Kazakh-Russian Medical University

Topic: The system of thermoregulation. Fever

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Almaty 2016

Plan:

- What is thermoregulation?
- Heat generation in the body
- Body Temperature Regulation
- Perception and temperature analysis
- Central mechanisms of heat regulation
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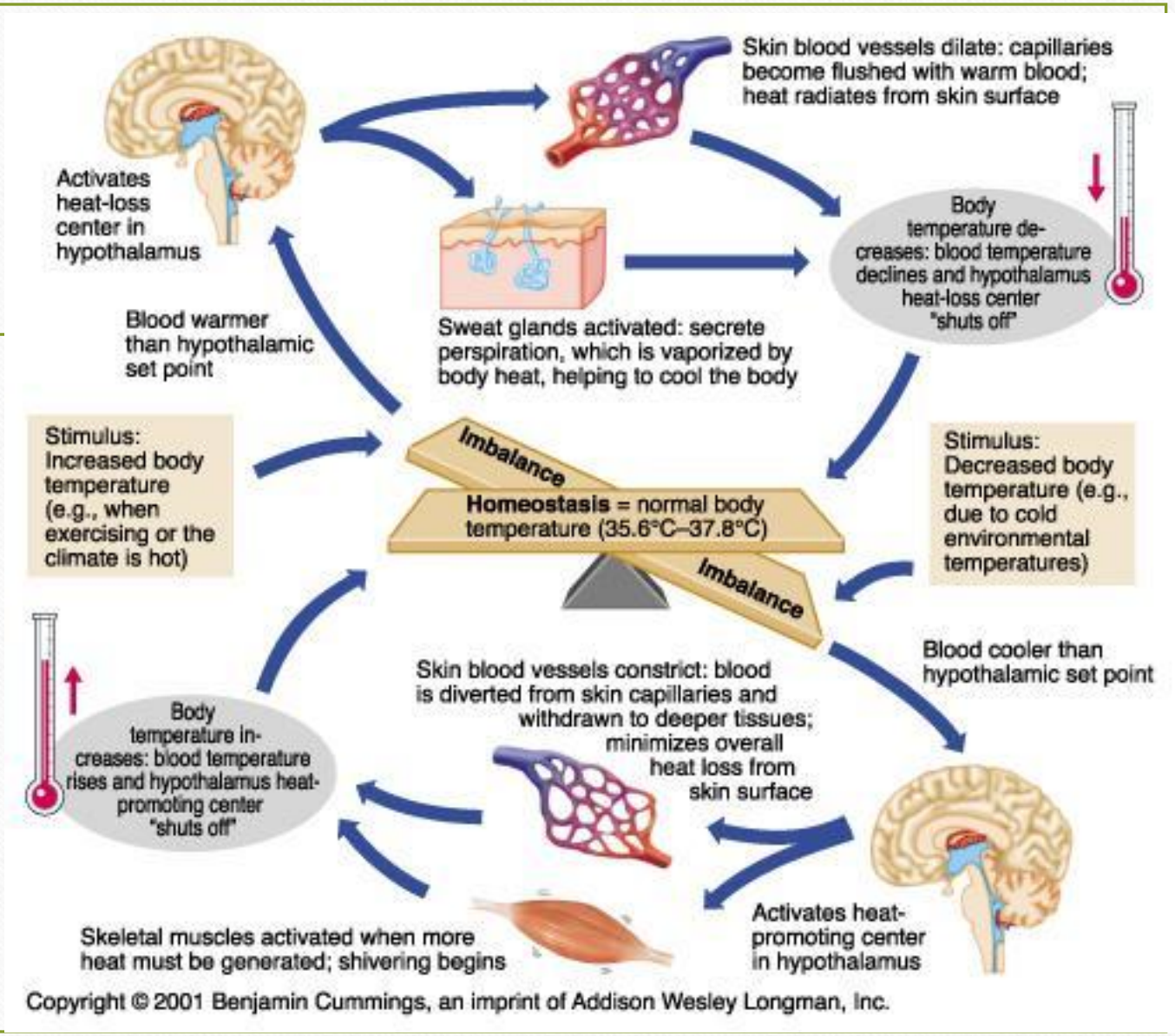
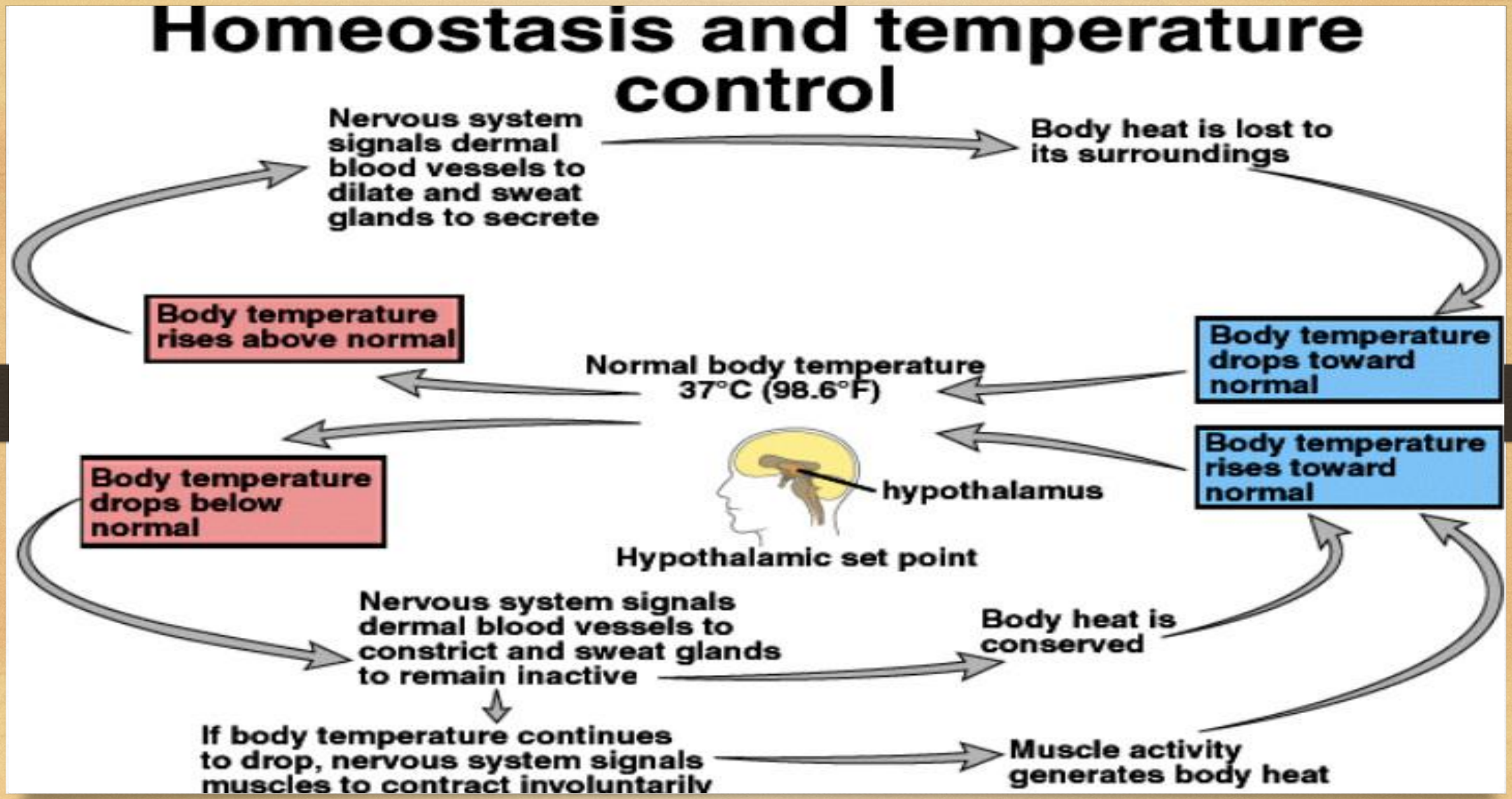
What is thermoregulation?

