Marmots can teach us about obesity

June 2 2010

A nutrient that's common to all living things can make hibernating marmots hungry - a breakthrough that could help scientists understand human obesity and eating disorders, according to a new study by a Colorado State University biologist.

The study appears in the current issue of the Journal of Experimental Biology.

Professor Greg Florant discovered he could slowly release a molecule called AICAR into yellow-bellied marmots that activates a neurological pathway driving food intake and stimulates appetite. The pathway, which shuts down during hibernation, relies on an important balance between two energy molecules - ATP and AMP. The lower the ratio between the two cellular molecules, the lower the energy in the cell and the more the appetite is stimulated.

Without this artificial stimulation, awake, hibernating marmots do not eat - even when researchers place food in front of them.

"The experimental group started to feed because they thought they had this energy deficit," Florant said. "Then when the pumps dispensing the molecule finally stopped, the animals went right back into hibernation. That suggests to us that the animals are still sensing energy levels within cells during the hibernation period."

Tissue samples taken from marmots in Florant's lab allow researchers to identify biochemical processes and genes that are active during

hibernation - as opposed to genes that are active when they're feeding or engaging in other behaviors.

The American Physiological Society has called hibernators such as marmots, bears, woodchucks, hedgehogs and lemurs "medical marvels" because they can turn off their appetites and slow their breathing to a point that would be lethal to other animals.

Marmots typically hibernate for as many as six or seven months.

"You can't eat if you're asleep," Florant said. "We've discovered that perhaps nutrients within the brain, such as fatty acids, can alter the food intake pathway, which normally shuts down when marmots hibernate. The perceived drop in energy nutrients (i.e. low ATP) makes the animals think they've got an energy deficit and want to eat."

Florant said he'll conduct additional research this summer to determine whether the reverse is true: Can he stop the animals from eating when they're not hibernating?

His team will also identify neurons in the particular areas of the hypothalamus that are involved in food intake in animals. The hypothalamus is one of the master regulator areas of the brain and controls such activities as food intake, sex and temperature regulation.

"We know which neurons are driving this process," he said. "We're just trying to identify them within the marmot and distinguish what's different about the neurons in a marmot compared to a rat or other animal that does not go into hibernation."

More information: The full paper is available at http://jeb.biologists.org/cgi/reprint/213/12/2031.

Provided by Colorado State University