EXCRETION

VS

EGESTION

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EGESTION

- The passing out of undigested food through faeces

EXCRETION

- The passing out of metabolic waste
  - Metabolic waste is waste that was made in the body
    - CO_2, sweat and urine

So:

Egestion = FAECES

Excretion = METABOLIC WASTE

EXCRETION

EXCRETION

- The passing out of metabolic waste
  - Metabolic waste is waste that was made in the body
    - CO_2
    - Sweat
    - Urine

EXCRETORY ORGANS

- Lungs – CO_2
- Skin - Sweat
- Kidneys - Urine

EXCRETORY PRODUCTS

- CO_2
- Urea

CARBON DIOXIDE

- CO_2
- Made in the mitochondria of all living cells during respiration
- Carbon dioxide leaves the body when we breathe out

UREA

- Made in the liver from excess proteins
- Excreted mainly through the kidneys
  - Urine
- Some urea is also lost in sweat
- **Sweat** and **Urine** both contain three substances:
  - water, salt, urea
  - Urine = water + urea + salt
  - Sweat = water + urea + salt

THE KIDNEY

- 2 kidneys (left and right)
- They are in the abdomen
- Two main functions:
  - 1) to remove toxic waste - urea
  - 2) to control the amount of water in the blood (osmoregulation)

THE KIDNEY

- Receives blood from the **renal artery**
- Contains thousands of **nephrons** that filter/ strain/ clean the blood to remove toxic substances
- A long tube called the **ureter** carries urine (containing waste) from the kidney to the bladder

HOW THE KIDNEY EXCRETES UREA

- The renal artery brings blood to the kidney
- The blood then passes through smaller arteries inside the kidney
- Each smaller artery leads to a nephron/ tubule
- Each nephron is approximately 12-14mm in length
- Each kidney has approximately 1.5 million nephrons
- The **nephrons/ tubules** are the exact place where the blood is cleaned

THE KIDNEY NEPHRON/ TUBULE

- Has five main parts:
  - The Bowman's Capsule
  - The 1st Convolution/ 1st Coiled Tubule
  - The Loop of Henle
  - The 2nd Convolution/ 2nd Coiled Tubule
  - The Collecting Duct

THE KIDNEY NEPHRON/ TUBULE

- **The Bowman's Capsule**
  - Very small molecules
    - water, salt, glucose, urea, and amino acids
  - Pass out of the blood
  - Enter the tubule/ nephron
  - These small molecules now form a **filtrate** as they pass through the nephron

THE KIDNEY NEPHRON/ TUBULE

- **The Glomerulus**
  - This is the cluster of blood vessels inside the Bowman's Capsule
  - Ultra-filtration takes place here
    - Small particles leave the blood and enter the nephron

THE KIDNEY NEPHRON/ TUBULE

- **The First coiled (convoluted) tubule**
  - Has a lot of microvilli
  - This provides a large surface area for absorption
  - Useful substances are reabsorbed:
    - Glucose
    - Amino Acids
    - Some water
    - Some salt
      - These go back into the blood to be used by the body

THE KIDNEY NEPHRON/ TUBULE

- **The Loop of Henle**
  - Water is reabsorbed into the blood
  - It is long
    - So an adequate amount of water can be reabsorbed

THE KIDNEY NEPHRON/ TUBULE

- **The Second coiled (convoluted) tubule**
  - If the body still does not have enough water, water will be reabsorbed here
  - The body gets rid of ammonium ions and some drugs from the blood by releasing them into this tubule

THE KIDNEY NEPHRON/ TUBULE

- **The Collecting duct**
  - This is where the liquid (urine) is collected
  - Urine contains water, salt, and urea
  - It has no glucose (sugar)
  - If the body needs more water, it will be reabsorbed here
  - From the collecting duct, the urine travels through the ureter to the bladder

THE BLADDER

- A muscular sac that holds between 600 and 800 cm^3 of urine
- A sphincter muscle at the opening of the urethra allows us to control the opening of the bladder
- Urea (Urine) goes from:
  - Kidney → ureter → bladder → urethra

OSMOREGULATION

controlling the amount of water in the blood

OSMOREGULATION

- The kidney controls the amount of water in the urine/ blood

- As the filtrate passes through the nephron water is reabsorbed back into the blood
  - The amount of water reabsorbed is based on how much water the body needs

