microbial habitats are under constant pressure due to anthropogenic activities, which may introduce non-indigenous microorganisms, via human bodies, clothing, food, cargo, or construction material. New 'entry points' for microbial contamination are a consequence of the increase and diversification of tourism and research stations. Climatic changes might increase the probability of establishment of non-native taxa. The impacts of such introductions are still unknown, but might lead to a loss of the native microbial biodiversity, or its modification.

The technical progress in molecular methodologies has generated very sensitive high-throughput methods. They have the potential to describe the microbial communities with unprecedented detail. However, due to the anthropogenic pressure described above, we may be losing the pristine Antarctic areas that would enable scientists to study the native microbial flora, its functions and properties.

One tool of the Protocol on Environmental Protection of the Antarctic Treaty that could be specifically used to protect microbial habitats is the creation of inviolate areas where a special entry permit is required (inside ASPAs, for example) and quarantine equipment needs to be used. These zones could be set aside for future research and become extremely valuable as after a few decades, they would be unique examples of pristine habitats, representative of the native microbial diversity and processes. Examples of this are ASPA 126, Byers Peninsula, and ASPA 172, Lower Taylor Glacier and Blood Falls.

This option would require discussions and a consensus with scientists of other disciplines to select these regions, and careful management protocols of the sites and their vicinity. In addition, gaps in knowledge should be addressed, like the extent of transportation of microorganisms by natural means (wind, birds...), and the probability of subsequent colonization of new areas by microorganisms coming from other Antarctic regions or from outside Antarctica.

We hope that the dialogue between scientists and policy makers will improve the conservation of Antarctic microbial diversity and safeguard the possibility to study these unique communities in the future by the next generation of scientists, with the most advanced techniques of the time.