

THERMOREGULATION

05 JUNE 2013

Lesson Description

In this lesson we:

- Question the need to regulate body temperature in humans
- Examine the structure and functions of the different parts of the skin
- Look at the role of each of the following in temperature regulation: Sweating, Vasodilation & Vasoconstriction
- Discuss the adaptations of parts of the skin for thermoregulation
- Compare the definitions of hypothermia and hyperthermia
- Consider the preventative measures for hypothermia and hyperthermia

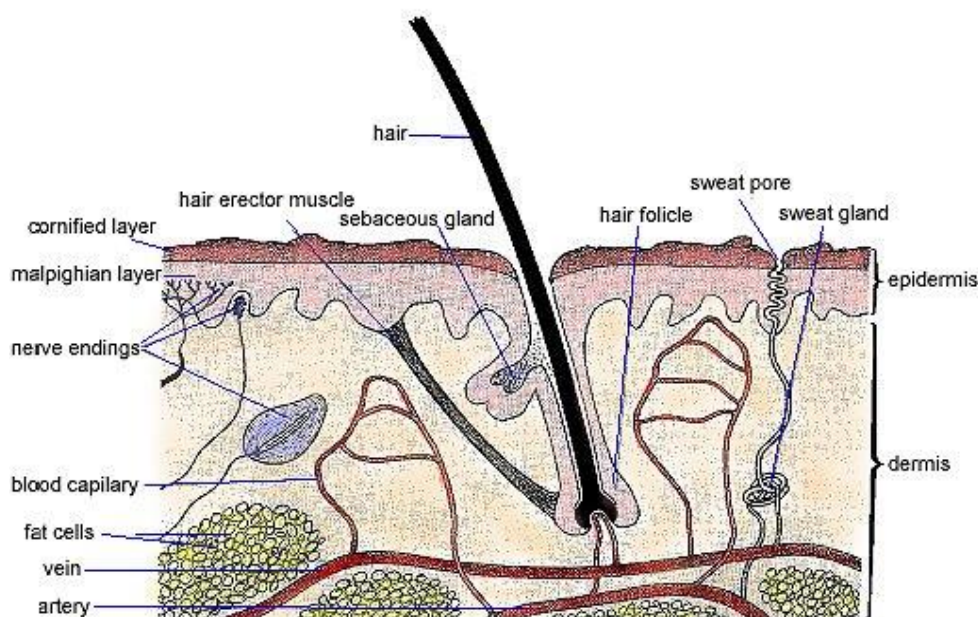
Key Concepts

The Skin and Thermoregulation

Why do we need to maintain a constant body temperature?

Which part of the brain controls body temperature?

The Skin



Too Hot

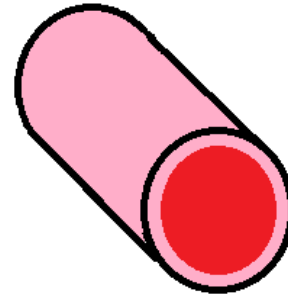
- **Vasodilation** occurs. Blood vessels leading to the skin capillaries become wider (dilate) allowing more blood to flow through the skin, and more heat to be lost.
- Sweat glands in the skin release more sweat, which evaporates, removing heat from the skin.



