

13.1 Homeostasis

1. Homeostasis is the regulation of the internal environment (chemical and physical) for the optimal function of the cells of an organism.

INTERNAL ENVIRONMENT

Consists of interstitial fluid and blood

PHYSICAL FACTORS

- Temperature
- Blood pressure
- Blood osmotic pressure

CHEMICAL FACTORS

- pH value
- Mineral salt concentration
- Blood sugar concentration

HOMEOSTASIS

Involves a negative feedback mechanism



STUDYwithAdmin

2. Stimulus will reverse the reaction/response by initiating a corrective mechanism to achieve a normal state of homeostasis.
3. In homeostasis, a number of organ system coordinate and conduct a particular function.
 - A) In regulation of body temperature, nervous system, endocrine system, integumentary system, circulatory system and muscular system coordinate and function to maintain body temperature within normal range.
 - B) In regulation of blood pressure and osmotic pressure, nervous system, endocrine system, circulatory system and urinary system coordinate and function to maintain blood pressure and osmotic pressure within normal range.

C) In regulation of carbon dioxide partial pressure, nervous system, respiratory system and circulatory system coordinate and function to maintain carbon dioxide partial pressure within normal range

D) In regulation of blood pH , nervous system, endocrine system, respiratory system and circulatory system coordinate and function to maintain blood pH within normal range.

E) In regulation of blood glucose, endocrine system and circulatory system coordinate and function to maintain blood glucose within normal range.



REGULATION OF BODY TEMPERATURE

1. When body temperature falls below normal range , thermoreceptors in hypothalamus detects the changes and send nerve impulse to thermoregulating center in the hypothalamus via sensory nerve. The thermoregulating center integrates and sends nerve impulse to effectors via motor nerve to produce response , then returning the body temperature to normal range. The negative feedback system is also functioning when the body temperature rises above normal range.
2. Thermoreceptors are found in skin and hypothalamus..
 - A) Thermoreceptors in skin detect the temperature change of external environment.
 - B) Thermoreceptors in hypothalamus detects temperature change of internal environment.
 - C) Regulation of body temperature physically..

IN HOT ENVIRONMENT	DALAM PERSEKITARAN YANG SEJUK
Action of sweat glands	
<ul style="list-style-type: none"> • Sweat glands become active • More sweat is produced • More heat lost through evaporation 	<ul style="list-style-type: none"> • Sweat glands become active • More sweat is produced • More heat lost through evaporation



StudyWithAdmin

Action of blood capillaries on skin

<ul style="list-style-type: none"> • The muscles in the afferent arterioles relax • Vasodilation occurs • Blood capillaries expands, the diameter increases • More blood flows through the blood vessels near the skin surface • Heat eliminated through radiation increases 	<ul style="list-style-type: none"> • The muscle in the afferent arterioles contract • Vasoconstriction occurs • Blood capillaries constrict, the diameter decreases • Less blood flows through the blood vessels near the skin surface • Heat eliminated through radiation decreases
---	---

Action of hair erector muscle

- Hair erector muscle relax
- Hair becomes slanted
- A thin layer of air trapped
- More heat are released

- Hair erector muscle contract
- Hair becomes erect
- A thick layer of air is trapped. Air is a good heat insulator
- Less heat are released

Action of skeletal muscles

- Skeletal muscle does not contract and relax repeatedly.
- Shivering does not occur
- Heat is not generated

- Skeletal muscle contracts and relaxes repeatedly
- Shivering occurs
- Heat is generated

D) Regulation of body temperature chemically..

IN HOT ENVIRONMENT

IN COLD ENVIRONMENT

Actions of adrenal glands

- Adrenal glands are less stimulated
- Less or no adrenaline hormone is secreted
- Low metabolism rate
- Less heat is generated

- Adrenal glands are stimulated by hypothalamus.
- Adrenaline hormones are secreted
- Metabolism rate increases
- More heat is generated

Actions of thyroid glands

- Thyroid glands are not stimulated
- Very less thyroxine hormone are secreted
- Low or normal metabolism rate
- Less heat is generated

- Thyroid glands are stimulated
- Thyroxine hormone are secreted
- Metabolism rate increases
- More heat is generated

REGULATION OF BLOOD SUGAR LEVEL

1. Blood sugar level (glucose) regulation is a homeostasis process which maintains the normal level of sugar in the blood.