- Thermoregulation - the ability of living organisms to maintain body temperature within certain limits, even if the ambient temperature is significantly different.Appointment of the thermoregulatory system - to maintain a constant body temperature values, that is, during hypothermia (decreased body temperature relative to normal) to increase heat production and reduce heat loss, and hyperthermia (increase in body temperature relatively normal), on the contrary, enhance heat transfer to the environment and to reduce heat generation.

- This process is one of the aspects of homeostasis - dynamically changing status of equilibrium between the internal environment of the animal body and its external environment. Section science that studies these processes in zoology, called ecophysiology or physiological ecology.



Homeostasis and temperature control



Heat generation in the body

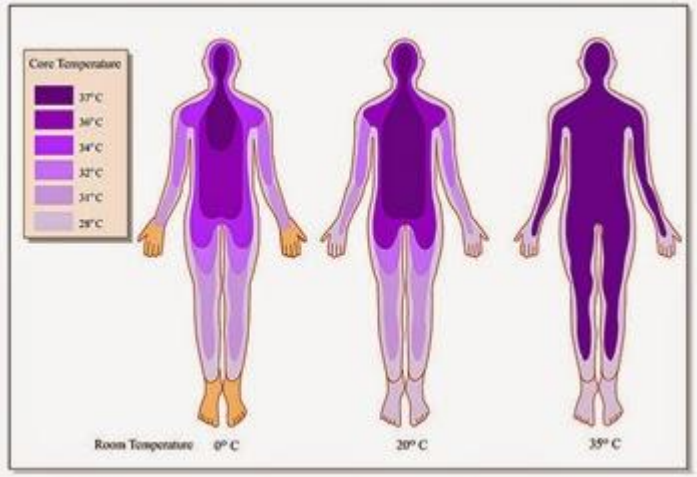
- The amount of heat in the body depends on the exchange rate in the organs and tissues, in those where the exchange processes take place at high speed, a large amount of heat.
- But the human body tissue and have a low thermal conductivity using teploprovedeniya heat transfer from the tissue to the tissue occurs in small quantities and at a low speed. The decisive role in the withdrawal of heat from the tissues that produce it in large quantities, and to prevent their overheating plays blood. Having a high heat capacity, carries blood to tissues with low heat generation and heat is taken away thereby promotes equalization temperature level in various parts of the body. In a similar manner, by strengthening or weakening the blood flow directed to the tissue surface, warming or cooling is carried out of the body surface.

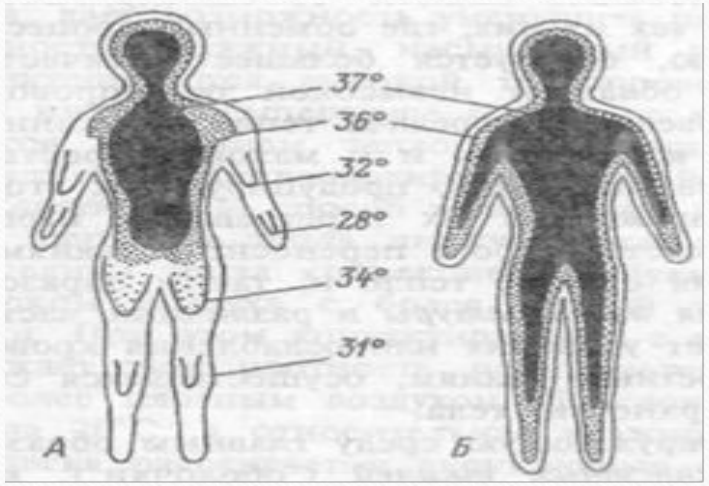
- As heat is given to the environment primarily through the skin surface tissue temperature ("shell") is usually lower than the temperature of deeper tissues ("core"). The surface temperature of the tissue is uneven, too - it is higher in the areas of the body covered with clothing and well vascularized. Body surface temperature depends on the one hand, on the intensity of heat transfer to it of blood from the deep parts of the body, and on the other - by a cooling or warming action ambient temperature. Thus, we can talk about "poikilothermic" shell body. Deep tissue body temperature of blood by heat transfer and more evenly distributed is about 36,7-37,0 ° C.

Her daily fluctuations in conditions of relative rest of the body is within the TOS. Therefore, talking about homoiothermal "core" of the human body. This concept includes, located at a depth of 1 cm from the surface and deeper into the tissue of the human body. In the tissues of the liver, brain, kidney temperature is somewhat higher than in other tissues of internal organs.