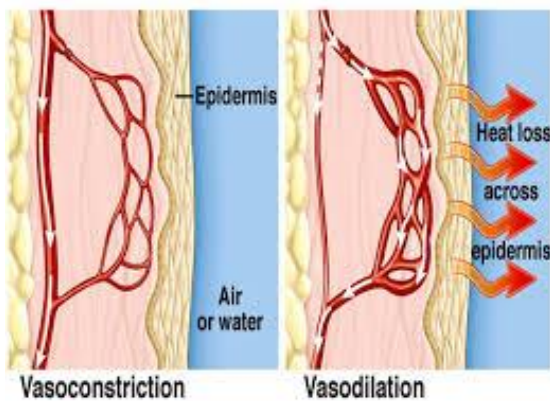
Normal Cross Section



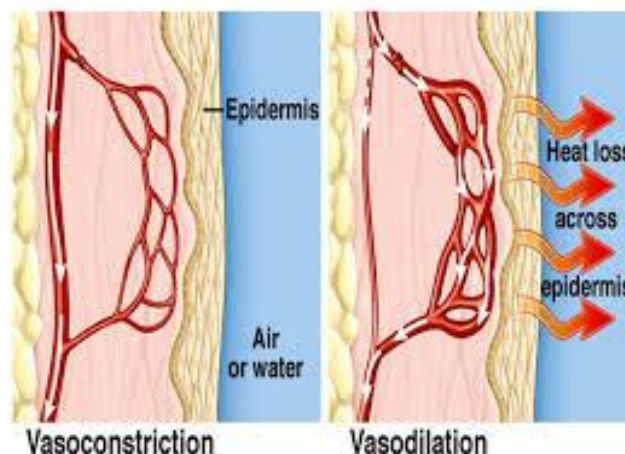
Vasoconstriction

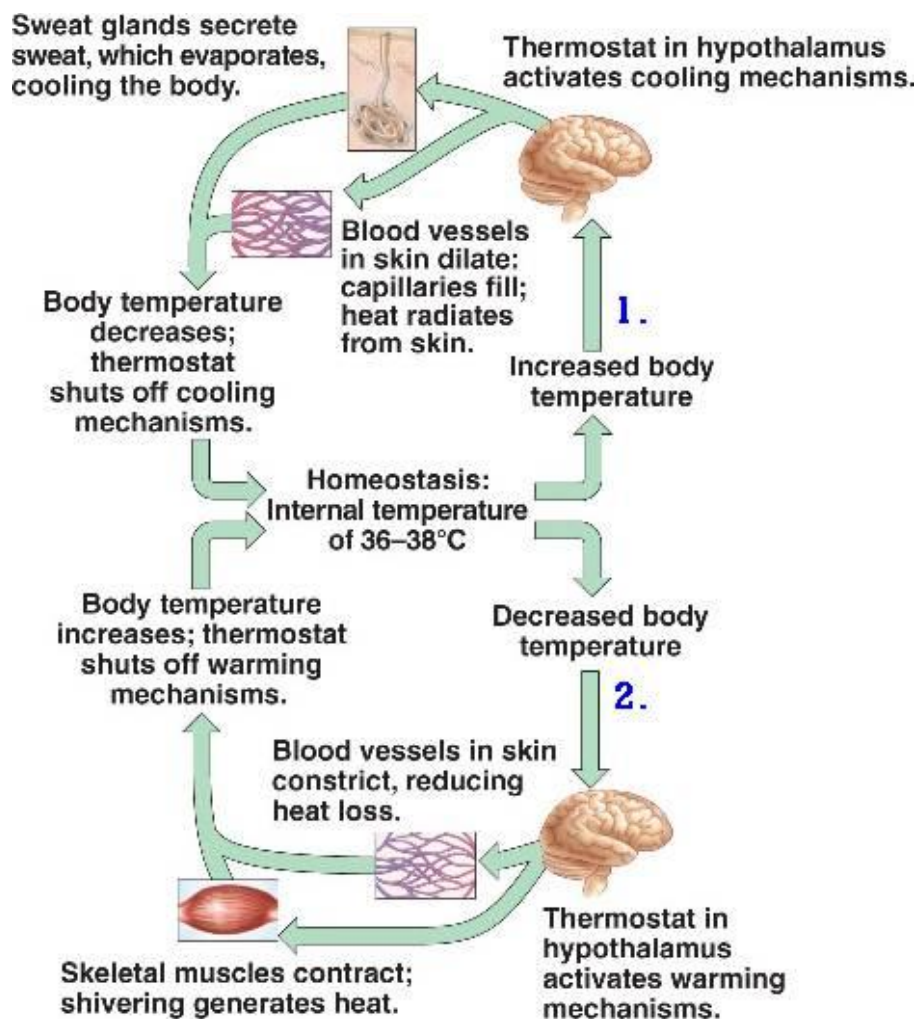
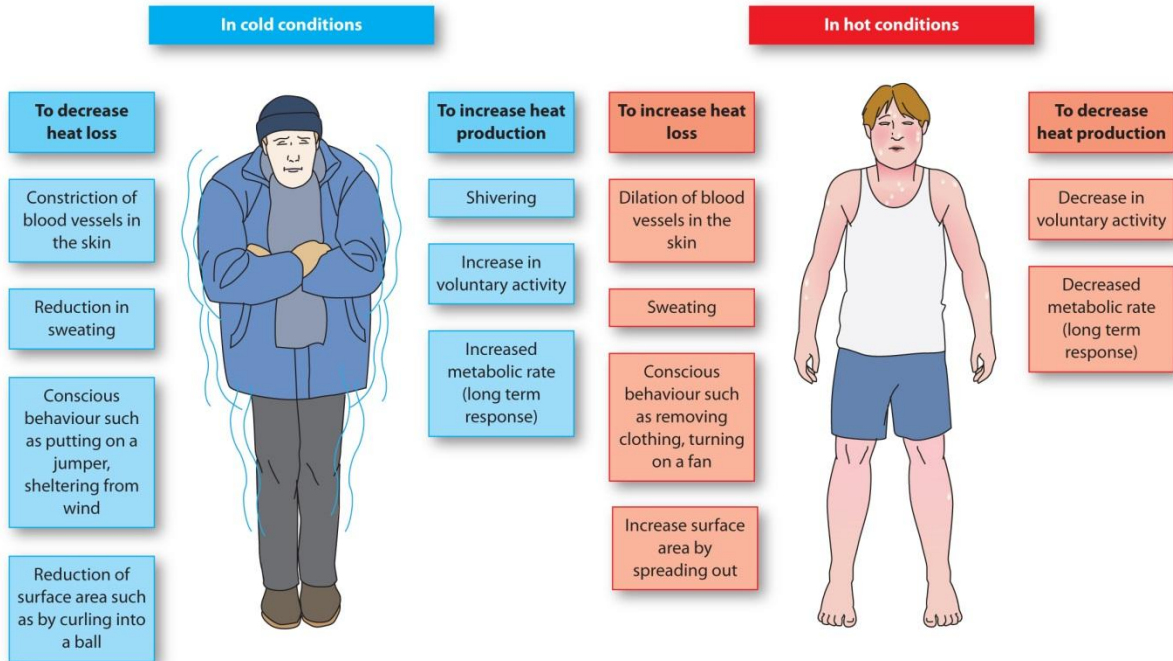


Vasodilation

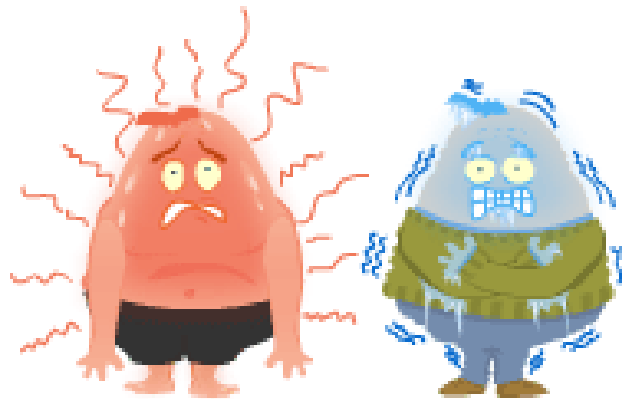
**Too cold**

- **Vasoconstriction** occurs - blood vessels leading to the skin capillaries become narrower (constrict) letting less blood flow through the skin and conserving heat in the body.
- Muscles may contract rapidly and we shiver. These contractions need energy from respiration, and respiration produces body heat.





