Hearty bacteria help make case for life in the extreme

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(PhysOrg.com) -- The bottom of a glacier is not the most hospitable place on Earth, but at least two types of bacteria happily live there, according to researchers.

The bacteria -- *Chryseobacterium* and *Paenisporosarcina* -- showed signs of respiration in ice made in the laboratory that was designed to simulate as closely as possible the temperatures and nutrient content found at the bottom of Arctic and Antarctic glaciers, said Corien Bakermans, assistant professor of microbiology, Penn State Altoona. She said that carbon dioxide levels in the laboratory-made ice containing the bacteria, which were collected from glaciers in Greenland and Antarctica, indicated that respiration was occurring at temperatures ranging from negative 27 to positive 24 degrees Fahrenheit.

Bakermans, who worked with Mark Skidmore, associate professor of geology, Montana State University, determined the level of respiration by measuring the amount of carbon dioxide in the laboratory-made ice.

While humans obtain energy from sugar, the bacteria in this experiment used acetate, a form of vinegar. Like human respiration, the microbes take in the molecules, extract energy from them and breathe out carbon dioxide as a waste product.

Bakermans said the study may have implications for the search for life on other planets, like Mars, because some places on Mars are in the same temperature range as the temperature levels recorded during the

experiment.

"Although there are a lot of other factors involved for life to take hold on other planets," Bakermans said, "we can still say that if microbes on Earth can do this, then there's the potential, at least, that microbes can do this on Mars."

Glaciers and ice sheets represent large ecosystems that cover more than 10 percent of the Earth and contain approximately 78 percent of the world's fresh water.

The researchers, who reported their findings in a recent issue of Environmental Microbiology *Reports*, said that respiration was reported at all temperatures examined.

The respiration rate of the microbes increased as the temperature rose. While the respiration rates of the bacteria are slow compared to the human respiration, the microbes could maintain cell structure and viability throughout the observed temperature range.

The researchers also performed a staining test to measure reproduction and cell viability. When cells are alive or dead, they leave a chemical footprint of those states. By applying stains to the bacteria in the laboratory-made ice, the researchers can find those chemicals and determine if the cells are alive and healthy.

Bacteria seem to grow best in cracks and crevices within the ice, Bakermans said. The cracks in the ice create channels that allow water and nutrients to circulate.

"It's hard for nutrients to be exchanged in the ice," Bakermans said. "But these channels appear to give the microbes access to nutrients."

The bottom of glaciers may be more hospitable for the microbes than other parts of the glacier because the areas draw warmth and nutrients from the earth, Bakermans said.

Provided by Pennsylvania State University

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