OSMOREGULATION

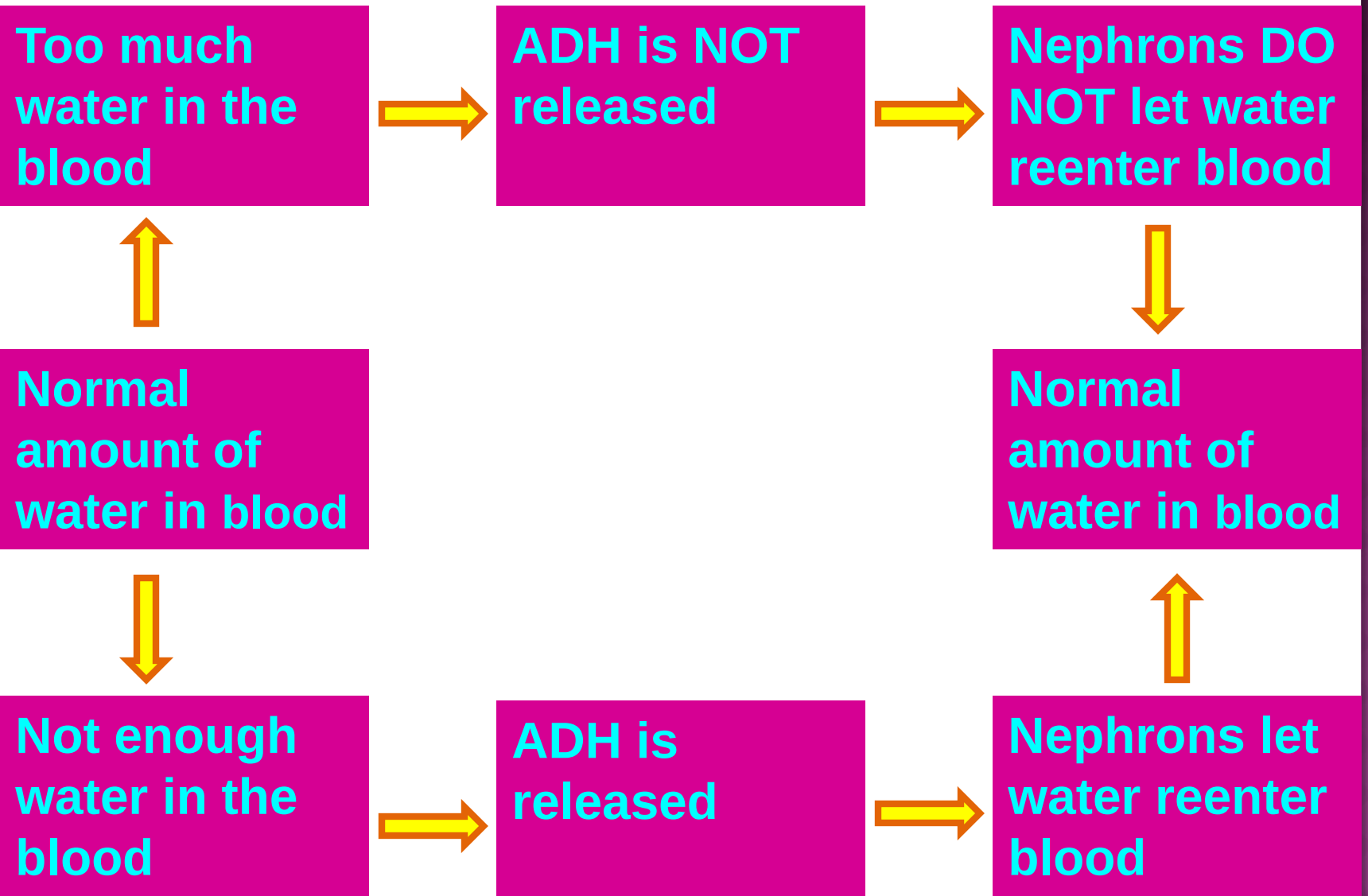
- The **hypothalamus** in the brain is responsible for detecting the amount of water in the blood
- If there is **NOT ENOUGH** water in the blood, a hormone called **ADH (Antidiuretic hormone)** is released from the brain and travels to the kidneys
  - This is on a hot day when the body loses water in sweat
- **ADH** causes the walls of the nephron to let more water pass back into the blood
  - So less water passes out in the urine
  - The urine is concentrated (yellow and has a strong smell)

