Vitamin E crucial to plants' survival of the cold, study finds

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Vitamin E does not play the same role in plants as it does in animals and humans, scientists from the University of Toronto and Michigan State University have found. Rather than protect fats in membranes from certain kinds of stress, Vitamin E instead fulfils a crucial role in plants' nutrient transport system in cold temperatures. The surprising finding, which has the potential to be applied in the development of biofuels and cold-tolerance in crops, was reported in a recent cover story of *The Plant Cell*.

Vitamin E is an essential nutrient to all mammals and its role has been widely studied in animals, but little research had been done on how Vitamin E functions in plants, says Tammy Sage of U of T's department of ecology and evolutionary biology. In animal systems, Vitamin E acts as an anti-oxidant that helps prevent lipids in membranes from stress. Sage and her colleagues decided to investigate the long-standing, but still largely untested hypothesis that the vitamin would function similarly in plants. "That wasn't what happened at all," says Sage. "The result was quite unexpected."

Researchers subjected a Vitamin E-deficient mutant of an Arabidopsis plant to stresses like high salinity, intense light and drought and measured the results. A lack of Vitamin E did not harm the lipid oxidation or photosynthesis processes but, under non-freezing cold conditions, did cause particular cells responsible for food and water transportation to accumulate a carbohydrate called callose in their cell walls. The increase of callose in these cells inhibited regular food

movement from the leaves to the rest of the plant and caused a buildup of sugars and starch within the leaves."

"Without this food movement, the plant produces fewer seeds," explains Sage. "We realized Vitamin E is essential for plants to be able to continue to reproduce well in lower temperatures."

There may be practical applications to this discovery, Sage says. The information could be useful to researchers seeking ways to develop species of plants resistant to cold temperatures. And researchers involved in alternative energy production may take interest.

"There is a lot of current interest in extracting cellulose from plant cell walls to produce biofuels," explains Sage, "but it takes a large amount of energy to break cellulose down into the carbohydrates that are needed. If you had a plant that had already accumulated an abundance of sugars and starch in the leaves, then you wouldn't have to worry as much about breaking down the cellulose to make biofuels."

Source: University of Toronto