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A2 Biology OCR

Unit F214: Communication, Homeostasis and Energy

Module 1.1 Communication

Notes

Outline the need for communication systems within multicellular organisms, with reference to the need to respond to changes in the internal and external environment and to coordinate the activities of different organs.

- Organisms need to respond to external stimuli,
    - e.g. temperature, oxygen concentration and levels of sunlight.
- These may be over time
    - e.g. winter fur to summer fur, or quickly, e.g. changing size of pupils.
- Internal environments change too- the buildup of carbon dioxide as a result of respiration, changes the pH of the tissue fluid, and therefore inhibits enzyme activity.
- Multicellular organisms need to coordinate different organs, so this requires a good communication system which will:
    - Cover the whole body
    - Enable cells to communicate with each other
    - Enable specific communication
    - Enable rapid communication
    - Enable both short and long-term responses

State that cells need to communicate with each other by a process called cell signalling.
&
State that neuronal and hormonal systems are examples of cell signalling.

- Cells communicate with each other by a process known as cell signalling
- There are two methods of cell signalling
- The Neuronal system
    - Interconnected network of neurones that signal to each other across synapse junctions
    - Neurones can conduct a signal very quickly
    - Enable rapid responses to stimuli

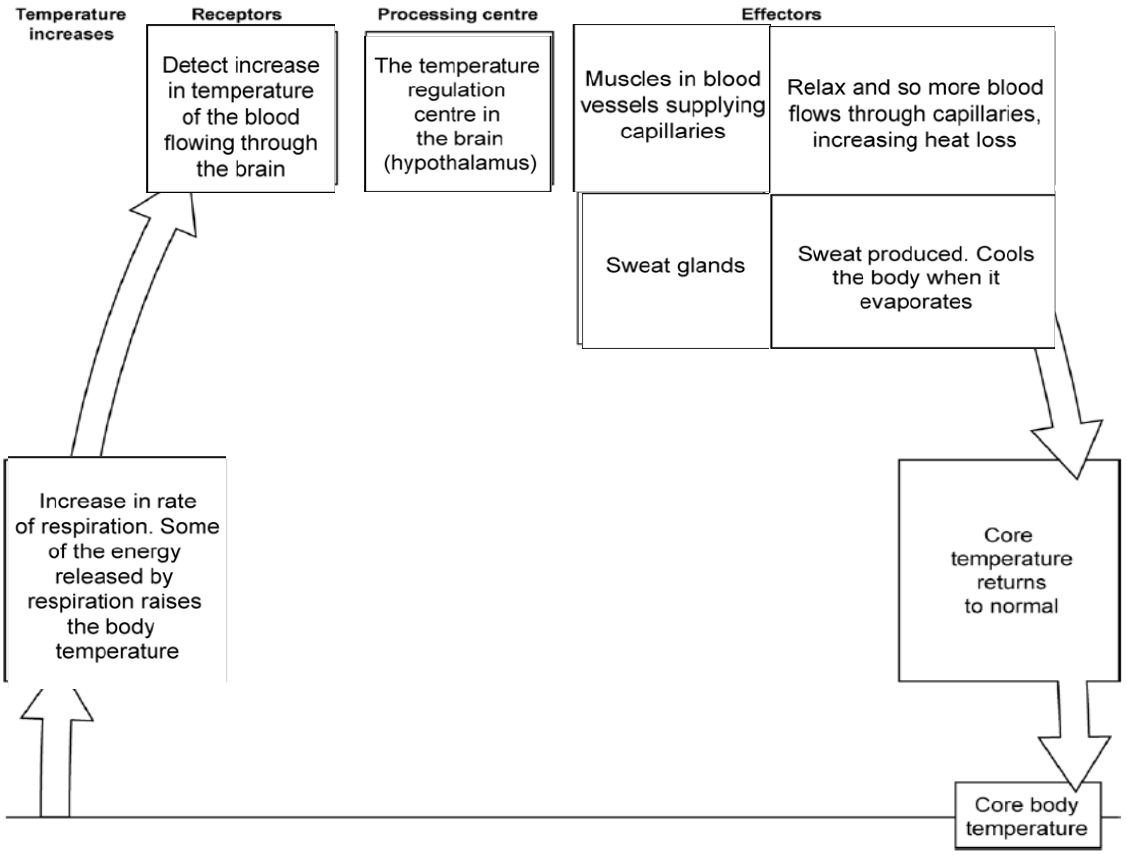
- The endocrine system
    - Uses the blood to transport chemical signals
    - Carried all over the body but only recognised at specific target cells
    - Enables longer term responses to be co-ordinated.

