Medical Xpress

Research explains link between exercise and appetite loss

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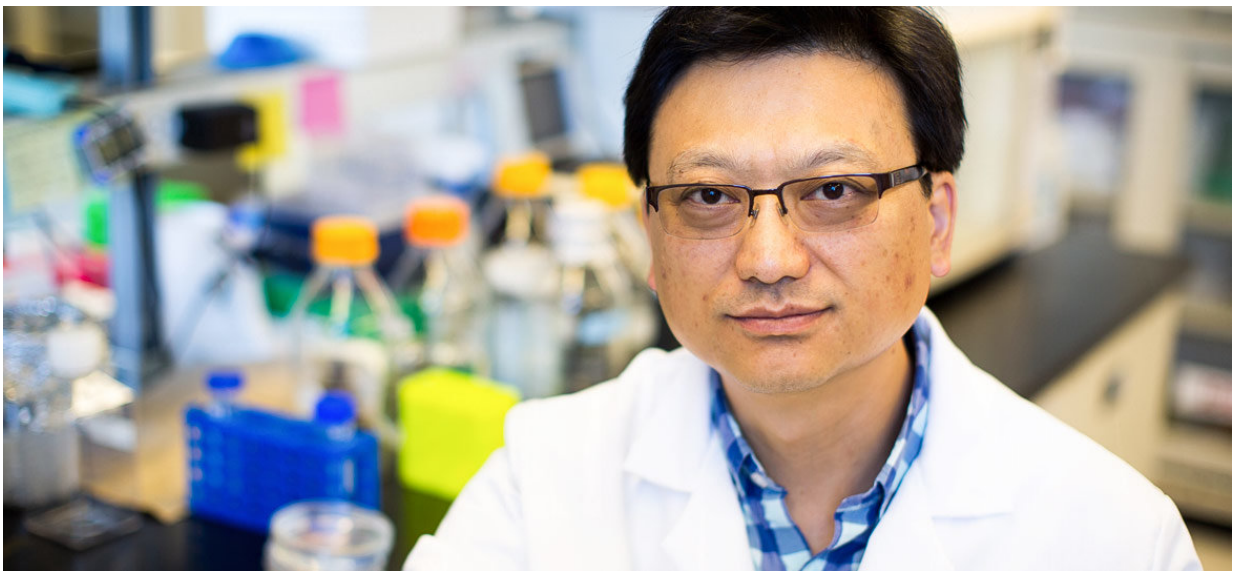

Young-Hwan Jo, Ph.D. Credit: Albert Einstein College of Medicine

Ever wonder why intense exercise temporarily curbs your appetite? In research described in today's issue of *PLOS Biology*, Albert Einstein College of Medicine researchers reveal that the answer is all in your head—more specifically, your arcuate nucleus.

Senior author Young-Hwan Jo, Ph.D., associate professor of medicine and of molecular pharmacology at Einstein, runs on a track near his house three times a week for 30 to 45 minutes at a time. Like many

exercisers, he noticed two things about intense workouts: they raised his body temperature and reduced his appetite for several hours afterward.

"I'm a neuroscientist who studies the hypothalamus—the portion of the brain that plays the central role in regulating metabolism and weight," he says. "I wondered if certain hypothalamic neurons sense temperature increases and respond to exercise-induced warming by releasing a 'stop eating!' message."

Anyone who's suffered a burn or eaten a jalapeño pepper knows that sensory neurons with "heat-detecting" receptors (called TRPV1 receptors) abound in the body. Those neurons react to physical heat and to capsaicin, the active ingredient in jalapeños and many other spicy foods. Could brain neurons possess similar receptors?

Dr. Jo focused on appetite-suppressing proopiomelanocortin (POMC) neurons in the arcuate nucleus (ARC) of the hypothalamus. Some of those neurons are not shielded by the blood-brain barrier, so they're able to directly detect and respond to hormones and nutrients in the blood. He wondered whether those neurons sense changes in body temperature as well.

To sense and respond to heat, ARC POMC neurons would need receptors similar to the capsaicin- and heat-sensitive TRPV1 receptors found elsewhere in the body. Dr. Jo and colleagues took mouse hypothalamus tissue containing POMC neurons and exposed the tissue to capsaicin or to heat, to see if such receptors were present.

Sure enough, both capsaicin and heat caused POMC neurons to fire by activating their receptors. About two-thirds of the ARC's POMC neurons possessed such receptors. Next came experiments exploring the role of POMC neurons and their TRPV1 receptors in reducing appetite and curbing food intake. Dr. Jo and colleagues found that:

- Infusing capsaicin into the ARC of mice reduced the amount of food they ate over the next 12 hours. Researchers could prevent this appetite suppression by first blocking the POMC neurons' TRPV1-like receptors or silencing the gene that codes for those receptors.
- When mice were put on treadmills for 40 minutes, their body and ARC temperatures rapidly increased, plateauing after 20 minutes and remaining at that elevated level for more than an hour. After the workout, the mice reduced their food intake by about 50 percent compared with non-exercising mice.
- Bouts of treadmill exercise did not affect the food intake of mice whose ARC POMC neurons lacked TRPV1 receptors.

"Our study provides evidence that body temperature can act as a biological signal that regulates feeding behavior, just like hormones and nutrients do," says Dr. Jo. He also notes that his findings could lead to new approaches for suppressing appetite or helping people lose weight.

The *PLOS Biology* paper is titled "Activation of temperature-sensitive TRPV1-like receptors in ARC POMC neurons reduces food intake."

More information: Jeong JH, Lee DK, Liu S-M, Chua SC Jr, Schwartz GJ, Jo Y-H (2018) Activation of temperature-sensitive TRPV1-like receptors in ARC POMC neurons reduces food intake. *PLoS Biol* 16(4): e2004399. doi.org/10.1371/journal.pbio.2004399

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