

Chapter 49

Evolutionary Aside 49.1--The Evolution of Freeze Tolerance

Most ectothermic animals survive the winter by moving to places either underground or under water that do not freeze. However, some animals, including some frogs and turtles living in northern areas, have evolved the ability to actually freeze, and yet survive. Freezing is usually fatal because the ice crystals that form in body fluids damage intracellular structures. To survive freezing, these animals convert glycogen to either glycerol or glucose, which works as an antifreeze. Glycerol or glucose are pumped into the cells and so, even if the water in the extracellular spaces freezes, the water within the cells does not, and thus the animals can survive, even though they are frozen solid with their hearts stopped. Functioning of the heart is one of the first signs of reanimation, occurring even before the resumption of breathing and while not all ice has melted in the body. The neurological mechanism by which the heart is stimulated to resume beating is still unclear and is the subject of active research.