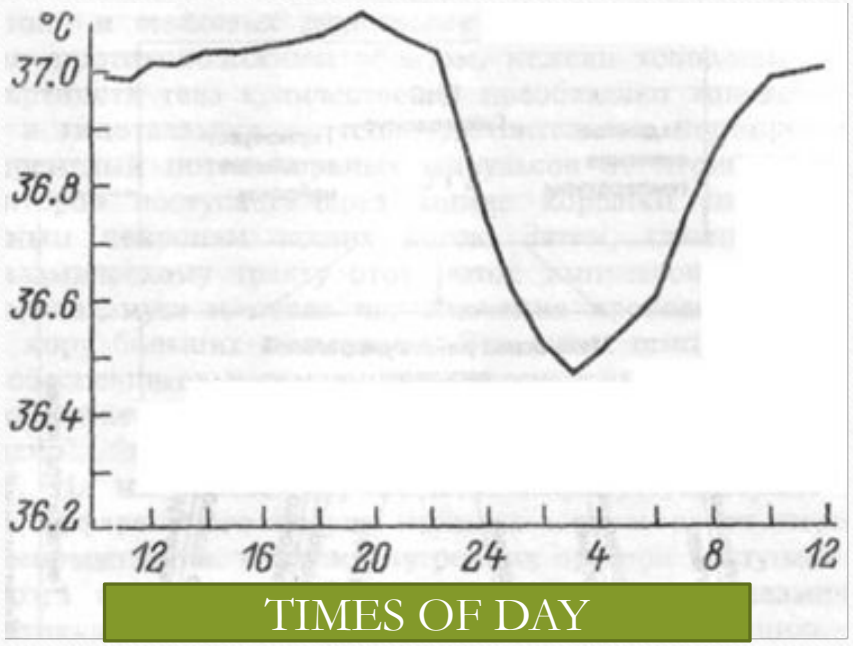
The temperature of the distal portions of the upper and lower limbs is lower than their temperature proximal and deep tissues of the body. Relative constancy of the temperature is stored in a larger mass of deep tissues when the body is in an environment with a temperature of 25-26 ° C.

This temperature for the easily dressed man called thermoneutral zone or room temperature. When the cooling effect of ambient temperature of deep tissue mass, which is supported by a relatively constant temperature, decreases, and if warming - increasing





- With deep tissue temperature changes during the day revealed a definite pattern to vibrate The maximum value of the body temperature reaches 18-20 hours and is reduced to its minimum during the night, for 4-6 hours in the morning.

