

Abstract

The capacity to regulate body temperature is of great importance for the survival and evolution of organisms. Endotherms possess highly efficient mechanisms for generating heat, including muscle shivering and non-shivering thermogenesis (NST), which occurs predominantly in brown adipose tissue and muscle. The process of muscle NST is a complex one, involving multiple mechanisms. However, it seems likely that the effect of sarcolipin on SERCA protein plays a key role. This occurs when ATP cleavage occurs without Ca^{2+} pumping into the sarcoendoplasmic reticulum, accompanied by heat generation. Other key proteins of the muscle NST include ryanodine receptors, which regulate calcium concentrations, and phospholamban, which regulates SERCA activity. Mitochondrial activity also plays a crucial role in this process.

The ability of muscle NST depends on the ontogenetic stage of the organism and the external conditions to which it is exposed. In addition to thermal homeostasis, these mechanisms also have a major impact on the regulation of whole-body metabolism and may serve as protection against diet-induced obesity.

As with other thermogenic mechanisms, muscle NST is an energy-intensive process. Consequently, an understanding of its processes and the ability to regulate them could provide a new avenue in the treatment of obesity and related metabolic diseases.

Keywords: nonshivering thermogenesis, sarcolipin, SERCA, muscle, brown adipose tissue