Fungi in the Arctic and Antarctic's ice cores, and new attempts to use fungi in polar regions

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Ice sheet deposited in Arctic and Antarctica entraps viable and nonviable fungi, as well as biomolecules and air. They become temporal atmospheric records. Despite exposure to conditions adversely affecting their survival, such as subzero temperatures and low nutrient and water availability, some of fungi that entrapped in ice sheet can survive.

Fungi in the Antarctic and Arctic are known to have a high cold and freezing tolerance, as they can survive in extreme environments below -40°C. Because the polar environment is oligotrophic, the fungi that inhabit it play an important role in nutrient cycling, and even changes in the fungal diversity due to climate changes can have a significant impact on material production in the polar regions. Therefore, isolation of fungi in ice cores and investigation of their genomic and physiological characteristics are important not only for understanding the evolution of fungi in polar regions, but also for elucidating polar ecosystems.
In this presentation, I would like to talk about my attempts to isolate ancient fungi from ice cores in the Arctic and Antarctica.

According to the IPCC Special Report, if global warming continues at its current pace, the annual average temperature is expected to increase by about 3.2°C by 2100, which corresponds to a temperature difference of about 360 km (equivalent to the distance between Shinjuku Ku, Tokyo and Sendai City, Miyagi) in terms of Japanese latitude. Since most of the fungi in Antarctica and the High Arctic are specialized for cold environments, this rise in temperature could have a serious impact on the survival of fungi around Syowa Station, Antarctica, in the Canadian High Arctic etc.

Fungi in Antarctica and the High Arctic are threatened with habitat shrinkage and extinction due to climate change because they are specialized for growth at low temperatures. These fungi have the unique characteristic of growing even at sub-zero temperatures and have recently begun to attract attention as a microbial resource.

In addition, fungi in polar regions, which inhabit one of the world's harshest environments, are attracting attention as a new genetic resource. However, the genome sequences of Antarctic and High Arctic fungi are not available without advanced bioinformatics technology, since only about 20 whole genome data are stored in DDBJ, NCBI, and EBI, which are international nucleotide sequence databases.

In the second topic, I would like to talk about the attempt to make the National Institute of Polar Research a research hub on fungi in Polar regions.