What can go wrong?



Hyperthermia

Increase of core body temperature above the normal range of 36°C to 37.5°C due to failure of thermoregulation

- Extremely high temperatures which cause an increase in sweating. This can lead to dehydration which reduces sweating which then allows the core body temperature to rise.
- not drinking sufficient water when hot
- prolonged exercise

As the core body temperature rises, the normal mechanisms for controlling body temperature break down. This can lead to a further rise in the core body temperature.

Heat Stroke

- Temperature $> 41.1^{\circ}\text{C}$
- Coma, seizures, confusion
- No sweating

Symptoms

- Increased body temperature
- Hot, dry skin
- Rapid heartbeat
- Increased or decreased blood pressure
- Headache
- Confusion
- Unconsciousness.

Treatment

- Move the person to a cool, shady place.
- Cool the person by covering them with damp sheets or spraying them with water.
- Cool the person with a fan.
- Keep person hydrated
- Seek professional medical help.

Hypothermia

Hypothermia occurs when the core body temperature falls below 35°C. It happens when the body is losing heat faster than it can make it.

- Mild: 32.2 - 35°C
- Moderate: 28 - 32.2°C
- Severe: < 28°C

Causes

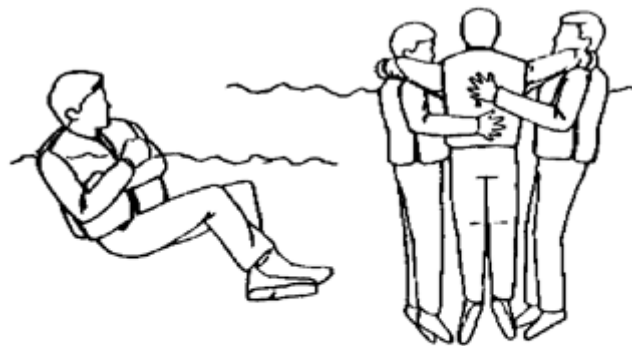
- Extreme cold
- Taking sedatives or alcohol when cold
- Certain medical conditions such as heart problems
- Being very young or very old - these people cannot regulate their body temperature very well

Symptoms

- Violent shivering, which stops as hypothermia becomes more severe
- Confusion
- Difficulty in moving
- Memory loss
- Tiredness
- Slurred speech
- Slow, shallow breathing
- Weak pulse.

Treatment

- Move the person somewhere warm.
- Change them out of wet clothing.
- Wrap them in warm clothing.
- Give them warm drinks, but not alcohol.
- Give them food that is rich in carbohydrates.



H.E.L.P.
(Heat Escape
Lessening Posture)

