Medical Xpress

Antifreeze protein from ticks fights frostbite in mice

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A protein that protects ticks from freezing temperatures also prevents frostbite when introduced in mice, a Yale-led study has found. The research is the first to demonstrate the protein's ability to boost frostbite resistance in an adult mammal.

The research was published Feb. 25 in the journal *PLOS ONE.*

Several animal species, such as ticks and fish, have anti-freeze proteins that protect them from cold conditions. However, warm-blooded mammals do not have such proteins in their genomes and can suffer severe cold injuries such as frostbite. "We wanted to ask if you put antifreeze in mammals, can you protect them from a cold injury," said Erol Fikrig, M.D., principal investigator, professor of medicine at Yale School of Medicine, and an investigator for the Howard Hughes Medical Institute.

In the study, Yale investigators and their co-authors at Gulhane Military Medical Academy and Old Dominion University introduced an antifreeze protein derived from the black-legged tick into mice cells as well as in whole live mice. They first tested frostbite resistance of skin samples from mice that were treated with the antifreeze protein and from control mice. The skin samples were stored at 4 degrees Celsius for four days. At the end of four days, the skin cells from the treated mice fared better and even increased in number compared to the control samples.

The researchers also compared the effect of the antifreeze protein on whole mice tails. After seven days of cold exposure, 60% of the treated mice showed no visible sign of frostbite compared to only 11% of control mice. The tails of treated mice also showed fewer signs of inflammation consistent with frostbite damage than control mice.

The authors noted that the antifreeze protein prevents cold damage by limiting the growth of ice crystals that would otherwise cause tissue damage. "This study shows that if you put an antifreeze protein into warm-blooded animals, it does elicit antifreeze activity and it can protect the animal from frostbite," Fikrig explained.

While more research is required to test the application of the study findings beyond mice, they could have two hypothetical future benefits, noted the researchers. In the case of organ transplantation, the antifreeze protein could potentially help extend the amount of time that organs are placed in cold storage prior to transplant. Researchers could also explore the benefit of antifreeze protection for people with certain autoimmune diseases, such as scleroderma, that are characterized by cold sensitivity.

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