

Preventing frog-sicles

By Meghan Rosen/ August 28, 2013

Even in the super cold, Alaskan wood frogs can survive. Sure, up to two-thirds of the water in their body may freeze. But with a slow thaw, they'll spring back to life. Scientists now report how it's done: The hoppers produce a natural antifreeze.

Wood frogs live across a broad swath of North America. Their range spans from Georgia up through Canada and into Alaska's Arctic forests. But members of this species (*Rana sylvatica*) don't all encounter equally extreme winters. The average January low in Ohio is -5° Celsius (23° Fahrenheit). Where these frogs live in Alaska, January temps can reach a very frigid -28° C. (-18.4° F.)!

Biologists knew these amphibians could withstand some freezing weather. But no one understood how those in Alaska survived its extreme cold. So Jon Costanzo and his colleagues at Miami University in Oxford, Ohio, investigated. They collected wood frogs from Ohio and Alaska and brought them to their lab. Then they closely observed the animals after freezing and thawing them.

Less ice formed in the skin and muscles of the wood frogs living in Alaska than in those of the species from Ohio. Costanzo's team also found the Alaskan frogs' blood and tissues had higher levels of sugar, urea (a waste product in urine) and another unidentified chemical. The researchers suggest these chemicals lower the Alaskan frogs' freezing point. Levels of this antifreeze were really high in the brain.

So it appears that frogs exposed to extremely cold temperatures have evolved a special way to cope from freezing to death.

The new findings appeared August 21 in the *Journal of Experimental Biology*.

In this time-lapse video, a frog frozen for 24 hours takes 10 hours of thawing to spring back to life. Credit: Jon Costanzo/CompanyofBiologists



Wood frogs in some regions appear to rely on antifreeze to survive extreme winters. Credit: iStockphoto

Power Words

amphibians A group of animals that includes frogs, salamanders and caecilians. Amphibians have backbones and can breathe through their skin. Unlike reptiles, birds and mammals, unborn or unhatched amphibians do not develop in a special protective sac called an amniotic sac.

urea A nitrogen-rich chemical that the bodies of many animals produce after breaks down proteins, amino acids (the building blocks of proteins) or ammonia. People excrete excess nitrogen from the body — as urea — in urine. But many other mammals, amphibians and fish make urea as well. Synthetic urea is often a nitrogen source of plant fertilizers. In 1828, German chemist Friedrich Wöhler for the first time created urea in the laboratory. This discovery would lead to the widespread use of synthetic fertilizers in farming.