

Team finds mechanism that regulates production of energy-burning brown fat

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Joslin scientists have discovered a mechanism that regulates the production of brown fat, a type of fat which plays an important role in heat production and energy metabolism. The findings, which appear in the upcoming issue of *Nature*, may lead to new therapies that increase BAT formation to treat obesity.

Two types of fat tissue are present in humans and other mammals: [white adipose tissue](#) (WAT) or white fat, which stores fat; and [brown adipose tissue](#) (BAT) or brown fat, which burns fat to produce heat. Brown fat also metabolizes glucose and fatty acids which is important in diabetes and [metabolic diseases](#). Studies suggest that brown fat provides a natural defense against obesity: people with greater quantities of brown fat have lower body weights. This has made brown fat the focus of considerable interest among scientists and pharmaceutical companies looking for ways to treat obesity.

Joslin scientists in the Tseng Laboratory of the Section on Integrative Physiology and Metabolism previously discovered that one type of [bone morphogenetic protein](#), BMP-7, plays a key role in the control of brown fat formation and its heat-producing activity, which regulates whole [body metabolism](#). In the present study, the scientists created a genetically mutant mouse model deficient in type 1A BMP-receptor (BMPRI1A), a key receptor for BMP-7 which has been shown to be associated with obesity in [human populations](#).

Mice have two types of BAT: constitutive BAT (cBAT), which develops

before birth; and recruitable BAT (rBAT), which is found in WAT and skeletal muscle. Humans may also have two types of BAT.

The mice lacking BMPR1A were born with a deficiency of cBAT. Despite their lack of cBAT, the mutant mice were able to "maintain their body temperature perfectly," says senior author Yu-Hua Tseng, Ph.D., Assistant Professor of Medicine at Harvard Medical School, Principal Faculty of the Harvard Stem Cell Institute and an Investigator in the Section on Integrative Physiology and Metabolism.

The scientists discovered that when cBAT is deficient, cBAT cells send a signal through the sympathetic nervous system to increase production of rBAT within white fat. This study is the first to report this cross-talk between these two types of brown fat. The increased rBAT was sufficient to maintain normal body temperature and also protect against diet-induced obesity: When the control and mutant mice were fed a high-fat diet, the [mutant mice](#) did not gain more weight than the control mice.

Until this study, it was not known why a body needs two types of BAT and how they interact with each other. "These results show us that brown fat is essential for normal functioning. When one type of brown fat is deficient, the body has a sophisticated system for inducing development of the other type of brown fat to maintain body temperature and metabolism," says Dr. Tseng.

Tseng Laboratory scientists are interested in learning more about the function of human brown fat cells, including whether humans have two types of BAT, and understanding how BMP and related factors affect human [brown fat](#) production. "We would like to translate this research to develop treatments for diabetes and obesity. This new type of therapy would be especially beneficial to individuals who cannot lose weight through diet or have a limited ability to exercise," says Dr. Tseng.

Provided by Joslin Diabetes Center

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