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Frogs Freeze to Survive the Alaskan Winter

How Turning Into a Frogsicle Prevents Death

BY SIMONE SCULLY

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Less than three inches long with paper-thin skin, wood frogs might seem like one of the most unlikely creatures to be able to endure Alaska's frigid winters. However, it turns out they take a rather Zen-like approach to the cold, becoming one with their environment by freezing along with it.

For as long as seven months, up to 60 percent of their bodies freeze solid. They stop breathing. Their heart stops beating. This semi-frozen state allows them to survive temperatures that dip below zero, explains Brian Barnes, researcher and director of Arctic Biology at the University of Fairbanks, Alaska. Come spring, they thaw out and come back to life.

Scientists have known for decades that the amphibians deep-freeze when the mercury drops. However, this is the first time they've been observed surviving such low

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temperatures or for such a long stretch of time. It's also the first time that researchers might have an explanation for why these critters don't just turn into permanent frogsicles.

The answer, reveals the work of Barnes and his Ph.D student Don Larson, appears to lie in how the death-defying frogs freeze.

"Our study is the first to demonstrate that frogs freezing under natural conditions experience multiple successive freeze-thaw episodes," said Barnes. In fact, the amphibians cycle through 10-15 of these episodes before they ice up for the season.

Barnes and Larson, who recently presented the findings at the 2014 Society for Integrative and Comparative Biology conference in Austin, think that by alternately freezing and thawing, the creatures build up high concentrations of glucose—as much as 10 times the normal amount. The sugar solutes acts as "cryoprotectants," protecting the hoppers while they turn to ice by lowering the freezing temperatures of tissues and allowing cells to survive. In most creatures, prolonged exposure to subzero temperatures causes cells to shrink while ice forms in the tissue. The formation of ice sucks the water out of the cells, killing them. But with Alaskan wood frogs, the cryoprotectants help the cells resist this shrinkage.

The researchers believe that the freeze/thaw cycles work similarly to the deliberate hyperventilation divers use to increase the volume of air in their lungs before submerging. By freezing and thawing, the frogs build up the amount of cryoprotectant glucose in their body for the long winter ahead. It's a pretty sweet solution to beating the cold.

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