



## A Short Note on Adipose Brown Fat

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### Short Note

Brown fat (BAT) makes up the adipose organ alongside white fat. Brown fat is found in most mammals. Classification of brown fat refers to 2 distinct cell populations with similar functions. The primary shares a standard embryological origin with muscle cells, found in larger "classic" deposits. The second develops from white adipocytes that are stimulated by the sympathetic system. These adipocytes are found interspersed in white fat and also are named 'beige' or 'brite' (for "brown in white).

Brown fat is particularly abundant in newborns and in hibernating mammals. It's also present and metabolically active in adult humans, but its prevalence decreases as humans age. Its primary function is thermoregulation. Additionally, to heat produced by shivering muscle, brown fat produces heat by non-shivering thermogenesis. While brown fat is crucial for maintaining core blood heat and energy balance, brown fat adaptive thermogenesis is often detrimental to the hypermetabolic response to heat. On the opposite hand, the therapeutic targeting of brown fat for the treatment of human obesity is a lively research field reviewed by Samuelson and Vidal-Puig in 2020.

In contrast to white adipocytes, which contain one lipid droplet, brown adipocytes contain numerous smaller droplets and a way higher number of (iron-containing) mitochondria, which provides the tissue its color. Brown fat also contains more capillaries than white fat. These supply the tissue with oxygen and nutrients and

distribute the produced heat throughout the body.

Brown fat (BAT) is currently being explored as a target for the treatment of obesity and diabetes after repeated demonstrations on positron emission tomography-computed tomography (PET/CT) imaging of its ability to metabolize glucose following acute cold exposure. Measurement of whole-body BAT volume, activity, and distribution is difficult because brown adipocytes are structurally commingled among white fat, muscle, and blood vessels. Thus, BAT's potential contribution to metabolism remains unclear. To deal with this, we've identified several refinements to enhance current PET/CT analyses and demonstrated their impact in healthy lean vs. obese individuals. Using the refined technique, we defined whole-body BAT distribution and estimated its metabolic capacity and located that it's substantially above usually reported.

Brown fat (BAT) is that the site of sympathetically activated adaptive thermogenesis during cold exposure and after hyperphagia, thereby controlling whole-body energy expenditure (EE) and body fat. Radionuclide imaging studies have demonstrated that adult humans have metabolically active BAT composed of mainly beige/brite adipocytes, recently identified brown-like adipocytes. The inverse relationship between the BAT activity and body fatness suggests that BAT is, due to its energy dissipating activity, protective against body fat accumulation in humans because it is in small rodents. In fact, either repeated cold exposure or daily ingestion of some food ingredients working on transient receptor potential channels recruits BAT in parallel with increased EE and decreased bodyfat.

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