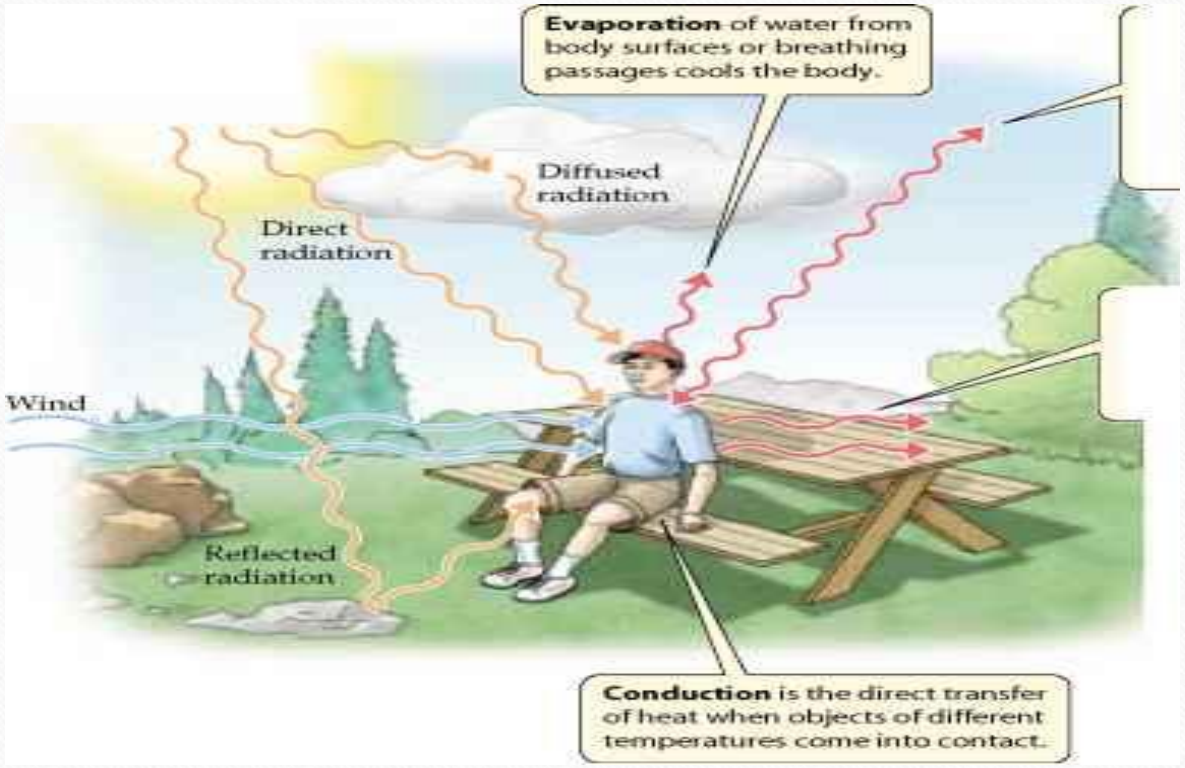


The closest the average value of the body "core" temperature reflects the temperature of the blood in the cavities of the heart, aorta and other major vessels. The least compared with other organs and tissues, the value ranges of the brain temperature. However, the change in temperature in these parts of the human body, for obvious reasons, can not be driven. Therefore, for practical purposes, as a body deep tissue temperature indicator are used sufficiently available to measure its value as a rectal temperature, sublingual and axillary temperature, the temperature in the ear canal from the eardrum. Obviously, similar measurements in each of theAse areas of the body have their own characteristics and limits, and the values obtained at temperatures greater or a lesser extent reflect deep tissue temperature.

Body Temperature Regulation

- Under the regulators understand the totality of physiological and psycho-physiological mechanisms and processes, which are aimed at maintaining a relatively constant body temperature. As in humans and other warm blooded animals at a relatively constant temperature is maintained at the "core" of the body. This is achieved by a balance between the amount of heat produced per unit of time and the amount of heat dissipated by the body in the same time into the environment

Body thermoregulation



Perception and temperature analysis

- Implementation of metabolic transformations and functions cells depends on temperature, so any cell has a certain degree of temperature sensitivity. Detected sensory nerve cells and nerve processes, characterized by a particularly high sensitivity to temperature effects. Such cells, although they are morphologically distinctive form is not described, perform the function thermoreceptors. Temperature reception is performed and sensory nerve endings of thin fiber type C and A (delta), which exist in various parts of the body. Are thermoreceptors in the skin, muscles, blood vessels, internal organs, respiratory tract, spinal cord and other parts of the nervous system. Cooling and heat-sensitive neurons located in the medial preoptic area of the anterior hypothalamus. The perception of thermal stimuli, and the formation of thermal sensations by means of cutaneous cold receptors (increase the frequency of impulses for cooling and reduces it to heat) and heat receptors (react to temperature changes in the opposite way than the cold receptors). On the surface of the body quantitatively holodochuvstvitel prevail in kind, and in the hypothalamus - heat sensitive thermoreceptors.

