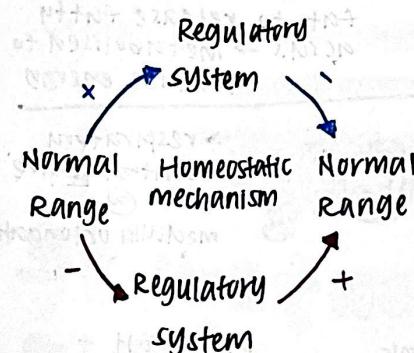


Homeostasis -

Physical factors

- temperature
- osmotic blood pressure
- blood pressure
- pH value
- concentration of minerals
- blood sugar level



- ↳ regulation of physical + chemical factors of the internal environment within normal ranges for the cell to function in optimum conditions
- ↳ any deviation triggers homeostatic mechanism that involves -ve feedback
- ↳ internal envir. in constant state altho external env. changes a LOT
- ↳ cell activities = optimum level

organ systems involved in homeostasis

- ① Body temp. → too ↑, cell denature; too ↓, metabolic actut. slow
 - integumentary syst.
 - nervous syst.
 - circulatory syst.
 $(75-110 \text{ mg/100 mL})$
- ② Blood sugar levels
 - endocrine system
 - circulatory system
 - digestive system
- ③ Partial pressure of CO_2 in blood
 - respiratory syst.
 - circulatory syst.
 - nervous syst.
- ④ Blood pressure
 - circulatory system
 - nervous system

body temperature

importance:

- cell metabolism reactions that are catalysed by enzymes work at optimum level
- ↳ temp ↑ → denature
- ↳ temp ↓ → x active

- erector muscles relax
- ↳ fine hair lower towards skin
- ↳ thin layer of air is trapped → heat released quickly
- arterioles in the skin dilates = vasodilation
- more blood flow to the surface → more heat loss

Thermoreceptors in hypothalamus

Thermoreceptors in the skin

Physical

- skeletal muscles relax
- body x shiver

Chemical

- sweat glands stimulated
- ↳ produce more sweat
- heat absorbed to evaporate sweat
- ↳ cools the skin

- adrenal glands = ICS stimulated
- ↳ ↓ adrenaline, ↓ metabolic rate
- thyroid gland x stimulated
- ↳ ↓ thyroxine, ↓ metabolic rate
- excess heat

Body temp ↓

Thermoreceptors @ hypoth.

Thermoreceptors in the skin

Physical

- hair erects → trap air → heat insulator
- ↳ prevent loss of heat
- arterioles in skin contracts (vasoconstriction)
- less blood flow to the surface → less heat loss

Chemical

- skeletal muscles contract + relax → shiver
- ↳ generate heat → ↑ body temp.
- constriction of muscles require energy

- thyroid gland stimulated
- secrete more thyroxine
- ↳ metabolic rate ↑
- more heat generated

