Energy metabolism and body temperature

BASIC CONCEPTS OF ENERGY EXPENDITURE AND ENERGY BALANCE
The energy liberated during a chemical reaction appears either as heat or work.
Total energy expenditure = heat produced + external work done + energy stored.
Metabolic rate is influenced by the many factors summarized in Table 18-7.
Basal metabolic rate is increased by the thyroid hormones and epinephrine. The other functions of the thyroid hormones are maturation of the nervous system, bodily growth, alertness and reflexes, body heat production, stimulation of receptor synthesis for epinephrine and norepinephrine.
Energy storage, as fat, can be positive or negative when the metabolic rate is less than or greater than, respectively, the energy content of ingested food.
  Energy storage is regulated mainly by reflex adjustment of food intake to the metabolic rate.
  In addition, the metabolic rate increases or decreases, to some extent, when food intake is chronically increased or decreased, respectively.
Food intake is controlled by leptin, secreted by adipose-tissue cells, and a variety of satiety factors, including (1) plasma glucose, insulin, glucagon, leptin and hormones, (2) body temperature, (3) stomach and duodenal stretch- and chemoreceptors, (4) conditioned responses, (5) stress, and (6) food palatability.
Obesity, the result of an imbalance between food intake and metabolic rate, increases the incidence of many diseases.

REGULATION OF BODY TEMPERATURE
Core body temperature shows a circadian rhythm, being highest during the day and lowest at night.
The body exchanges heat with the external environment by radiation, conduction, convection, and evaporation of water from the body surface.
The hypothalamus and other brain areas are the integrating centers for temperature-regulating reflexes, and both peripheral and central thermoreceptors participate in these reflexes.
Body temperature is regulated by altering heat production and/or heat loss so as to change total body heat content.
  Heat production is altered by increasing muscle tone, shivering, and voluntary activity.
  Heat loss by radiation, conduction, and convection depends on the difference in temperature between the skin surface and the environment.
  In response to cold, skin temperature is decreased by decreasing skin blood flow through reflex stimulation of the sympathetic nerves to the skin. In response to heat, skin temperature is increased by inhibiting the nerves.
  Behavioral responses such as putting on more clothes also influence heat loss.
  Evaporation of water occurs all the time as insensible loss from the skin and respiratory lining. Additional water for evaporation is supplied by sweat, stimulated by the sympathetic nerves to the sweat glands.
  Increased heat production is essential for temperature regulation at environmental temperatures below the thermoneutral zone, and sweating is essential at temperatures above this zone.
Temperature acclimatization to heat is achieved by an earlier onset of sweating, an increased volume of sweat, and a decreased sodium concentration of the sweat.
Fever is due to a resetting of the temperature set point so that heat production is increased and heat loss
is decreased in order to raise body temperature to the new set point and keep it there. The stimulus is endogenous pyrogen, which is interleukin 1 and possibly other peptides as well.
The hyperthermia of exercise is due to the increased heat produced by the muscles.

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