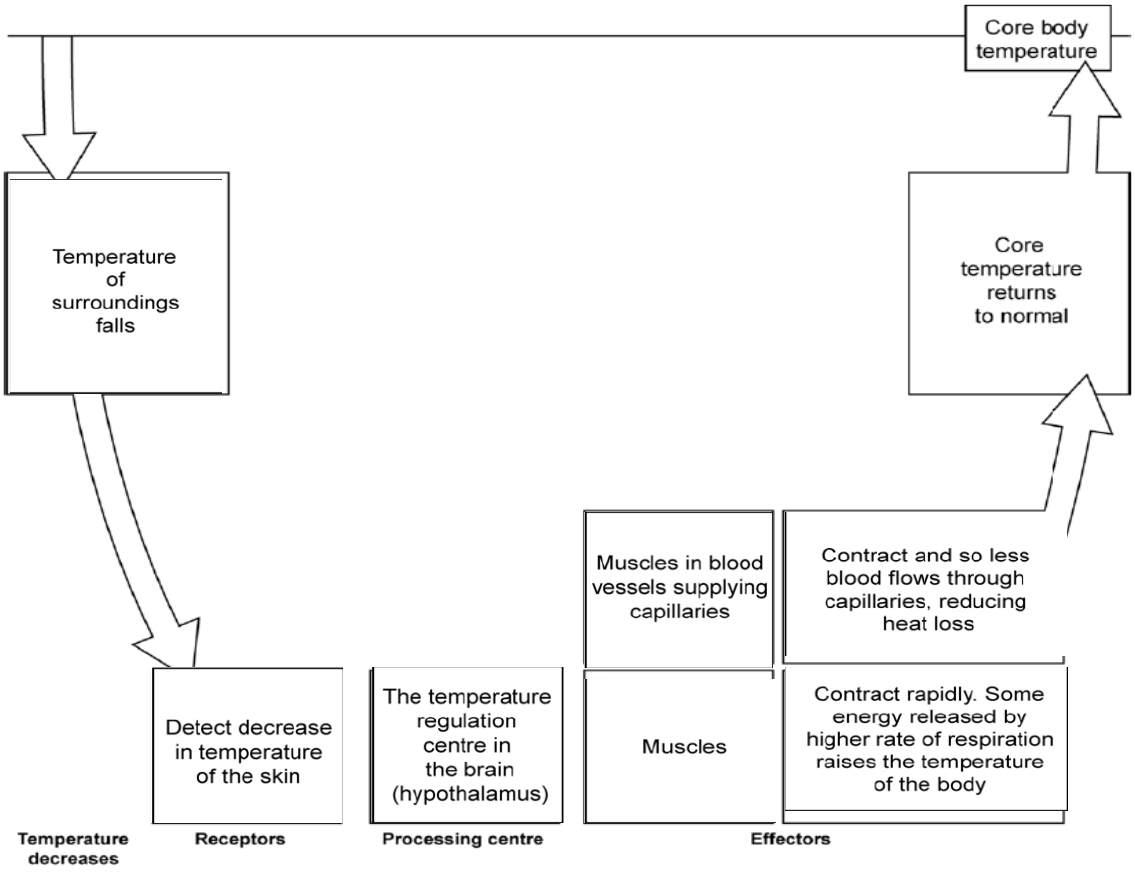
Define the terms negative feedback, positive feedback and homeostasis.

- **Homeostasis**
  - The maintenance of a constant internal environment despite external fluctuations
- **Negative Feedback**
  - The process that brings about a reversal of any change in conditions
  - It ensures an optimum steady state can be maintained
  - Returns the internal environment to its original set of conditions after any change
  - Essential for homeostasis
  - E.g Thermoregulation, osmoregulation

- **Positive Feedback**
  - The process that increases any change detected by the receptors
  - It tends to be harmful
  - It does not lead to homeostasis
  - E.g. Oxytocin and birth

Explain the principles of homeostasis in terms of receptors, effectors and negative feedback.





Describe the physiological and behavioural responses that maintain a constant core body temperature in ectotherms and endotherms, with reference to peripheral temperature receptors, the hypothalamus and effectors in skin and muscles.

