6.4 Homeostasis

Maintaining an internal environment within set limits

Homeostasis

- pH
  - Need to control to maintain enzyme activity
- Temperature
  - Detected by hypothalamus
    - Too hot – vasodilation, sweating, seeking shade
    - Too cold – shivering, vasoconstriction, raising hairs on skin
- Negative feedback
  - The change detected leads to a reduction in the stimulus, turning the system off or restoring to original level
  - Example – control of blood glucose
- Positive feedback
  - The change detected leads to a further deviation away from the normal value

Changes in water potential in blood and cells can lead to shrinkage or bursting

Osmoregulation

- Kidney
  - Water potential of blood detected in hypothalamus
  - Cortex and medulla
  - Nephron = functional unit of kidney
    - Glomerular filtrate – forms in Bowman's capsule
    - Glucose and water are reabsorbed in the proximal convoluted tubule
    - Loop of Henle – maintenance of sodium ion gradient
      - Counter-current multiplier
    - Water is reabsorbed in the distal convoluted tubule and collecting duct
      - ADH from posterior pituitary

Blood glucose is controlled to ensure the cells have enough respiratory substrates

Blood glucose

- Liver
  - Glycogenolysis
  - Gluconeogenesis
  - Glycogenesis
- Insulin
  - Regulates channel proteins and glucose uptake in cells
  - Pancreas
    - Activates enzymes to convert glucose into glycogen
    - Decreases blood glucose concentration
- Glucagon
  - Activates enzymes to convert glycogen into glucose
  - Activates enzymes to convert amino acids and glycerol into glucose
  - Increases blood glucose concentration
- Diabetes
  - Type 1 and type 2
    - Insulin-dependent or insulin-independent
  - Second-messenger model of hormone action
    - Adrenaline

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