HUDDLE
to maintain
body heat

Questions

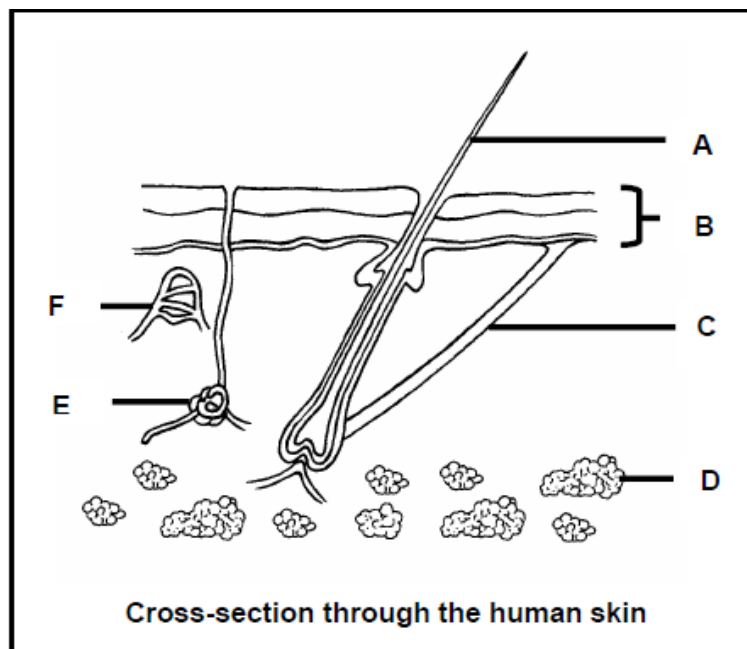
Question 1

Give the correct word or term for the following:

- the maintenance of a constant internal environment
- the maintenance of a constant body temperature
- type of an animal that has a controls body temperature from within.
- widening of blood capillaries in the skin
- method by which most heat is lost through solids
- condition that occurs when the body becomes overheated

Question 2

Study the diagram below and answer the questions

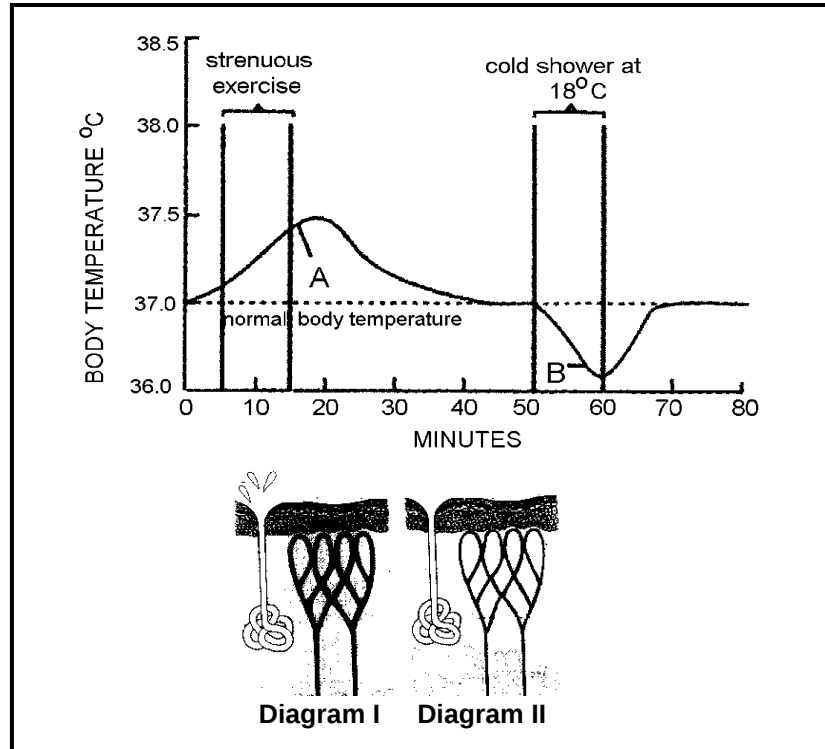


- Label layer B and part C. (2)
- Write down the **letters** of TWO parts in the diagram which are involved in the insulation of the body. (2)
- Describe how the human skin maintains the core body temperature on a day when the environmental temperature is around 40 °C. (5)
- Explain how the skin is suited for thermoregulation. (4)

Question 3

(Adapted from Learner Resources Western Cape)

The graph below shows the effect of strenuous exercise, followed by a cold shower, on the body temperature of an athlete



- Which part of the brain responds to the temperature changes that occur at A and B on the graph? (1)
- What was the maximum temperature reached? (1)
- For what period of time did the person engage in strenuous exercise? (1)
- Why should body temperature not be allowed to fluctuate too much? (1)
- Which diagram (I or II) would represent the condition of the skin after 15 minutes. (1)
- Explain your answer to QUESTION (e.). (2)

Question 4

Draw a flow diagram to show how the body uses negative feedback to maintain a constant body temperature.