bark beetle—must be the world champion cryonic insect. In the laboratory, these beetles have been exposed to temperatures approaching 238 degrees below zero (–150° C), and they did not freeze. That's incredible!

Fish—including northern cod, herring, and flounder—survive the frigid Arctic ocean because God pumps them full of special antifreeze proteins that possess an unusual molecular structure with a repeating pattern, not unlike the proteins found in cold-tolerant insects. These cryoprotective proteins bind to tiny ice crystals, thus preventing larger ice crystals from forming and damaging the fish's tissues and organs.

Plants, fungi, and bacteria have also been designed by our Lord Jesus Christ to withstand the ravages of winter through similar methods.

Incidentally, how would you feel about eating a strawberry laced with beetle protein? You may be interested to know that food scientists are presently attempting to create frost-tolerant fruits and vegetables by inserting into plants the gene for the antifreeze proteins found in certain insects. They are also trying to come up with a smoother ice cream texture using the same insect molecules. (The presence of antifreeze proteins prevents ice crystals from forming and thus causing "grittiness.") Just imagine the advertisement—"Our ice cream is made with real bug protein for that smooth taste you've come to love!"

This happened that we might not rely on ourselves but on God, who raises the dead.
2 Corinthians 1:9

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"I am the resurrection and the life. He who believes in me will live, even though he dies."
John 11:25

ISSUE 21

THE COLD TRUTH

Did you know that the frogs and insects that suddenly appear in spring preach a special sermon about our Creator and Savior, Jesus Christ? Have you ever wondered how these tiny creatures survive the icy tomb of winter? After all, extreme cold is a tremendous challenge for every living thing. Unprotected, the fragile cells that make up the substance of plants and animals burst like water pipes in freezing temperatures—and this leads to irreversible tissue damage.

It may be that God gave people the intelligence to protect themselves in harsh weather because we are more sensitive to cold than most other creatures.

Wood frog

In this sense, we are also more dependent upon our Creator. If our core body temperature drops below 95° F (35° C), we will die. According to the Centers for Disease Control (CDC), hypothermia causes approximately 600 deaths each year in the United States alone. With these facts in mind, the following account is nothing short of astounding!

The common wood frog (*Rana sylvatica*) of North America is

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the only amphibian found living above the Arctic Circle. Unlike most frogs, which hibernate by burrowing into the soft mud of lakes or ponds, the wood frog seeks shelter in the late-autumn ground litter of its forest habitat. This leaves it exposed to much harsher temperatures than pond-dwelling amphibian species, which are insulated by water.

In winter, the wood frog freezes solid for two or three months at a time without harm. This exposure to bitter cold causes its internal organs to become encased in ice, and the frog's eyes turn ghostly white as the lenses inside freeze. Not a pretty sight. Yet, in spring it comes back to life. How does our Creator, Christ Jesus, accomplish this seemingly impossible feat? Simply put, he makes the wood frog extra sweet!

As autumn temperatures plummet in the far north, the liver of the wood frog churns out huge amounts of glucose (a sugar common to the body). Glucose accumulates in the frog's tissues and acts as a type of antifreeze—not unlike the ethylene glycol used in your car's radiator. The presence of this enormous amount of sugar allows the fluids inside the frog's tissues to become thick like maple syrup, which prevents intracellular ice crystals from forming. The frog is safe as long as ice doesn't crystallize within its cells, causing them to rupture. Fluid outside the cells, however, can freeze completely without damaging the frog's internal organs.

This incredibly high concentration of sugar—pumped out by the liver—would quickly cause you and me to enter into an irreversible diabetic coma. And it flies in the face of the way an amphibian's body usually works. Normally, the pancreas (a special organ in its belly) releases a protein called insulin when blood sugar rises. Insulin drives the blood glucose level back down by helping the frog's tissues utilize sugar. All this changes in late fall. During winter months, glucose remains extremely elevated. For the wood frog, it effectively prevents cells from exploding in the cold.

As the frog freezes solid like a Popsicle, its heart stops, blood flow and breathing cease, and brain activity disappears. For all intents and purposes, it is clinically dead—and remains this way for weeks at a time. In spring, the frog thaws and miraculously comes back to life, leaping and jumping around only hours after being as stiff as a brick.

The wood frog's testimony to our Creator's genius cannot be ignored (Romans 1:20). And it is an incredible symbol of our future resurrection in Christ. If we stop to ponder this fantastic feat of survival, we might better appreciate the certainty of our own eternal life found in Jesus. He is our sweetness because he brings peace between us and God (Matthew 11:28-30; Isaiah 9:6). He alone protects us from the coming storm of God's wrath against sinners. Christ is our resurrection if we trust him with our lives (John 11:25; 1 Corinthians 15:20-23; 50-58). Oh, that our hearts might continue to fall upon him with the simplicity of this pure faith in God.

Upis ceramboides

DIGGING DEEPER

Over the past 50 years, it's been discovered that many of the organisms Christ has fashioned possess a type of antifreeze in winter. What's fascinating is that the method of cold protection often varies from animal to animal and plant to plant, a clear display of our Maker's far-reaching creativity. Our incredibly compassionate God uses a host of sugars, alcohols, and proteins to shield his creation from the bitter cold.

Several of the insects and spiders found in Alaska, for instance, are laced with antifreeze proteins (AFPs) that allow them to survive temperatures down to -94 °F (-70 °C)! The beetle *Upis ceramboides* is unique among Alaskan insects because it is protected by a complex sugar known as xylomannan. But another species—the red flat

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