mystery science

Grades K-5
Mini-Lesson: “What’s the coldest temperature any animal could survive?”

VIDEO TRANSCRIPT

VIDEO 1

[Video Call]

- Hi!

- Hi, Piper!

- I have a question for you. What's the coldest temperature any animal can survive?

- Ooh, that's a great question.

As you might know, the coldest place on Earth is the South Pole, where temperatures have been recorded as low as -137 degrees Fahrenheit. If you've seen our mini-lesson "How do polar animals survive the cold?" then you might know that polar animals depend on layers, things like blubber or fur or thick feathers, to help keep them warm. But is having layers of blubber or thick fur or feathers the only way some animals survive incredibly cold temperatures? This is a frog called a wood frog. It lives in parts of North America. But now check this out. This is a wood frog when temperatures have dropped below freezing. Do you notice anything unusual about it? It's covered in ice! What do you think is going on here? Scientists have nicknamed them frogsicles because it turns out these frogs have the ability to actually freeze, and when I say freeze, I mean their skin gets covered in ice and their insides

are totally frozen. Their hearts stop beating. They even stop breathing. But now watch this. Once it warms up, the frog is thawing out. It's moving. It's alive and healthy. How is this possible? How do you think the wood frog stays alive, even though its body becomes frozen? Now would be a good time to pause the video and discuss.

Okay. You ready?

VIDEO 2

You might have some cool ideas about this, like, maybe there's something about its skin that protects it. What exactly is happening? Is this some special way of hibernating? The answer might surprise you. You see, unlike polar animals, these wood frogs don't depend on stuff that's on the outer layers of their body to beat the cold, like blubber or thick fur. Instead, these frogs depend on something inside their bodies. It turns out that the wood frog has special chemicals in its body that protect its inner body parts from damage, even though they're getting frozen. While these frogs probably couldn't survive polar temperatures, this ability does allow them to survive some really cold winters where they live. It's almost like a superpower that a superhero has. In fact, the creators of the movie "Captain America" say that that character's ability to survive being frozen was inspired by the real-life example of the wood frog. Learning about this made me wonder. Are there any other animals that have surprising ways of surviving the cold? Check this out. These kids were skating on a frozen pond when they noticed right under their feet a bunch of painted turtles resting in the water under the ice. What are they doing down there? And don't turtles have to come to the surface to breathe? Well, it turns out, what they're doing down there is staying warm. In wintertime, even though the water in a pond or lake gets really cold, it's only the top layer that actually freezes. Under

the ice, it's slightly warmer than freezing. So if you're a painted turtle, hanging out at the bottom of a cold pond isn't a bad place to spend the winter, if you could solve the problem of how to breathe underwater. But how do they do that? It's not like they have gills like a fish. Well, scientists figured out that certain kinds of turtles have something in their bodies that acts like gills, that is, lots of tiny blood vessels that can pull oxygen out of the water—not a lot, just enough to survive underwater during the winter. Except, unlike a fish, in a turtle, these blood vessels are located in their cloaca. That's their butt. Okay, we've heard about some pretty weird ways animals survive cold temperatures: frogs with special chemicals in their bodies, turtles breathing through their butts. But what this animal, the Arctic ground squirrel, can do might be the strangest one of all. Like a lot of mammals, these squirrels hibernate in the winter. But unlike other mammals, the Arctic ground squirrel's body temperature goes below freezing. As this happens, part of their brain seems to kind of shrivel up and stop working. But then, incredibly, it actually grows back, and in only about two hours! Some scientists are fascinated by this and are carefully trying to figure out exactly how and why they can do this. Still, while all the animals we've talked about have some pretty unusual ways of surviving cold temperatures, none of these animals could likely survive a temperature colder than the coldest place on Earth. But there is one animal that we absolutely know can survive temperatures even colder than the coldest place on Earth, and that's because we've taken this animal to a place that's colder than the coldest place on Earth, a place where the temperature is -455 degrees Fahrenheit. The place I'm talking about is outer space. But what animal could I possibly be talking about? This. It's called a tardigrade. It's got a chunky body, eight legs, two tiny eyes, and a really round head. It looks a little bit like its nickname, a water bear. Tardigrades were taken to space as part of a mission where they spent 12 days riding on the outside of a rocket orbiting the Earth, and they came home alive. The reason scientists did this

was because they knew that tardigrades are pretty tough. Being adaptable, or able to change, is the key to their toughness. In wet conditions, they're wriggly. They swim around. They eat. But in dry conditions, they turn into something that looks like a hard little pebble. They might look dead and unmoving, but with just a little bit of water, they'll start moving and eating again. In their dried-up form, scientists have discovered that tardigrades can survive for years and years. And maybe the best part of all: tardigrades live right in your neighborhood. You just haven't noticed them yet, because these things are tiny. They're microscopically small. Each tardigrade is about the size of a grain of salt, and they can often be found on any kind of moss that you see growing, whether it's moss on the ground or growing on a building or a tree. It doesn't matter where you live. To see one in person, you do need to know someone with a microscope, but it doesn't have to be a fancy one. Even a cheap paper microscope will work, like this one. It's called a Foldscope. In fact, this tardigrade footage you're seeing here was actually recorded with one. So in summary, animals can adapt to extreme cold in some surprising ways: wood frogs that freeze solid, painted turtles that breathe through their cloacas, and Arctic ground squirrels that regrow parts of their brains. Still, no other animal on Earth is as tough as the tardigrade, which can survive super cold temperatures, even the cold of outer space. That's all for this week's question. Thanks, Piper, for asking it!