KMB 2019

46th ANNUAL MEETING & INTERNATIONAL SYMPOSIUM

The Korean Society for Microbiology and Biotechnology

June **23** (Sun) - **25** (Tue), 2019

ICC JEJU, Korea

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Microbes of the Rocks and Permafrost, an Extraterrestrial Analog

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The polar region is characterized by low temperatures, dry air, strong UV, and poor nutrient. Even though Earth has sufficient oxygen, the polar region is a good analog of the extraterrestrial environment such as Mars. Permafrost is a frozen ground with a temperature below 0℃ for two or more years, which lies on approximately 25% of Earth's terrestrial surface. Despite the long subzero temperature and poor water availability, a diverse group of microbes is living in permafrost. Permafrost is a good source of extremophiles. Methanogenic archaea from Siberian permafrost, for example, can survive in the Martian subsurface, showing a remarkable dry condition, osmotic stress, low temperatures, and radiation. Rock is also a sheltered habitat to avoid environmental stresses in the polar region. In fact, microbes of rocks are a major focus of many investigations of life in harsh environments or studies with astrobiological implications. In this lecture, I would like to introduce the diversity and function of microbes living in Arctic rocks and permafrost. From these extreme microbes, I would also like to find the insights of extraterrestrial life that may be living outside the Earth.

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Abstract

The polar region is characterized by low temperatures, dry air, strong UV, and poor nutrient. Even though Earth has sufficient oxygen, the polar region is a good analog of the extraterrestrial environment such as Mars. Permafrost is a frozen ground with a temperature below 0°C for two or more years, which lies on approximately 25% of Earth's terrestrial surface. Despite the long subzero temperature and poor water availability, a diverse group of microbes is living in permafrost. Permafrost is a good source of extremophiles. Methanogenic archaea from Siberian permafrost, for example, can survive in the Martian subsurface, showing a remarkable dry condition, osmotic stress, low temperatures, and radiation. Rock is also a sheltered habitat to avoid environmental stresses in the polar region. In fact, microbes of rocks are a major focus of many investigations of life in harsh environments or studies with astrobiological implications. In this lecture, I would like to introduce the diversity and function of microbes living in Arctic rocks and permafrost. From these extreme microbes, I would also like to find the insights of extraterrestrial life that may be living outside the Earth.