- **<u>Ectotherms</u>**
  - To maintain a constant core body temperature, ectotherms have physiological and behavioural responses;

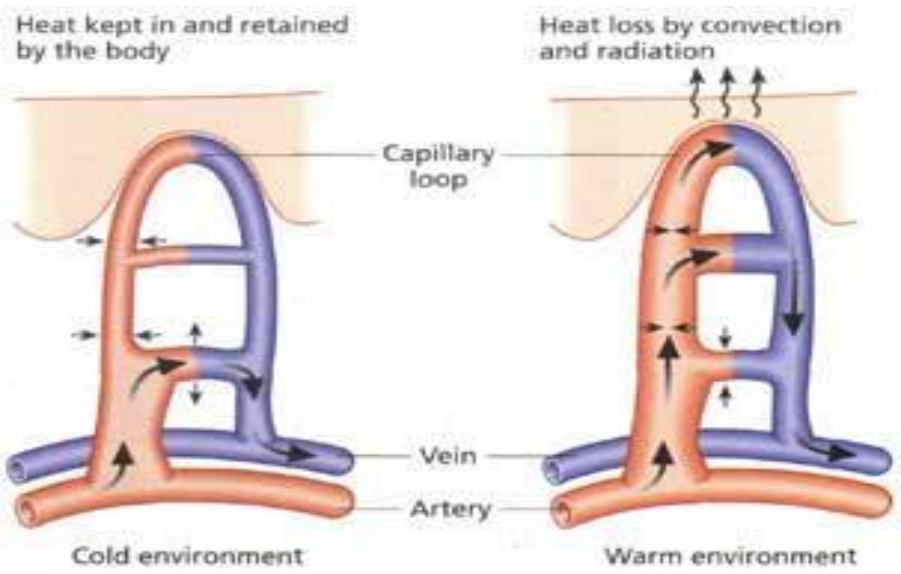
- **Physiological**
  - The horned lizard expands its ribcage and the frilled lizard uses its frill to expand its surface area to absorb more heat from the sun
  - Locusts increase their abdominal breathing movements to increase water loss when hot

- **Behavioural**
  - Snakes expose their body to the sun so more heat is absorbed
  - Locusts orientate their body towards the sun to expose a larger surface area & so more heat is absorbed. By orientating their body away from the sun, more heat is lost.
  - Lizards hide in burrows to prevent heat absorption by staying out of the sun.

- **<u>Endotherms</u>**
  - Endotherms monitor blood temperature in the hypothalamus. If the core temperature drops or rises it sends signals to the effectors to reverse the changes.
  - Peripheral temperature receptors monitor the extremities. The information is fed to the thermoregulatory centre. If it signals a temperature change to the brain, it can initiate behavioural mechanisms for maintaining body temperature.
  - To maintain a constant core body temperature, endotherms have physiological and behavioural responses;

- **Physiological**
  - **Sweat glands**
    - When hot they secrete sweat onto the skin. Water evaporates using heat from the blood to supply latent heat of vaporisation.
    - When cold, less sweat is secreted, less water evaporates and so less loss of latent heat Lungs, nose and mouth
  - **Panting**
    - When hot, panting increases water evaporation from lungs, tongue and moist surfaces. Loss of latent heat as above.
    - When cold, no panting, less water evaporates, no loss of latent heat.

  - **Hairs on skin**
    - When hot, the hairs lie flat, providing little insulation, meaning heat can be lost through convection and radiation.
    - When cold, hairs raise to trap a layer of air, insulating the skin and reducing heat loss
  - **Arterioles leading to capillaries in skin**
    - Hot- vasodilatation allows more blood to capillaries near skin surface, so heat can be radiated from skin
    - Cold- vasoconstriction reduced the flow of blood through the capillaries near skin, so less heat is radiated



- **Liver cells**
  - Hot- reduce rate of metabolism so less heat is generated from exergonic reactions e.g. respiration.
  - Cold- increased rate of metabolism so more heat is generated. Respiration generates more heat which is transferred to the blood.
- **Skeletal muscles**
  - Hot- not spontaneous contractions
  - Cold- spontaneous contractions generates heat as muscle cells respire more.

- **Behavioural**
  - **Hot**
    - Move into shade or hide in burrow
    - Orientate body to decrease surface area exposed to sun
    - Remain inactive and spread out limbs to increase surface area
  - **Cold**
    - Move into sunlight
    - Orientate body to increase surface area exposed to sun
    - Move about to generate heat in muscles
    - In extreme heat, roll into ball and keep still to decrease surface area**.**

Physiological	Ectotherm	Endotherm
Behavioural	**Ectotherm**	**Endotherm**