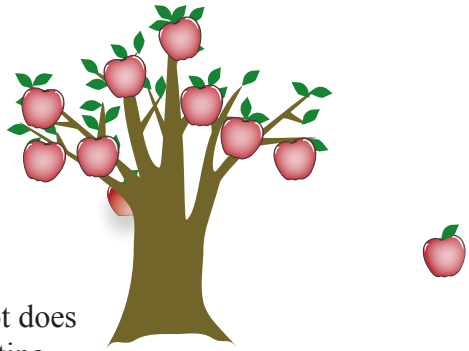
Fruits of Hibernation Research



Temperature independent metabolic inhibition. Hibernation suppresses metabolic rate by lowering body temperature and by other means that are not well understood. If we could understand how hibernators decrease demand for oxygen even without lowering body temperature, we could make a drug to decrease the need for oxygen for someone trapped in low oxygen conditions, such as the group of Boy Scouts trapped in a cave in Thailand last year.

Anti-coagulant. Blood does not clot well during hibernation and if a clot does begin to form, it rapidly falls apart. If we could understand how blood clotting is prevented during hibernation, we could develop new drugs that could break up a clot to prevent deep vein thrombosis or stroke.

Programing metabolic fuel use. Hibernating mammals switch from burning carbohydrates to burning fat. The switch is programmed by a seasonal change in gene expression. If we could understand how to flip the switch we could go into fat burning mode anytime our pants got a little tight.

Inducing nonshivering thermogenesis for weight loss. Hibernating animals use a type of tissue called brown adipose tissue (BAT) to generate heat. Hibernators can double the mass of BAT in the body in preparation for hibernation. Humans have a small amount of BAT in their bodies. There is growing interest in increasing the amount of BAT and stimulating BAT activity as a means to lose weight. If we understood how bears or ground squirrels increase BAT mass and activity, we could mimic these mechanisms in humans.

Healthy obesity is a term used for people who are obese, but do not show other signs of metabolic syndrome such as insulin resistance and unhealthy amounts of certain types of fats in the blood. Hibernating mammals may have the means to maintain healthy obesity when they double their body weight in preparation for hibernation. If we knew more about metabolic health during the fattening period of hibernation, we could design therapies to maintain healthy obesity in humans.

Targeted temperature management is a clinical procedure to lower or maintain core body temperature at a prescribed level during critical care. Knowing how hibernating animals control body temperature during onset of hibernation will guide discovery of drugs designed to improve clinical application of targeted temperature management.

Alzheimer's Disease (AD) is the most common cause of dementia among older adults. In AD, proteins in the brain called tau are modified by a process called phosphorylation. This modification is thought to cause the disease. When animals hibernate these proteins are modified in the same way as in AD, but when the animals warm up all of the modifications go away. Understanding how the modifications disappear could lead to a cure for AD.

Inhibiting disuse atrophy. When people are confined to bedrest for even a few days muscles shrink and weaken, a process known as disuse atrophy. Astronauts in a zero gravity environment loose muscle for the same reason. Hibernation is like bedrest, but even after lying in bed for many months hibernating bears and ground squirrels do not loose muscle size or strength. Learning how they maintain muscle will reveal new strategies to prevent or reverse muscle loss in humans.