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SUMMER****April 9, 2009**

## Calorie-Burning Fat? Study Says You Have It

By [GINA KOLATA](#)

For more than 30 years, scientists have been intrigued by brown fat, a cell that acts like a furnace, consuming [calories](#) and generating heat. Rodents, unable to shiver to keep warm, use brown fat instead. So do human infants, who also are unable to shiver their muscles to stay warm. But it was generally believed that humans lose brown fat after infancy, no longer needing it once the shivering response kicks in.

That belief, three groups of researchers report, is wrong.

Their papers, [appearing Thursday in The New England Journal of Medicine](#), indicate that nearly every adult has little blobs of brown fat that can burn huge numbers of calories when activated by the cold, like sitting in a chilly room that is between 61 and 66 degrees.

Thinner people appeared to have more brown fat than heavier people, younger people more than older people; people with higher metabolic rates had more than those whose metabolisms were more sluggish, and women had more than men. People taking beta blockers for [high blood pressure](#) or other medical indications had less brown fat.

“The thing about this brown fat is that it takes a very small amount to burn a lot of energy,” said Dr. C. Ronald Kahn, head of the section on [obesity](#) and hormone action at the Joslin [Diabetes](#) Center in Boston.

The fat really is brown, researchers say, because it is filled with mitochondria, cells’ tiny energy factories. Mitochondria contain iron, giving the tissue a reddish brown color.

The hope is that scientists may find safe ways to turn peoples’ brown fat on, allowing them to lose weight by burning more calories. But researchers caution that while mice lose weight if they activate brown fat, it is not clear that people would shed pounds — they might unwittingly eat more, for example. The data on global patterns of obesity are not good enough to say whether living in a cold climate makes people thinner.

The best evidence for the effects of brown fat is from earlier studies in mice, said Leslie P. Kozak, a professor of molecular [genetics](#) at the Pennington Biomedical Research Center of Louisiana State University.

Recently, Dr. Kozak put mice predisposed to obesity in a cold room, 41 degrees, for a week. The animals activated their brown fat. As a result, they lost 14 percent of their weight, which constituted 47 percent of their body fat, while eating a high-fat [diet](#) with two and a half times more calories than they had consumed at room temperature. “That’s just by going out in the cold, without any drug treatment,” Dr. Kozak said. But, he cautioned, mice, small animals with a comparatively huge surface area, are easily chilled. “Put the mouse in the cold,” he added, “and it becomes a heat producing machine.”

Jan Nedergaard of the University of Stockholm did the opposite of Dr. Kozak. He and Barbara Cannon, also at

the University of Stockholm, [studied mice that were genetically engineered so their brown fat could not burn calories](#). The animals became fat.

“Until very recently, we would have said that it is doubtful that differences in brown fat really could contribute to obesity,” Dr. Nedergaard said. Now, he said he had changed his mind, at least for mice.

The key to finding brown fat in humans was PET scans, which pinpoint areas where cells are actively burning glucose. Because brown fat rapidly burns glucose to produce heat, it lights up in the scans. In two of the three studies, investigators also studied samples of brown fat that were removed from a few subjects, confirming that the cells had a protein, UCP-1, that is unique to brown fat.

Brown fat in adult humans was in an unexpected place. Infants have it mostly as a sheet of cells covering their backs. Rodents have it mostly between their shoulder blades, just down from the neck. But in adult humans, it showed up in the upper back, on the side of the neck, in the dip between the collarbone and shoulder, and along the spine.

That may be one reason it was missed for so long, Dr. Kahn said.

“There was an interest in looking at humans 20 or 25 years ago with different scanning techniques, but people were always looking between the shoulder blades,” he said. And since there is so little brown fat — just a few grams of tissue — it can be hard to find, Dr. Kahn added.

His study, one of the three published Thursday, involved 1,972 people who had had PET scans for a variety of reasons. The scans showed brown fat in 7.5 percent of the women and 3 percent of the men — an underestimate, Dr. Kahn says, because the people had not deliberately activated brown fat by getting cold.

Dr. Kahn and his colleagues also examined [biopsy](#) samples taken from the necks of two patients. They concluded that what looked like brown fat in their scans was indeed brown fat.

A second study, led by Wouter D. van Marken Lichtenbelt of Maastricht University in the Netherlands, involved 24 healthy young men. Ten were lean, the rest overweight or obese.

The scans showed no brown fat when the men had been in a room that was a comfortable temperature. But after they were in a chilly room for two hours, scans showed brown fat in all but one, an obese man.

A third study, led by Dr. Sven Enerbäck of the University of Goteborg in Sweden, involved five healthy adults. Each had two PET scans — one after being in a room at a comfortable temperature, the other after being in a chilly room for two hours. The investigators saw brown fat in their chilled subjects. Three participants allowed the researchers to remove some white fat and some brown fat to demonstrate that what looked like brown fat in the scans really was that elusive substance.

The studies, investigators say, should stimulate research on safe ways to activate brown fat. It is known to be activated not only by cold but also by [catecholamines](#), hormones that are part of the fight or flight response. That is why beta blockers, which block catecholamines, can suppress brown fat activation.

Epinephrine, or adrenaline, and ephedra, a [herbal supplement](#) containing epinephrine, can stimulate brown fat, said Dr. Rudolph Leibel, co-director of the Naomi Berrie Diabetes Center at the [Columbia University Medical Center](#). But, he added, the drugs have too many side effects to be used for weight loss. While caffeine

can boost ephedra's effects, Dr. Leibel said, it is easy to eat your way out of a brown fat effect.

Brown fat, he said, "fits the fantasy — I eat what I want and burn it off."

That, however, is still a fantasy, Dr. Leibel added.

If a drug that stimulates brown fat could be developed, said Dr. Claude Bouchard of the Pennington Biomedical Research Center, it would be the first obesity drug to affect energy expenditure rather than appetite.

Then there is the notion of simply hanging out in a cold room.

"We're thinking of opening a frosty spa," Dr. Kozak joked.

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