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De-coding the Genes of Animal Survival Strategies

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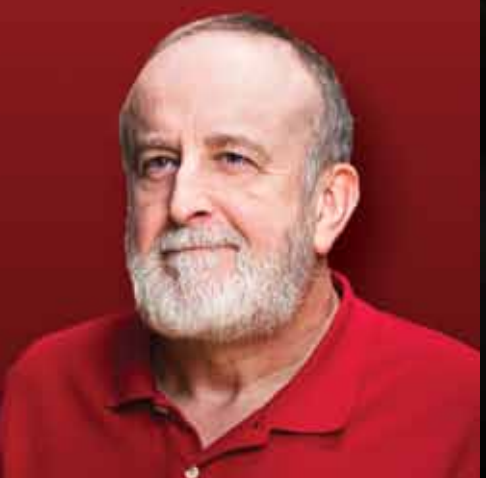
Kenneth Storey, FRSC, PhD
Carleton University's Canada Research Chair in Molecular Physiology



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 adaptions 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.

THE RESEARCH

What I do

Investigate the genetic and regulatory factors of metabolism that allow animals to endure severe environmental challenges with a special focus on the molecular mechanisms that control hibernation and freezing survival.

Why it matters

Knowledge of metabolic programming in animals helps understand options and limitations for survival in the face of challenges such as pollution and climate change.

What it will change

Knowledge of the genetic and regulatory factors of metabolism that are used in nature by hibernating mammals or freeze-tolerant animals can contribute to innovative biomedical applications related to preservation of human organ tissue in heart attack patients, in surgery, for organ transplantation and in cryopresevation.

THE RESEARCHER

2010 Royal Society of Canada, Flavelle Medal, in recognition of significant achievement and outstanding contributions to biological science.

2011 The Canadian Society of Zoologists, Fry Medal, in recognition of long-term achievement.

PARTNERS

University of Ottawa; University of Stellenbosch, South Africa; Université de Louvain, Brussels; Precarpathian National University, Ukraine; University of Rhode Island, U.S., Ocean University of China, PR China, and University of Western Ontario.

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"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."

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