OBESITY

Targeting fat deposits—one step closer

A new study published in *Science Translational Medicine* reports the identification of three new cell surface proteins that are selectively expressed on, and thus capable of discriminating between, white, beige and brown adipocytes. In addition to their diagnostic potential, these markers might facilitate therapeutic targeting of individual adipose deposits in individuals with obesity and related metabolic disorders, such as type 2 diabetes mellitus.

"It is now recognized that there are several types of fat in the body, each with their own function," explains lead investigator Ronald Kahn. "White fat

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stores energy, brown fat burns energy (thermogenesis), and beige fat, which is brown fat that gets induced in white fat deposits, also burns energy." Currently, PET–CT is used for imaging brown fat, but the technique is limited to the identification of stimulated (by exposure to cold) brown fat; no technique is yet available for imaging beige fat.

Kahn and colleagues set out to identify novel markers specific to white and brown adipocytes that could be used for imaging and targeting of these cells *in vitro* and *in vivo*. The researchers analyzed microarray data from the SymAtlas database to identify genes whose expression correlated with expression of *Adipoq* and *Ucp1* (markers of white and brown adipocytes, respectively). The identified genes were then filtered to reveal only those encoding cell surface proteins that were highly expressed in adipose tissues. Ultimately, genes encoding three new proteins

were identified: the amino acid transporters ASC-1 and PAT2; and the purinergic receptor P2RX5. *In vitro* and *in vivo* studies confirmed ASC-1 to be a specific marker of white adipocytes and PAT2 and P2RX5 to be brown and beige adipocyte-specific markers. These findings were confirmed by histological analysis of biopsy samples from three cohorts of patients.

"Our next step is to develop monoclonal antibodies to these cell surface proteins," explains Kahn. "If successful, we will, for the first time, have a way to detect how much brown and beige fat a person has, even without prior stimulation of brown fat thermogenesis. We will also have a new way to target fat deposits for the delivery of specific drugs that can activate brown and beige fat or modify the metabolism of white fat."

David Holmes

Original article Ussar, S. *et al.* ASC-1, PAT2, and P2RX5 are cell surface markers for white, beige, and brown adipocytes. *Sci. Transl. Med.* **6**, 247ra103 (2014)