# Research

## Adipocytes and energy balance

Obesity is a major source of morbidity and mortality and is increasingly prevalent in many areas of the world. Excess fat accumulation is a contributing factor in such severe human diseases as type 2 diabetes and certain cancers. It is urgent to develop new therapies to treat obesity. Our lab is interested in understanding the epigenetic regulation underlying adipocyte development in physiological and pathological conditions, which may reveal novel therapy targets.

There are two principal types of fat in mammals. While white adipose tissue is specialized for energy storage, brown adipose tissue burns lipids for heat generation and energy expenditure as a defense of cold temperature and obesity. Our current focus is to determine role of non-coding RNAs such as microRNAs and long non-coding RNA in white and brown fat development.

White adipose, under certain stimuli such as cold temperature, will take on brown adipose features including increased mitochondria biogenesis and thermogenesis – a phenotype referred as “browning”. The “browning” phenotype has been shown to have anti-obesity function. Recently, it has been proposed that, during “browning”, the brown fat-like gene expression program is induced in a subset of myf5-adipocytes in WAT, known as brite or beige adipocytes. They have low thermogenesis activity and a small number of mitochondria at basal state; however, once activated, they possess many biochemical and morphological features of BAT. Another focus of my lab is to determine the non-coding RNAs’ function in “browning”.

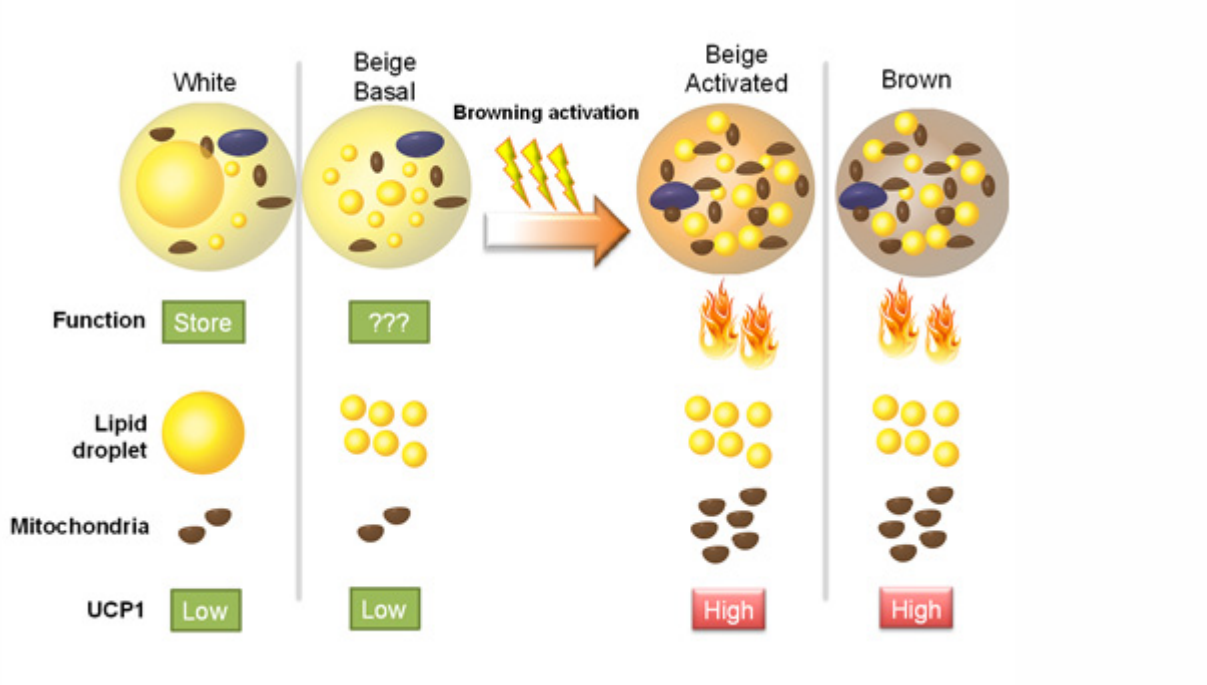


**Figure Legend:** The main function of white adipocytes is to store lipid as TAG while the main function of brown adipocytes is to burn lipid to generate heat. In white adipocytes, there is only one big lipid droplet, while in brown adipocytes there are many small lipid droplets. White adipocytes contain only few mitochondria, but brown adipocytes are very enriched in mitochondria, which can be used to burn lipids. Another major difference is that brown adipocytes express a unique protein, UCP1, which is the key regulator for brown fat to generate heat. Beige adipocytes are a subpopulation found in white adipose. At both basal and activated status, beige adipocytes have multiple small lipid droplets, similar to brown adipocytes. At basal status, beige adipocytes have few mitochondria and are similar to white adipocytes, but upon activation, they have a large number of mitochondria and are more like brown adipocytes. UCP1 levels are low at basal status, but high upon activation. At basal status, they store lipids like white adipocytes; upon activation, beige adipocytes can burn lipids as brown adipocytes because of their abundant mitochondria and UCP1.