Functional involvement of Na^+/Ca^{2+} exchanger type 1 in brown adipose tissue thermogenesis

Tomo Kita[1], Hideaki Tagashira[1], Takayuki Nemoto[1], Satomi Kita[1,2], Takahiro Iwamoto[1]

[1]Dept. Pharmacol., Facl. Med., Fukuoka Univ., [2]Dept. Pharmacol., Facl. Pharmaceu. Sci., Tokushima Bunri Univ.

Brown adipose tissue (BAT) is a primary site for non-shivering thermogenesis in mammals. In cold temperature, β-adrenergic stimulation activates mitochondrial uncoupling protein 1 (UCP1), which consequently generates heat by uncouples of the respiratory chain. Previous report suggested that intracellular Ca^{2+} signaling induced by transient receptor potential vanilloid 2 (TRPV2) activates UCP1 in BAT thermogenesis. However, molecular mechanisms of intracellular Ca^{2+} signaling in BAT are not well characterized. We have been systematically studying the physiological functions of Na^+/Ca^{2+} exchangers, which regulate intracellular Ca^{2+} signaling. Recently, we found that Na^+/Ca^{2+} exchanger type 1 (NCX1) is abundantly expressed in interscapular BAT (iBAT) from wild-type mice. Therefore, in this study, our research interest focuses on elucidating functional involvement of NCX1 in BAT thermogenesis. Intriguingly, we observed that NCX1-heterozygous ($NCX^{+/-}$) mice did not maintain their core body temperature in cold exposure. Furthermore, UCP1 transcripts in iBAT were significantly decreased in $NCX^{+/-}$ mice compared with wild-type mice. These results suggest that NCX1 may contribute to BAT thermogenesis against cold environment.