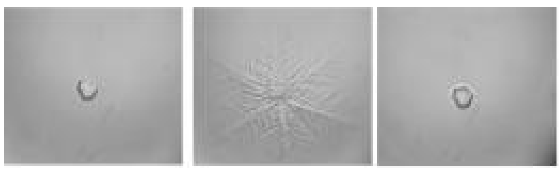
# Antifreeze proteins can stop ice melt, new study finds

March 1 2010



A crystal of ice protected by anti-freeze proteins, can withstand cooling (left) and melting (right). In contrast, ice that grows quickly in a snowflake formation in cold temperatures (middle), is not protected and melts quickly in warm temperatures (right). Credit: Ido Braslavsky, Ohio University

The same antifreeze proteins that keep organisms from freezing in cold environments also can prevent ice from melting at warmer temperatures, according to a new Ohio University and Queen's University study published today in the Early Edition of the journal *Proceedings of the National Academy of Sciences*.

Antifreeze proteins are found in insects, fish, bacteria and other organisms that need to survive in cold temperatures. These proteins protect the organisms by arresting the growth of ice crystals in their bodies. The new study not only has implications for understanding this process in nature, but also for understanding the superheating of crystals in technologies that use superconductor materials and nanoparticles.

Twenty years ago, researchers proposed that antifreeze proteins can create superheating by suppressing melting at temperatures higher than the equilibrium melting point.

"During recrystallization, a larger ice crystal grows while a smaller one melts. Antifreeze proteins can help control both of these processes," explained Ido Braslavsky, an associate professor of physics and astronomy at Ohio University who worked on the study with lead author Yeliz Celik, a doctoral student in physics at Ohio University, and Professor Peter Davies of Queen's University in Canada.

The team's study, supported by the National Science Foundation and the Canadian Institutes for Health Research, presents the first direct measurements of the superheating of ice crystals in antifreeze protein solutions, Celik said.

In addition, the researchers provide the first experimental evidence that superheated ice crystals can be stabilized above the melting point for hours, at a maximum temperature of about .5 degree Celsius. Superheated crystals rarely stay stable for long periods of time, and previous studies showed that stabilization only occurs under unique conditions, Braslavsky explained.

The researchers used two techniques in the study, fluorescence microscopy and sensitive temperature control of a solution within a thin cell. In order to track the position of the antifreeze protein on an ice crystal, the researchers attached a second protein to the antifreeze protein—the green fluorescent protein, which glows under certain conditions. The scientists then placed the antifreeze protein solution in the thin cell, which allowed them to observe the fluorescence signal from the protein while finely controlling the ice crystal's temperature.

Although the study reveals that these proteins can suppress ice melting up to a certain point, the protein's ability to suppress ice growth is much stronger. The hyperactive antifreeze proteins used in the study were more capable of suppressing melting than the moderately active ones, Braslavsky said.

These findings potentially could make the process of ice recrystallization inhibition more efficient for applications such as maintaining the quality of frozen foods, Braslavsky said.

"Antifreeze proteins that inhibit growth and melt are essential for protection against freeze and thaw damages," he said. "Big crystals (that occur in the recrystalization process) separate cell walls and damage the integrity of the tissue."

Provided by Ohio University

Citation: Antifreeze proteins can stop ice melt, new study finds (2010, March 1) retrieved 9 April 2024 from https://phys.org/news/2010-03-antifreeze-proteins-ice.html