OSMOREGULATION

- If there is **TOO MUCH** water in the blood, **ADH (Antidiuretic hormone)** is **NOT** released
  - This is on a cold day or when you drink a lot of water

- The walls of the nephron **DO NOT** allow a lot of water to be reabsorbed back into the blood
  - So more water passes out in the urine
  - The urine is dilute (watery and clear)

OSMOREGULATION



KIDNEY FAILURE

- There are two types of treatment:
  - (1) Dialysis and the artificial kidney
  - (2) Kidney Transplant
- The kidney removes toxic substances from the blood
- If the kidney does not clean the blood, the individual will die

KIDNEY DIALYSIS

- A patient is attached to a kidney dialysis machine
- A tube is inserted into the patient's vein (inside the hand)
- Blood then passes from the patient into the machine
- The machine cleans this blood
  - Removes the urea
- The clean blood is then returned to the patient's hand via another tube
- This is done once or twice a week

KIDNEY TRANSPLANT

- A healthy person (donor) gives one of his/ her kidneys to the patient (recipient)
- A surgeon performs the operation
- A kidney transplant is better than kidney dialysis
  - It is cheaper in the long run
  - The patient can live a normal life (no frequent hospital visits for dialysis)

HOW THE BODY LOSES AND GAINS WATER

- LOSES WATER
  - Exhaled air
  - Sweat
  - Urine
  - Faeces
- GAINS WATER
  - Food
  - Drink
  - Respiration

HOMEOSTASIS

the ability of the body to maintain **constant internal conditions** despite the external conditions

HOMEOSTASIS

- Controlled by two main systems
  - **NERVOUS** and **HORMONAL**

HOMEOSTASIS

- Energy levels
  - When we have little energy left, we consume food
    - Therefore the energy level in the body is restored to normal

HOMEOSTASIS

- Body temperature
  - When the body is too hot, we sweat
    - This cools us down and normalizes the body temperature
  - When the body is too cold, we get goose bumps and start to shiver
    - This warms us up and normalizes the body temperature

HOMEOSTASIS

- Water levels
  - If there is **too much** water in the blood
    - No ADH is released
    - We urinate more often
  - If there is **not enough** water in the blood
    - ADH is released
    - We urinate less often

HOMEOSTASIS

- Breathing rate and Heart rate
  - When we exercise or are anxious or afraid, we breathe faster and the heart beats faster
    - This allows us to take in more oxygen and to release more carbon dioxide
    - This allows the heart to pump more oxygen around the body