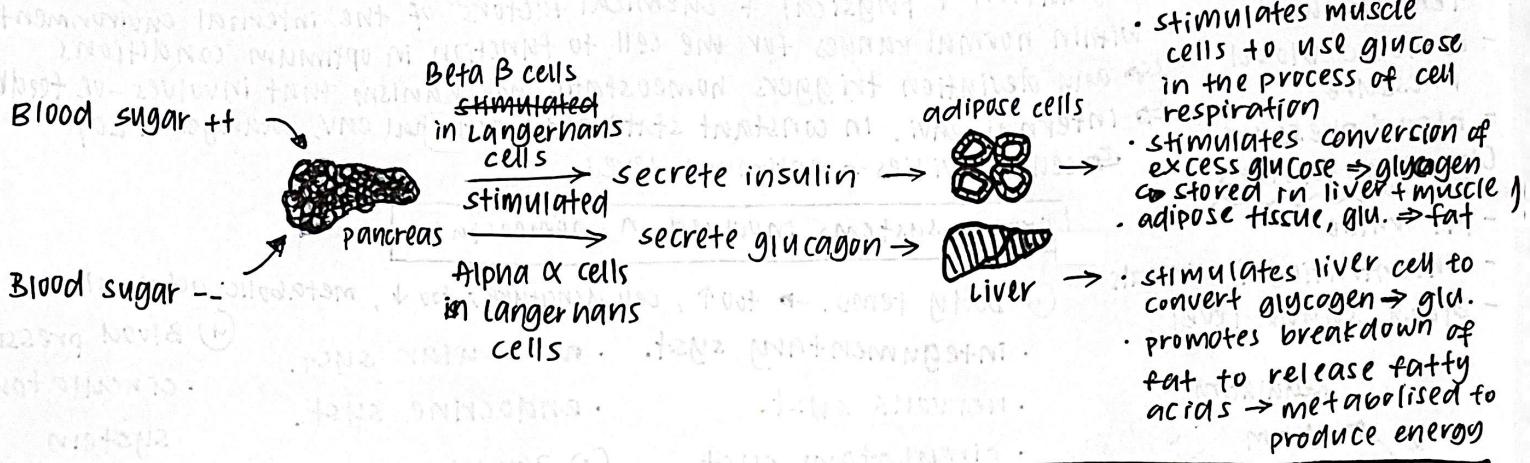
- sweat gland x stimulated → x sweat
- adrenal glands stimulated → secrete more adrenaline
- ↳ speeds up conversion of glycogen to glucose
- metabolic rate ↑
- oxidation of glucose releases heat

Blood sugar level

= glucose

Organ that's responsible = pancreas

normal range = 75-110 mg / 100ml



partial pressure of CO₂

vigorous activity

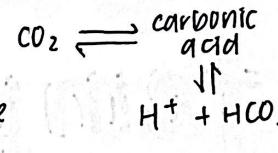


blood CO₂ partial pressure ↑
↳ cellular respiration

CO₂ dissolves in blood plasma



carbonic acid
↓ break down
hydrogen ions + bicarbonate ions



→ respiratory control centre @ medulla oblongata

blood pH + fluid that flood the brain, aka cerebrospinal fluid

↓ detect

central chemoreceptor

@ medulla oblongata

+ peripheral

chemoreceptor @ neck (carotid + aortic body)

Breathing rate,
heart rate +
ventilation rate

Intercostal muscles,
Diaphragm, cardiac
muscles contract
+ relax quickly

Respiratory control centre
@ medulla oblongata

Nerve impulses triggered + sent

Baroreceptors / pressure receptors
@ aortic arch + carotid artery
→ send impulse to medulla oblongata
blood head

arterial vasoconstriction
↳ adds resistance to blood flow
→ stronger contractions of cardiac muscles

b.p. =

arterial vasodilation
↳ reduce resistance to blood flow
→ weak contractions of cardiac muscle

Blood pressure

Blood pressure → baroreceptors less stimulated → cardiov. control centre @ m. o. less stimulated

Baroreceptors / pressure receptors
@ aortic arch + carotid artery
→ send impulse to medulla oblongata
blood head

Blood pressure → baroreceptors are stimulated → card.vas. control centre @ mo. stimulated

arterial vasoconstriction
↳ adds resistance to blood flow
→ stronger contractions of cardiac muscles