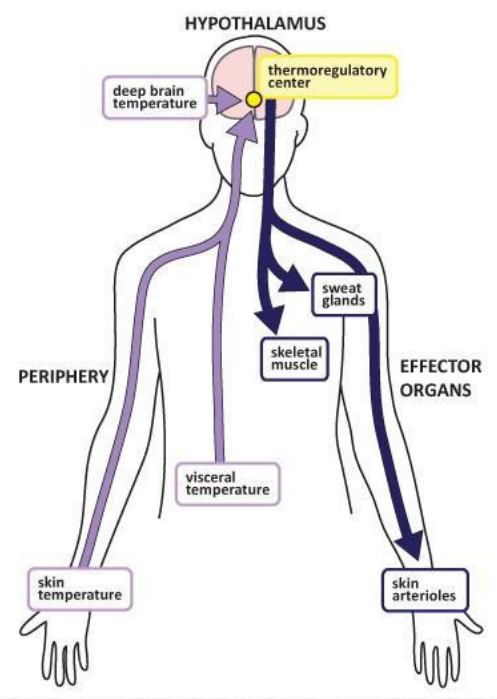
- Afferent flow of nerve impulses from peripheral thermal receptors enters through the back to the roots of spinal cord neurons posterior horns. Then, mainly on spinothalamic tract, this stream of pulses reaches the front of the nuclei of the thalamus, and after the switch is held in Somatos-weed cerebral cortex. This part of the thermal analyzer provides mainly topical occurrence and localization of subjective thermal sensations such as "cold", "cool", "warm", "thermal comfort" or "uncomfortable" hot. " On this basis, formed thermoregulatory responses.
- Part of the flow of afferent nerve impulses from peripheral thermal receptors of the skin and internal organs come from the spinal cord by older upward (spinothalamic and spinoretikulyarnomu) paths in the reticular formation, non-specific thalamic nuclei, in the association areas of the cerebral cortex and the medial preoptic area of the hypothalamus.

Central mechanisms of heat regulation

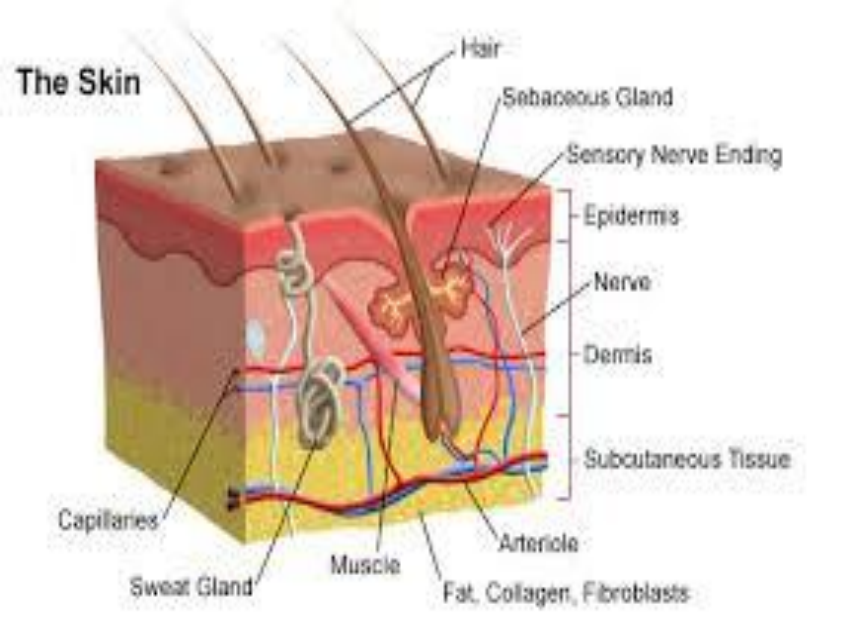
- Regulation of the heat exchange, and hence the body temperature is performed, mainly thermoregulatory center, is localized in the medial preoptic area of the hypothalamus and the anterior posterior hypothalamus. The destruction of this area of the hypothalamus, or violation of its neural connections by transection at the level of the midbrain in animal experiments leads to the fact that the organism is disturbed homoiothermal control of body temperature. The thermoregulatory center found different functions for the group of nerve cells - thermosensitive neurons; cells, "defining" the level maintained in the body in body temperature ("setpoint" thermoregulation), in the anterior hypothalamus; effector neurons that control the processes of heat production and heat loss in the posterior hypothalamus.

