

SITES AND CELLULAR MECHANISMS OF HUMAN ADRENERGIC THERMOGENESIS - A PROPONENT'S VIEW

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Evidence in the literature clearly documents existence of nonshivering thermogenesis of adrenergic origin in adult humans. This thermogenesis is activated in cold exposed individuals, during the early phase of cooling, prior to the start of shivering and equals to about 25 % of the basal metabolic rate (0.29 W.kg^{-1}). This amount of heat can compensate for heat loss from the body when the air temperature is about 5°C below the thermoneutral zone. Human nonshivering thermogenesis is probably based on thermogenic actions both of adrenaline and noradrenaline. Relative participation of adrenaline or noradrenaline in the thermogenic response is not known, however, and the mode of action of both amines may be different. In contrast to noradrenaline thermogenesis, the adrenaline thermogenesis can be potentiated by cold adaptation to the level corresponding to the total capacity of beta adrenergic (isoprenaline) thermogenesis (0.53 W.kg^{-1}). Adrenaline thermogenesis is located in skeletal muscles and probably also in the white fat. Diffused brown fat cells appearing inside of white fat pads may be also involved. Although several molecular mechanisms have been suggested, the discrete mode of catecholamine thermogenic action in organs other than the brown adipose tissue remains unknown. It was found that the adrenergic thermogenesis is mediated by $\beta 1$ and $\beta 2$ adrenoceptors, however. Possible involvement of $\beta 3$ adrenoceptors and of uncoupling proteins UCP 2 and UCP 3 is to be also considered, although the direct evidence for their involvement in human adrenergic thermogenesis is still missing. Regulatory mechanisms based on changes in blood flow also may play a role.

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