55 Thermoregulation in Humans

Key Idea: The hypothalamus regulates body temperature in humans. It coordinates nervous and hormonal responses to keep the body temperature within its normal range.

The hypothalamus regulates temperature

In humans, the temperature regulation center of the body is a region of the brain called the **hypothalamus**. It has a 'set-point' temperature of 36.7°C (98.6°F).

The hypothalamus acts like a thermostat. Changes in the core body temperature or in the skin temperature are registered by the hypothalamus, which then coordinates the appropriate nervous and hormonal responses to counteract the changes and restore normal body temperature. When normal temperature is restored, the corrective mechanisms are switched off. This is an example of a negative feedback regulation.

Infection can reset the set-point of the hypothalamus to a higher temperature. The body temperature then increases above the normal range, resulting in a **fever**. Fever is an important defense against infection.

Counteracting heat loss

The hypothalamus monitors blood temperature and receives input from thermoreceptors in the skin. The heat promoting center in the hypothalamus detects a fall in skin or core temperature below 35.8°C and coordinates responses that generate and conserve heat.

Increased metabolic rate produces heat.

Body hairs become raised and increase the insulating air layer around the body.

In extreme cold, two hormones (epinephrine and thyroxine) increase the energy-releasing activity of the liver.

The flow of blood to the skin decreases, keeping warm blood near the core (where the vital organs are).

Shivering (fast contraction and relaxation of muscles) produces internal heat.

Counteracting heat gain

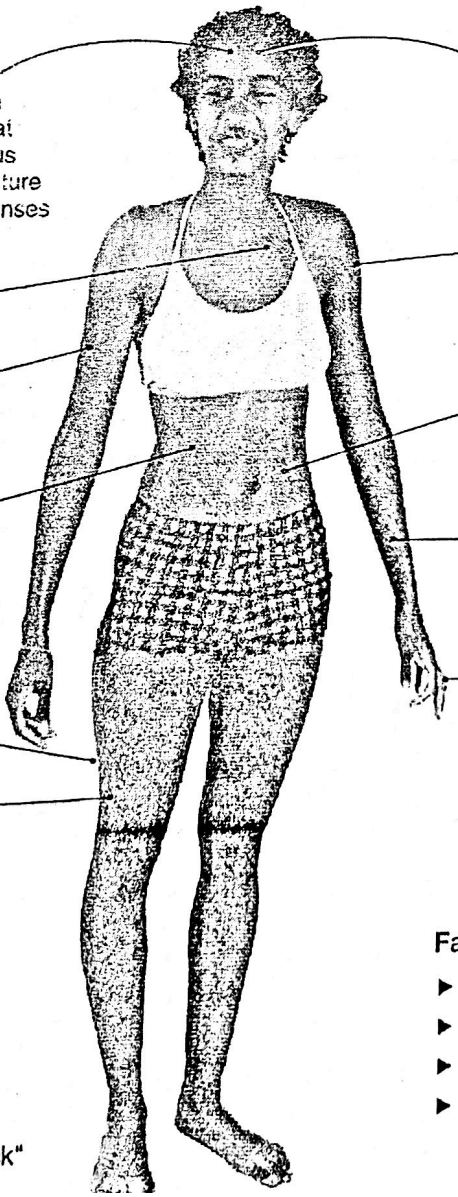
The heat losing center in the hypothalamus monitors any rise in skin or core temperature above 37.5°C and coordinates responses that increase heat loss.

Sweating occurs. This cools the body by evaporation.

Decreased metabolic rate. This reduces the amount of heat generated by the body.

Body hairs become flattened against the skin. This reduces the insulating air layer around the body and helps heat loss.

The flow of blood to the skin increases. Warm blood from the body core is transported to the skin and the heat is lost from the skin surface.



Factors causing heat loss

- Wind
- Cold external temperature
- Not wearing enough clothing
- Being wet or in cold water
- Dehydration or being in "shock"

Factors causing heat gain

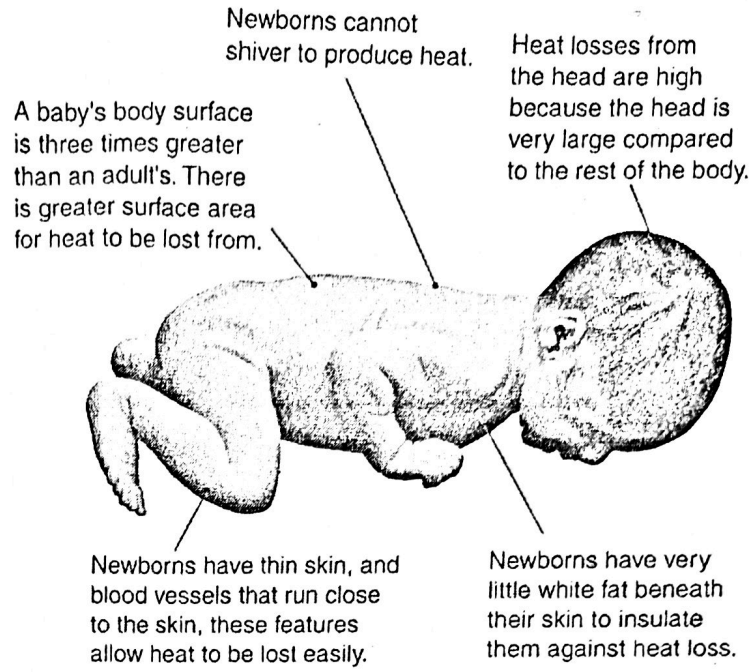
- Warm external temperature
- High humidity
- Excessive fat deposits
- Wearing too much clothing

Thermoregulation in newborns

Newborn babies cannot fully thermoregulate until six months of age. They can become too cold or too hot very quickly.

Newborns minimize heat loss by reducing the blood supply to the periphery (skin, hands, and feet). This helps to maintain the core body temperature. Increased brown fat activity and general metabolic activity generates heat. Newborns are often dressed in a hat to reduce heat loss from the head, and tightly wrapped to trap heat next to their bodies.

Newborns lower their temperature by increasing peripheral blood flow. This allows heat to be lost, cooling the core temperature. Newborns can also reduce their body temperature by sweating, although their sweat glands are not fully functional until four weeks after birth.



1. Where is the temperature regulation center in humans located? _____

2. (a) Why does infection result in an elevated core body temperature? _____

_____

(b) What is the purpose of this? _____

_____

3. Describe the role of the following in maintaining a constant body temperature in humans:

(a) The skin: _____

_____

(b) The hypothalamus: _____

_____

(c) Sweating: _____

_____

(d) Shivering: _____

_____

4. Describe the features of a newborn that can cause it to lose heat quickly: _____

_____

_____

_____

5. How can newborns control body temperature by altering blood flow to the skin? _____

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