

[The Scientist](#) > [News & Opinion](#) > [Daily News](#)

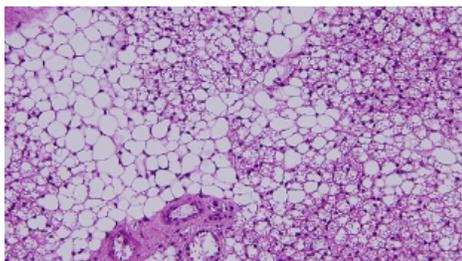
# Markers Distinguish “Good” from “Bad” Fat

Researchers have identified three fat cell-specific surface markers that distinguish white from brown and beige adipocytes.

By Anna Azvolinsky | July 30, 2014

[Comment](#)
[Like](#) 25

[g+](#) 2

[Link this](#)
[Stumble](#)
[Tweet this](#)


Stained brown fat cells surrounded by white fat cells  
SIEGFRIED USSAR

Since the discovery that not all fat cells are created equal, there has been a search for ways to reliably identify the so-called “good,” metabolically active, brown adipocytes, and the “bad,” relatively inert, white adipocytes. Thus far, biomarkers to distinguish brown from white fat have all been either intracellular or secreted proteins, which are not useful for whole-tissue or in vivo studies. Now, researchers have identified three cell-surface markers specific to adipocytes that are differentially expressed on white, brown, or third form of fat cell—beige—in both mice and in human tissue. The study is published today (July 30) in *Science Translational Medicine*.

“These markers look pretty selective and the key is that they are cell-surface markers, which will allow their use in a variety of applications in the future,” said [Patrick Seale](#), an adipose tissue researcher at the University of Pennsylvania in Philadelphia who was not involved in the work. “I think these are going to be a really great resource for [researchers].”

White adipocytes store energy in the form of triglycerides, and depending on their location in the body, can have negative effects on health—contributing to insulin resistance, metabolic syndrome, and type 2 diabetes. Brown adipocytes are morphologically and functionally distinct, and are able to burn the energy stored as lipids while consuming glucose. “One of the major differences between brown and white fat is that brown fat cells have a much higher amount of mitochondria and also express the UCP1 protein that burns energy and turns it into heat,” said study coauthor Siegfried Ussar of the Institute for Diabetes and Obesity at the Helmholtz Center Munich.

Beige adipocytes [are also energy-burning](#), and can be found embedded within white adipose tissue. All three fat cell types have distinct gene expression profiles, but it is difficult to morphologically distinguish between beige and brown adipocytes within a tissue.

To find proteins on the cells’ surfaces that are fat-tissue specific but also unique to each type of adipocyte, the researchers first mined publicly available gene expression databases for genes that mimicked the expression pattern of the well-defined adipocyte-specific protein, adiponectin, and the brown adipocyte-specific protein, UCP1. The team then tested the expression of the handful of genes retrieved from its in silico search on data from a variety of tissues from mice.

Ussar and his colleagues identified three markers: ASC-1, an amino acid transporter that is enriched in white but not beige or brown adipocytes; PAT2, another amino acid transporter, which is expressed in brown and beige but not white fat cells or in brown adipocyte precursors; and P2RX5, a purinergic receptor that was the most differentially expressed in brown adipocytes.

To validate these markers in human tissue, the team assessed biopsies of five patients from different fatty locations within the neck area, and, for further validation, compared the expression of these and other markers in paired superficial and deeper fat deposits from 10 additional patients.

“One important point of this study is that these markers were identified in a translational approach and shown to mark human adipocytes,” said [Christian Wolfrum](#), an obesity and nutrition researcher at ETH Zurich in Switzerland who was not involved in the study. “Most research is done in mouse and cell lines, but very little is done with human tissue.”

One potential application for these markers is in vivo imaging of brown and beige fat in humans. “There are no simple, specific imaging techniques that can differentiate among white, brown, and beige fat,” said study coauthor [C. Ronald Kahn](#) of the Joslin Diabetes Center at Harvard Medical School. Only the complex and partly invasive positron emission tomography-computed tomography (CT-PET) technique has been used to distinguish between white and brown fat deposits. But this technique is limited, said Kahn, as only the fraction of brown fat that is metabolically active at the time can be detected using CT-PET.

Wolfrum agreed. “We now have potential direct biomarkers to develop methods to trace and quantify

## Follow The Scientist



## Subscribe!

Print or Digital

- iPad
- Kindle
- Tablet

## Stay Connected with The Scientist

- [f](#) The Scientist Magazine
- [f](#) The Scientist Careers
- [f](#) Neuroscience Research Techniques
- [f](#) Genetic Research Techniques
- [f](#) Cell Culture Techniques
- [f](#) Microbiology and Immunology
- [f](#) Cancer Research and Technology
- [f](#) Stem Cell and Regenerative Science

## Popular Posts

1. [Imaging Intercourse, 1493](#)
2. [Genome Editing Cuts Out HIV](#)
3. [Sex in a Scanner](#)
4. [Dustup Over Lionfish Science Fair Project](#)
5. [Light’s Dark Side](#)

## Current Issue



[View the August 2014 contents.](#)

## Subscribe to RSS feed

All

brown fat in humans," he said. "We could be able to screen for brown fat populations and to quickly assess the impact of a treatment, let's say, on brown adipose tissues instead of taking a fat biopsy."

Kahn and his colleagues also envision that these markers might one day be used to develop adipocyte subtype specific drug delivery systems. The researchers are now assessing the physiological functions of the cell surface proteins they identified.

Still, both Seale and Wolfrum cautioned that the nature of brown, white, and beige fat remain up for debate.

"One of the challenges in this field has been to identify markers for different adipose cell types," said Seale. "This study is likely just the beginning. One can envision identifying markers for different precursor stages during the development of these adipocytes as well as different subtypes of white and brown adipocytes."

**S. Ussar et al., "ASC-1, PAT2, and P2RX5 are cell surface markers for white, beige, and brown adipocytes," *Science Translational Medicine*, doi:10.1126/scitranslmed.3008681, 2014.**

## Tags

[White Fat](#), [human research](#), [brown fat](#), [biomarkers](#), [beige fat](#) and [adipose tissue](#)

[Comment](#)

Like 25

[g+1](#) 2

[Link this](#)

[Stumble](#)

[Tweet this](#)

## Add a Comment



You

[Sign In](#) with your LabX Media Group Passport to leave a comment

Not a member? [Register Now!](#)

## Related Articles



### Week in Review: July 28–August 1

By Tracy Vence

See-through organs and animals; distinguishing white from brown and beige fat cells; chipping away at genetic mosaicism; catching up with the blogger behind Street Anatomy



### A Blood-based Biomarker for Suicide?

By Jyoti Madhusoodanan

Epigenetic and genetic changes in the SKA2 gene are correlated with suicidal behaviors, researchers show.



### Alzheimer's in the Blood

By Jef Akst

Researchers are on a mission to identify blood-borne biomarkers for dementia. Will this year's high-profile successes pave the way?

TheScientist

[Home](#) [News & Opinion](#) [The Nutshell](#) [Multimedia](#) [Magazine](#) [Advertise](#)  
[About & Contact](#) [Privacy Policy](#) [Job Listings](#) [Subscribe](#) [Archive](#)



© 1986-2014 The Scientist

Now Part of the LabX Media Group: [Lab Manager Magazine](#) | [LabX](#) | [LabWrench](#)