

Outdoors

How hibernating critters survive frigid winters without freezing to death

Suzanna Caldwell | Dec 13, 2012



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FAIRBANKS -- Alaskans are all-too familiar with living in cold weather. Most of us hunker down, suck down carbohydrates and, despite good intentions, sleep more and exercise less.

Animals in the North aren't too different. They do some of the same things, except for animals like Arctic ground squirrels and black bears, who take it to the next level.

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"There's a really remarkable diversity of tolerances and different ways or mechanisms animals use to achieve those tolerances," said Brian Barnes, director of the [University of Alaska Fairbanks Institute of Arctic Biology](#). "It's fascinating to be a biologist in Alaska."

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Barnes worked with the [University of Alaska Museum of the North](#) to come up with the museum's latest exhibit, "Hibernation and the Science of Cold."

The exhibit focuses on research Barnes and other scientists have done on animals surviving Arctic winters. Included in the exhibit are videos of black bears in hibernation and even a live, hibernating ground squirrel kept in a glass freezer set to a nippy 1 degree Celsius. Get a video preview of the exhibit [here](#).

Lessons of hibernation

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While the research on hibernation is fascinating, it's also practical. Barnes

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...For example, Barnes said, when bears



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emerge from hibernation, their muscles and bones remain strong despite months of sleep. Understanding how that works could help humans recover from extended bed-rest or periods of low muscle activity – which, for instance, afflicts astronauts in space.

"(Bear) bones don't change at all, even though they're in virtual bed-rest," he said. "How do they trick their muscles and bones into thinking they're still exercising?"

So what are some of the most surprising adaptations of arctic animals? Alaska Dispatch asked Barnes to offer up a few of the extraordinary hibernation techniques.

Arctic ground squirrels: No icy blood

In July, when it's still warm, green and sunny, Arctic ground squirrels decide to call it a night. The animals dig into little burrows near the permafrost and "unplug," Barnes said, slowing both their breathing and heart rate. In icy burrows, their body temperatures can drop to 1 degree Celsius. In the process leading up to hibernation, the squirrels scrub their blood of ice nucleators, tiny particles of

process leading up to hibernation, the squirrels secrete their blood with nucleators, tiny particles of food, dust or bacteria that ice crystals can bond around. With no nucleators, ice can't form in the squirrels' blood, allowing them to survive extreme winter temperatures.

Wood frogs: Frozen solid

While squirrels don't freeze, wood frogs do. Barnes calls them "world champs of being frozen" – one of only a handful of vertebrate animals that can survive the freezing process. He said 70 percent of their body's water freezes solid – including vital organs like their heart, brain and lungs. Come spring when temperatures warm up, they thaw out and eventually take their first breath in seven months. So why freeze solid? "They don't have a lot of choices," Barnes said. Check a video [here](#).

Glass insects: Spring surprise

Ever wonder where all those insects come from early each spring? Most never left, according to Barnes. Some beetles can even survive temperatures down to 100 degrees below zero. But it's not a total freeze. Barnes said the insects survive by undergoing a process of vitrification – a rapid cooling process that turns liquid into glass "just like a window." Come spring, they just "warm up and crawl away."

Baby bears: Nursing during hibernation

Perhaps bears are the most famous hibernators. Barnes calls them "human-sized hibernators," who spend the summer creating fat reserves to survive months of hibernation. Female bears are particularly interesting. Although they mate in June, sows don't allow the fertilized embryo to implant until late October during hibernation. While in hibernation, sows give birth – usually to twins, which they nurse, despite not eating or drinking.

Barnes said fat is key. For every ounce of fat a bear metabolizes, one ounce of water is produced. While that might not seem like much, it does the job. "That's enough to make the milk to grow those cubs," Barnes said.

Barnes hopes everyone who visits the exhibit finds some wonder and excitement over animals they regularly see in a state they're rarely seen.

Maybe visitors can even have a little fun.

"They can even say they heard a black bear snoring in its den," he said.

The exhibit opens at the University of Alaska Museum of the North Saturday (Dec. 15) and runs through May 15. For information on admission and hours of operation, visit the museum's [website](#).

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