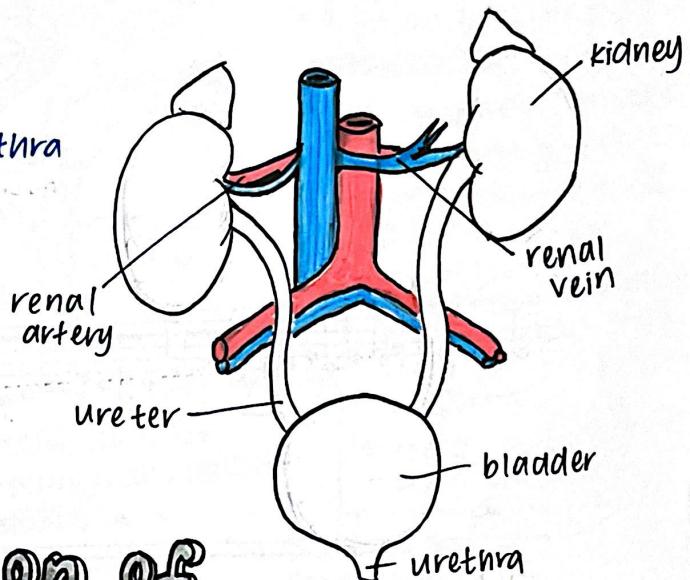
b.p. =

arterial vasodilation
↳ reduce resistance to blood flow
→ weak contractions of cardiac muscle

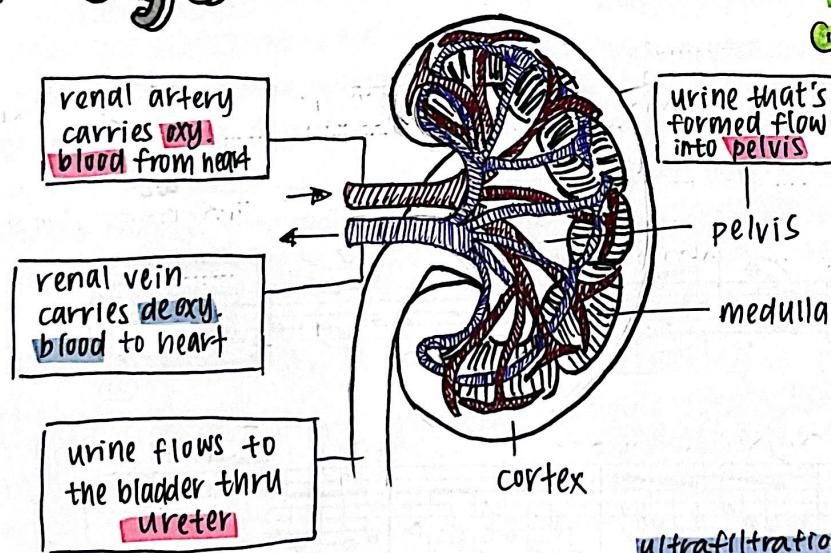
urinary system

introduction

- consists of : kidneys, ureters, bladder, urethra
- function :
- excrete nitrogenous compound wastes such as urea
- regulate → body fluids' volume → blood
→ blood osmotic pressure
→ pH
- ion concentration in body fluids
electrolyte content



Structure + function of kidneys



2 main functions

① excretion

- excrete toxic wastes (nitrogenous compounds)
- urea → ammonia
- uric acid → creatinine

