De-coding the Genes of Animal Survival Strategies

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Kenneth Storey’s Research Explores Biochemical Adaptations Underlying Animal Survival

Modern medicine is exploring a new approach to managing critical illness by inducing the human body into a hibernation-like state with reduced metabolism that provides an exceptional protective effect.

Investigating the biochemical adaptations that underlie animal survival including freeze tolerance, hibernation and other environmental stresses has been the life work of Kenneth Storey. His research has laid unique and significant groundwork by identifying and understanding the molecular controls and processes that impart and manage cellular metabolism during hibernation and conditions of stress in a range of native Canadian animal species.

Storey’s research on frogs, squirrels and other animals has not only uncovered knowledge of metabolic design but also identified elements that can be addressed to improve stress tolerance of human cells and organs with applications to a great many diseases and disorders. By mimicking a hypometabolic state that characterizes the animal mechanisms used in hibernation, medicine is learning to protect heart attack patients from further cardiac damage, and help patients with brain injury, acute lung injury and other conditions.

Storey’s laboratory, which runs collaborative studies with researchers around the world, conducts gene screening and protein regulation studies that examine how cells endure freezing, for example, while still preserving the essential components of life and enable cells to conserve energy while remaining viable under the extreme stress of freezing or lack of oxygen.

His molecular research has documented many genes that show a particular response to stress and are key to freezing survival, lack of oxygen (anoxia tolerance) or decreased physical activity (torpor) seen in hibernation. For Storey, the protein products of these genes – which execute the functions encoded in DNA – represent new avenues to explore animal adaption to environmental stress. Understanding cold tolerance and winter survival strategies provides basic information about a phenomenon – winter – that affects all Canadians and all organisms living in northern climates.

“Our research on the biochemistry of freezing survival by frogs and turtles – and their applications to cryomedicine – is unique in the world. We have come to understand how organisms can freeze and thaw without injury.”

Storey’s research also provides a base upon which to judge the impact of events such as global warming that threaten to radically alter the environmental in which cold-hardy animals live.

The applications in the field of medicine and biomedicine are equally critical. Increased knowledge about the mechanisms of metabolism is already being put into practice in the emergency room for cardiac care and to delay the impact of serious brain injury, for example. Insights from natural freeze tolerance also provide concepts for protocols to extend the viability of organs removed and transported for transplant and to improve cryopreservation technology for long term freezing storage of tissues and organs.

“Our research is unique and has added important principles to our understanding of the biochemistry of life. This also provides a blueprint for metabolic considerations in a growing new field of biomedicine.”