

Northeast Natural History Conference X — Keynote Lecture

New York State Museum
Clark Auditorium

Thursday, April 17, 2008 at 8:00–9:30 p.m.

Life in the Cold: A Biochemist's Perspective on Animals in Winter

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Winter temperatures below 0 °C pose a severe challenge to animal life. For many species, food supplies fail, the risk of freezing is high, endotherms are plagued by massive energy costs to stay warm, and ectotherms have low metabolic rates that are not conducive to growth and development. Some organisms escape winter by migration or avoid severe cold exposure by retreating under water or deep under ground but many must employ biochemical strategies to preserve life. My lab explores the metabolic and gene adaptations that support two main strategies of animal cold survival: mammalian hibernation and ectotherm freeze tolerance. Our hibernation studies analyze the regulatory mechanisms that allow ground squirrels and bats to sink into cold torpor, coordinating and reprioritizing all cell functions so that metabolic rate drops by >95%, body temperature falls to near 0 °C, and tissue viability is preserved over many weeks. Our research on frogs and insects explores life in a frozen state—how organisms deal with the consequences when 65–70% of total body water freezes. Survival requires extensive metabolic adjustments to deal with issues including oxygen deprivation when blood freezes, extreme cell shrinkage caused by water loss to extracellular ice masses, and physical damage to tissues by ice crystals. Hibernation and freeze tolerance are not only fascinating natural phenomena that are critical to the survival of hundreds of species in temperate and polar environments but the mechanisms identified from our studies have key applications in medicine for the long term preservation of human tissues and organs for transplant. For more information, go to www.carleton.ca/~kbstorey.