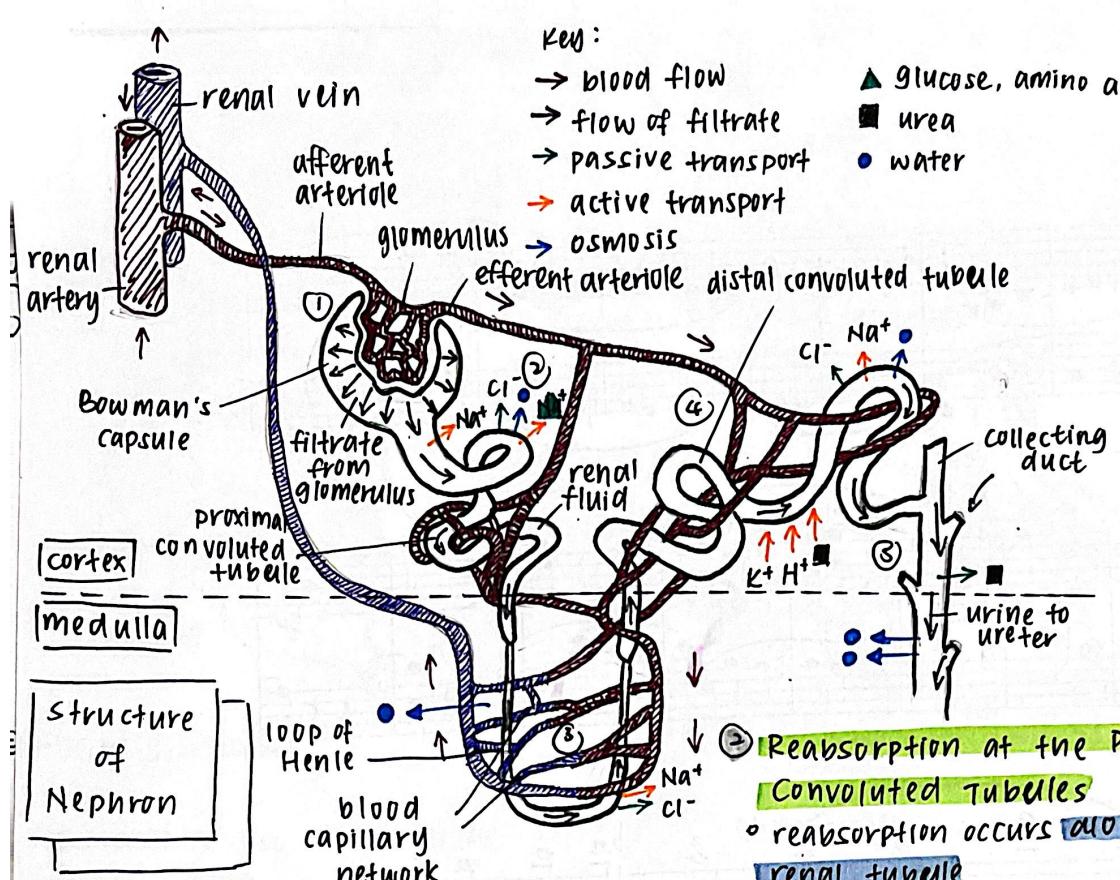
② osmoregulation

- kidney controls :
 - total vol of water in body fluids
 - concentration of ions in body fluids
 - blood osmotic pressure
 - concentration of dissolved materials + vol. of blood + body fluids
 - electrolyte content of blood + body fluids
 - pH of blood + body fluids

formation of urine

nephron → functional units in kidneys

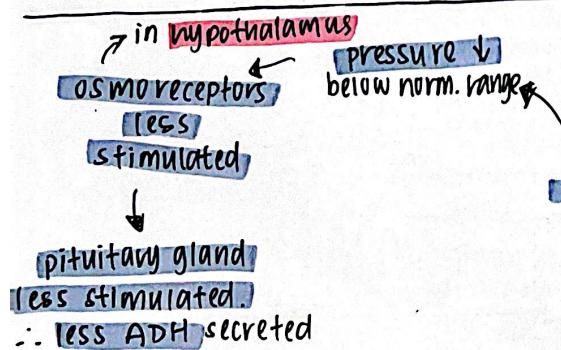
- made up of :
 - Bowman's capsule
 - glomerulus
 - functional units in kidneys
- cup-shaped
- contains a cluster of blood capillaries
- formed from the afferent arteriole branching from renal artery
- merge again to form efferent arteriole
- loop of Henle
- long V-shaped tubule that extends to the renal medulla
- proximal convoluted tubules
- distal convoluted tubules
- several nephrons joined together in collecting duct
- produced urine flow from c.d. to ureter