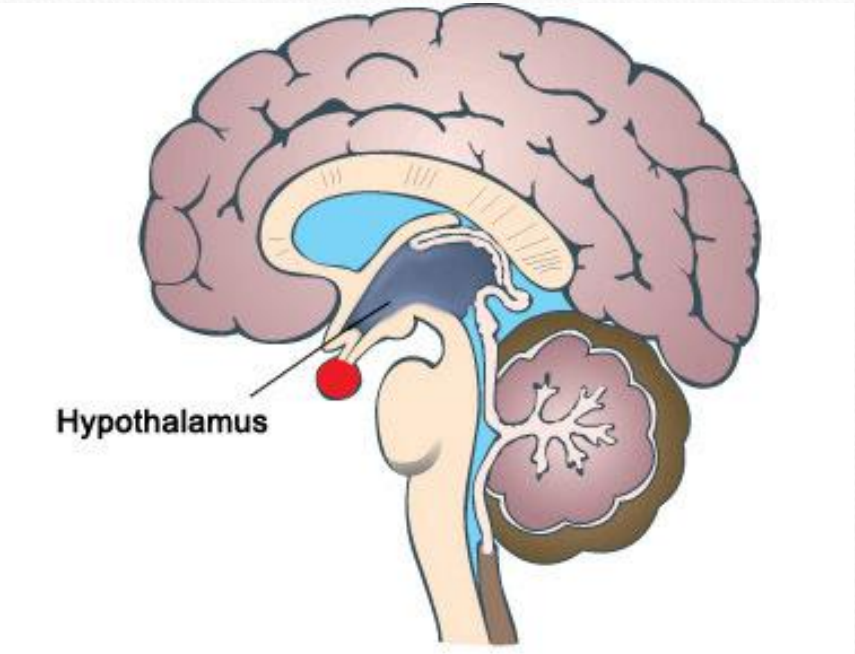
Temperature-sensitive nerve cells directly to "measure" the arterial blood temperature flowing through the brain. These cells are able to distinguish the difference in temperature 0,011 ° C. Afferent nerve impulse flow from thermoreceptors skin, internal organs thermosensitive nerve cells, spinal cord and other body parts is also supplied in preoptic area of the hypothalamus. Based on the analysis of information and integration value of the blood and peripheral tissues temperature is continuously determined an average value of the body temperature.

Data from body temperature are sent to a group of nerve cells of the hypothalamus, the body defining the level of the regulated body temperature, - "setpoint" thermoregulation.



- Based on the analysis and comparison of the mean body temperature and the temperature set value, subject to regulation mechanisms "set point" through effector neurons of the posterior hypothalamus affect heat transfer processes or heat production, to align actual and set temperature. Through the thermoregulatory center is established balance between heat production and heat loss, helping to maintain the body temperature within certain limits.





- The neural mechanisms that integrate the temperature afferentation and assessment of the current body temperature, involving norepinephrine and serotonin. The mechanisms determining the "insertion point", play a role of acetylcholine in the hypothalamus and the ratio of concentrations of sodium and calcium ions. The effector mechanisms of heat production and heat leading role of norepinephrine and acetylcholine. In the central mechanisms of regulation teplooobmena normally prostaglandins are not essential. However, with the development of fever in response to pyrogens prostaglandins appear to acquire the peculiar role in changing mediators "setpoint" thermoregulation.

Conclusion

- Thermoregulation is the ability of an organism to keep its body temperature within certain boundaries, even when the surrounding temperature is very different. A thermoconforming organism, by contrast, simply adopts the surrounding temperature as its own body temperature, thus avoiding the need for internal thermoregulation. The internal thermoregulation process is one aspect of homeostasis: a state of dynamic stability in an organism's internal conditions, maintained far from thermal equilibrium with its environment (the study of such processes in zoology has been called physiological ecology). If the body is unable to maintain a normal temperature and it increases significantly above normal, a condition known as hyperthermia occurs. For humans, this occurs when the body is exposed to constant temperatures of approximately 55 °C (131 °F), and with prolonged exposure (longer than a few hours) at this temperature and up to around 75 °C (167 °F) death is almost inevitable.

- Humans may also experience lethal hyperthermia when the wet bulb temperature is sustained above 35 °C (95 °F) for six hours.The opposite condition, when body temperature decreases below normal levels, is known as hypothermia. It was not until the introduction of thermometers that any exact data on the temperature of animals could be obtained. It was then found that local differences were present, since heat production and heat loss vary considerably in different parts of the body, although the circulation of the blood tends to bring about a mean temperature of the internal parts. Hence it is important to identify the parts of the body that most closely reflect the temperature of the internal organs. Also, for such results to be comparable, the measurements must be conducted under comparable conditions. The rectum has traditionally been considered to reflect most accurately the temperature of internal parts, or in some cases of sex or species, the vagina, uterus or bladder.

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