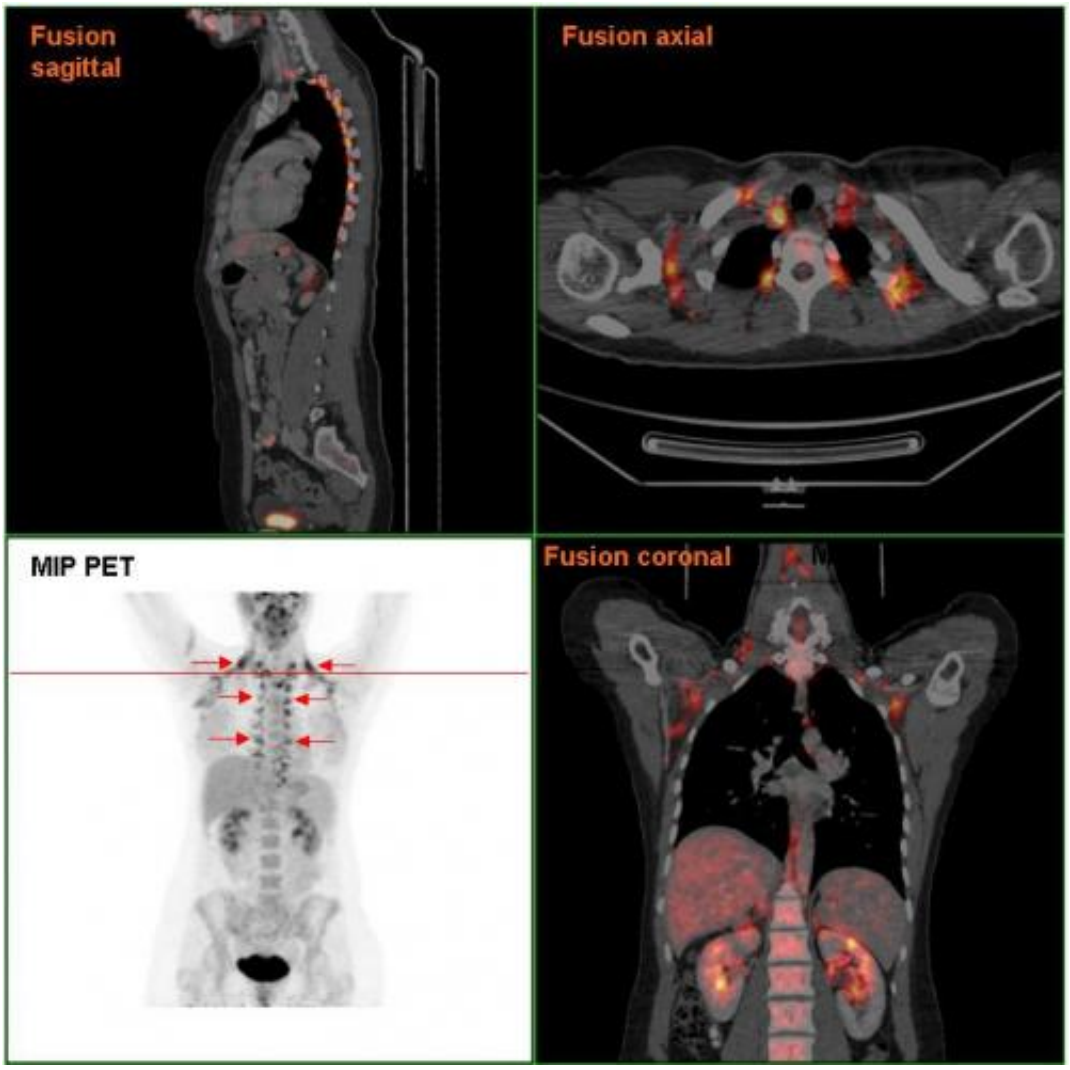
Researchers identify "beige" fat-burning cells in humans

April 1 2015, by Steve Tokar



Brown adipose tissue in a woman shown in a PET/CT exam. Credit: Public Domain

For the first time, a research team, led by a UC San Francisco biologist, has isolated energy-burning "beige" fat from adult humans, which is known to be able to convert unhealthy white fat into healthy brown fat. The scientists also found new genetic markers of this beige fat.

The discovery is an important advance in the search for new medications to fight obesity, said senior investigator Shingo Kajimura, PhD, UCSF assistant professor of cell and tissue biology, with a joint appointment in the UCSF Diabetes Center and the Eli and Edythe Broad Center of Regeneration Medicine and Stem Cell Research at UCSF.

The finding was published online on March 16, 2015 in *Nature Medicine*.

All mammals, including humans, have two types of fat with completely opposite functions: white, which stores energy and is linked with diabetes and obesity, and brown, which produces heat by burning energy and is associated with leanness. Human babies are born with brown fat as a natural defense against cold, and hibernating animals such as bears build up large stores of brown fat for the same reason.

Since 2009, explained Kajimura, it's been known that adult humans also have significant amounts of brown fat. But until now, it had not been known whether this fat is the so-called classical brown fat of the type that babies are born with, or beige fat, which is found within white fat and has the ability to convert, or recruit, white fat into brown fat in response to cold or other stresses.

To answer that question, Kajimura and his team isolated and cloned single brown fat cells from two adult individuals. After sophisticated genetic and protein analyses of the cloned cells, they concluded that they had successfully isolated recruitable brown fat.

"This finding brings us another step closer to the goal of our laboratory,

which is engineering fat cells to fight obesity," said Kajimura. "We are trying to learn how to convert white fat into brown fat, and until now, it had not been demonstrated that this recruitable form of brown fat is actually present in humans."

Now that they have a reliable human beige fat cell culture system, Kajimura said, his team will be able to use the system as a screening platform to identify and test small molecules that activate the development, differentiation, and thermogenic (heat-producing) activity of human brown fat.

The ultimate aim, he said, is the creation of drugs to turn white fat into brown fat through brown fat recruitment.

"If you think about obesity, it's generally caused by an imbalance between energy intake and energy expenditure," Kajimura said. "So far, all of the approved anti-obesity medications reduce energy intake by decreasing appetite. They work in the short term, but they often have side effects such as depression. If we have a compound that increases energy expenditure by recruiting new brown fat and activating brown fat thermogenesis, then it might work synergistically with conventional anti-obesity medications. This would be a novel approach to modulating whole-body energy balance."

More information: "Genetic and functional characterization of clonally derived adult human brown adipocytes." *Nature Medicine* (2015) DOI: 10.1038/nm.3819

Provided by University of California, San Francisco