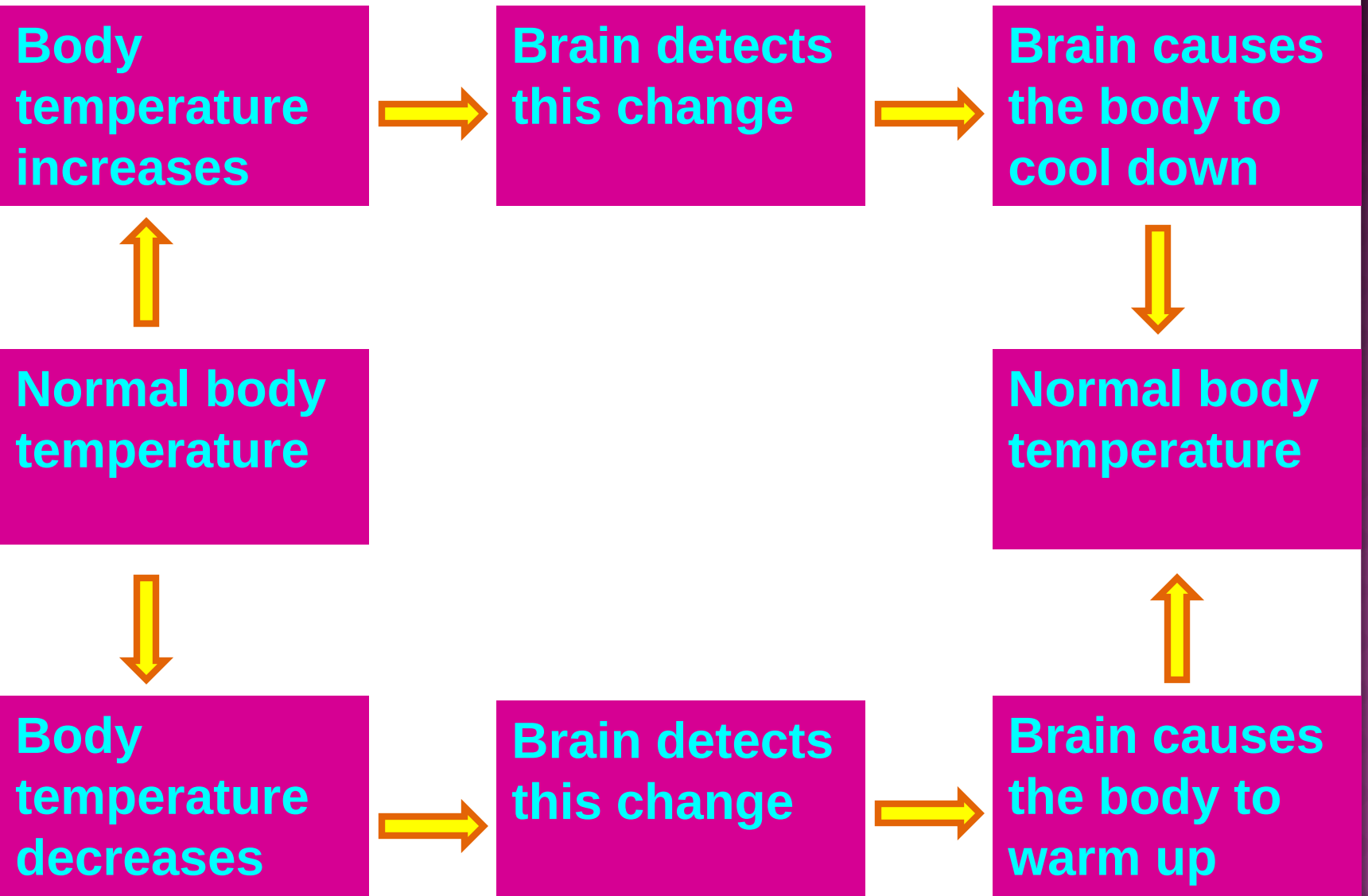
HOMEOSTASIS

- Hormone levels
  - If there is **too much** glucose in the blood
    - Insulin is released
    - Insulin changes the glucose into glycogen
  - If there is **not enough** glucose in the blood
    - Glucagon is released
    - Glucagon changes the glycogen into glucose

NEGATIVE FEEDBACK

- When a condition in the body changes from the norm, the brain causes the body to change to bring the condition back to normal
  - E.g. if the body temperature increases
  - Sweating cools down the body

NEGATIVE FEEDBACK



HOMEOSTASIS

the skin

and

temperature control

THE SKIN

- Largest and heaviest organ
- Contains sense organs
  - touch, temperature, pressure, pain
- Prevents the entry of pathogens
- Protects us from the Sun's harmful UV rays
- Excretes urea
  - Sweat
- Controls body temperature

COOLING DOWN

- We sweat a lot
  - The sweat picks up the heat on the skin
  - The sweat evaporates from the skin and carries away the heat
- Vasodilation – Capillaries get wider and carry more blood to the skin
  - The blood contains heat which escapes from the surface of the skin
- The hair on the skin lies flat
  - There is no layer of air close to the skin
  - No heat is trapped close to the skin

WARMING UP

- We do not sweat a lot
- Vasoconstriction – Capillaries get narrow and less blood flows to the skin
- The hair on the skin stands straight
  - There is a layer of air close to the skin
  - Heat is trapped close to the skin

ENDOTHERMS AND ECTOTHERMS

ENDOTHERMS

- Animals that can control their body temperature and keep it constant
  - Humans control their body temperature so that it is usually around 37^{o}C

ECTOTHERMS

- Animals that can not maintain a constant body temperature

- Their body temperature varies according to the external temperature
  - Lizards, fish

EXCRETION IN PLANTS

EXCRETION IN PLANTS

- Waste is excreted through the yellowing leaves of plants

EXCRETION IN PLANTS

- Plants excrete waste gases produced during photosynthesis and respiration

  - Daytime – Photosynthesis:
    - $CO_2 + H_2O \rightarrow$ glucose + O_2
    - Oxygen exits through the stomata

  - Nighttime – Respiration:
    - Glucose + $O_2 \rightarrow CO_2 + H_2O$
    - Carbon dioxide exits through the stomata