- ① **Ultrafiltration in Bowman's capsule**
- o blood enters glomerulus w/ ↑ hydrostatic pressure
 - o diameter of af. arteriole > ef. arteriole
 - o ↑ pressure, causes **ultrafiltration** to occur
 - o fluid seeps thru the walls of glomerulus capillaries in the cavity of B's cap.
 - o **glomerular filtrate**
 - o has the same composition as blood plasma, but x red blood cell, platelets, plasma proteins
 - o remain in the blood bc. size too large
- ② **Reabsorption at the Proximal Convoluted Tubules**
- o reabsorption occurs along renal tubule
 - o dissolved substances permeate across the renal tubular wall in blood capillary network.
 - o in PCT, sodium ions (Na^+) actively pumped in blood capillaries, Cl^- passively absorbed
 - o 100% glucose + amino acids = active transport reduces the concentration of dissolved substances in glomerular filtrate, increases in blood capillary network
 - o water → blood capillaries thru osmosis

- ③ **Reabsorption at the Loop of Henle + Distal Convoluted Tubules**
- o LOTH, water reabsorbed thru osmosis
 - o Na^+ reabsorbed thru act. trans.
 - o DCT, water, Na^+ , Cl^- more reabsorbed
 - o amount: depends on H_2O + NaCl content in the blood

- ④ **Secretion** → process of secreting waste materials from the blood that were not filtered earlier in the renal tubules
- o occur along renal tubules, most active at DCT
 - o thru simple diffusion, active transport
 - o sub: H^+ , K^+ , NH_4^+ , urea, **creatinine**, toxic sub., drugs
 - o get rid of toxic waste
 - o help regulate the level of ions in the body



walls of DCT + CD less permeable to water → less water reabsorbed from the renal fluid

less concentrated urine high vol.

concentrated, ↓ vol. urine

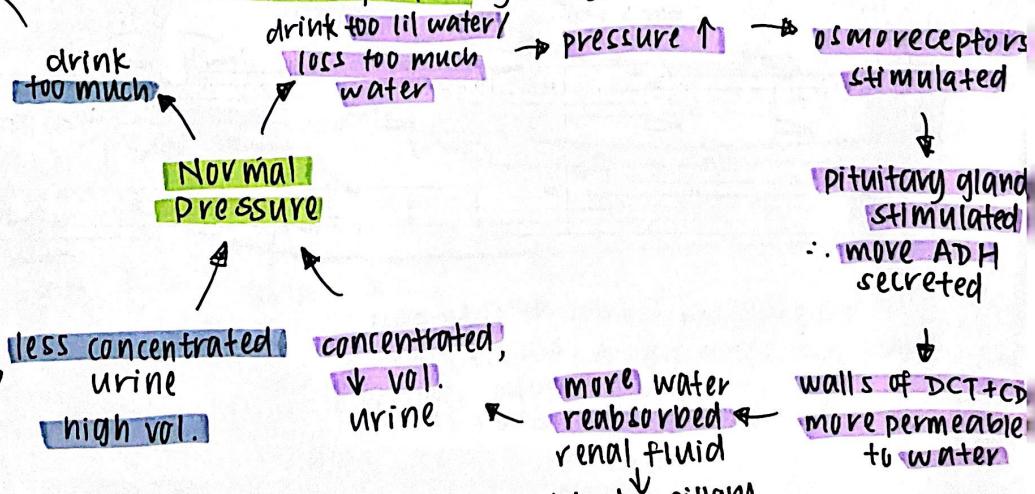
more water reabsorbed from renal fluid

walls of DCT + CD more permeable to water

- ⑤ **Urine Formation**
- o renal fluid reaches collecting duct
 - o small amount of salts
 - o water has been reabsorbed back in the bloodstream
 - o remaining is called urine
 - o urine flows down CD, small amount of urea diffuses out in surrounding fluid + blood capillaries → small size
 - o after CD → ureter → bladder → urethra → excreted

OS more regulation → process of regulating H_2O + NaCl in the body so that blood osmotic pressure can be maintained at a norm. rang

achieved by regulating the vol. of urine produced by kidneys



pituitary gland stimulated

more ADH secreted

walls of DCT + CD more permeable to water