Weapon against the co

In humans, a drop of two degrees Celsius in core body temperature is considered clinical hypothermia. A further drop of five degrees almost inevitably means death. Consequently, it would be difficult to find a more appropriate spot than Edmonton for the ground-breaking research of Dr. Lawrence Wang of the University of Alberta's Department of Zoology.

Wang has been investigating methods of improving human cold tolerance for over a decade, and is probably within a year of producing marketable results. These results could be in the form of a "super candy bar" which would make a welcome addition to the supplies of ice fishermen, skiers or winter joggers. More importantly, his research could save the lives of lost hikers or snow-bound motorists.

Mammals can increase brown fat content in response to cold.

Wang's research is significant to humans in that we do not possess the capabilities of other mammals to survive in cold outdoor temperatures. While exercising and shivering can increase heat production dramatically, Wang says that the key to cold tolerance in small northern mammals is found in brown fat.

This brown adipose tissue, affectionately known as BAT, is present in relatively large quantities in infancy to offset the rapid heat loss that a high surface to volume ratio produces in small animals. It is because of this heat loss that infants need the efficient heat source that BAT provides. The survival temperature of so-called "miracle babies" in extremes that would kill most adults is due to the functioning of brown fat.

This amazing tissue is the only part of the body where fatty acids can be converted directly into heat. In some mammals, up to one-third of the body's blood supply can be diverted for use in BAT. This is an incredible amount for a tissue that constitutes only two percent of the total body weight.

"It's like an oxygen vacuum cleaner," says Wang. "While other tissue can extract only about one-fifth, BAT extracts virtuallyl all the oxygen contained in its blood supply."

This huge supply of oxygen is used in the mitochondria of brown fat. Mitochondria are the organelles involved in energy metabolism in all tissues, but they are different in BAT. Not only are they found in greater numbers and larger size than in normal tissue, they also contain a unique uncoupling protein that appears to function solely in heat production.

The protein can be activated to take the raw materials that normally produce ATP for storage, and use them for direct heat production. The mechanism that causes this shift is not well understood, but in some mammals it can be activated by cold conditions or overeating.

Ten years ago, the Canadian Defense Department chose to fund Wang because of his extensive background in temperature regulation in northern mammals. They hoped that he could produce a formula to boost resistance to cold in humans.

Wang's initial work was done on rats, which are known to increase internal heat production in response to the cold. When he found that this response could be heightened dramatically by theophylline, a caffeine family drug, Wang was ready for human experimentation.

Volunteers spent three hour periods scantily clad, in specially equipped cold rooms.

Wang was joined by two colleagues: Paul Man of the Department of Medicine and Angelo Belcastro, an exercise Physiologist. They were joined by "a group of not entirely willing volunteers from upper level physiology classes," as Wang likes to joke. The volunteers spent three hour periods, scantily clad, in specially equipped cold rooms. Their core

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