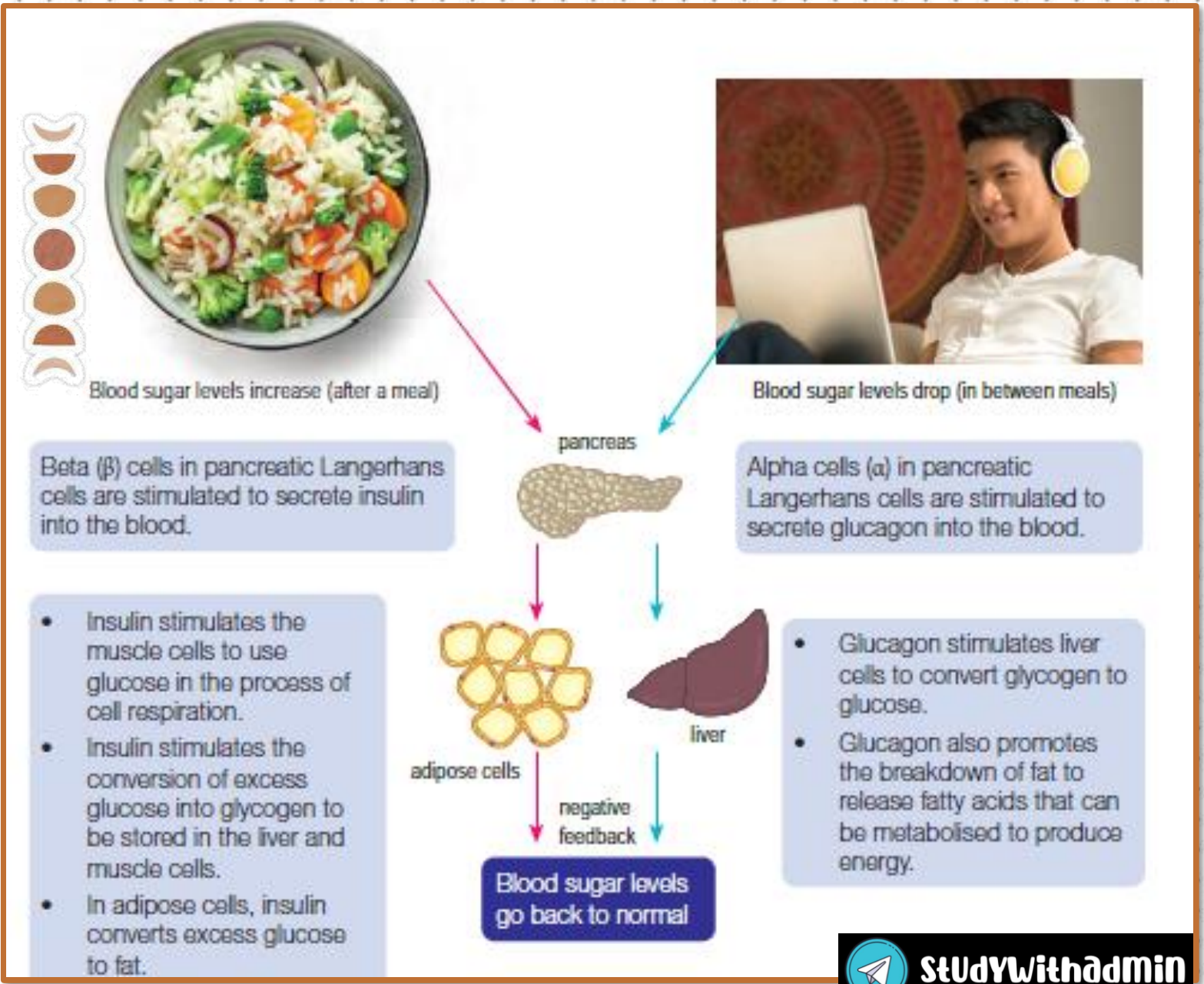
2. Two organs are involved:

A) Pancreas

- α -cells secrete glucagon
- β -cells secrete insulin

B) Liver

- Glucagon stimulates liver cell to exchange glycogen into glucose
- Insulin stimulates the of excess glucose into glycogen



MECHANISM OF REGULATION OF CARBON DIOXIDE PARTIAL PRESSURE IN BLOOD

1. Carbon dioxide produced by cells during cellular respiration.
2. In blood and tissue fluid, amount of carbon dioxide is measured as partial pressure of carbon dioxide.

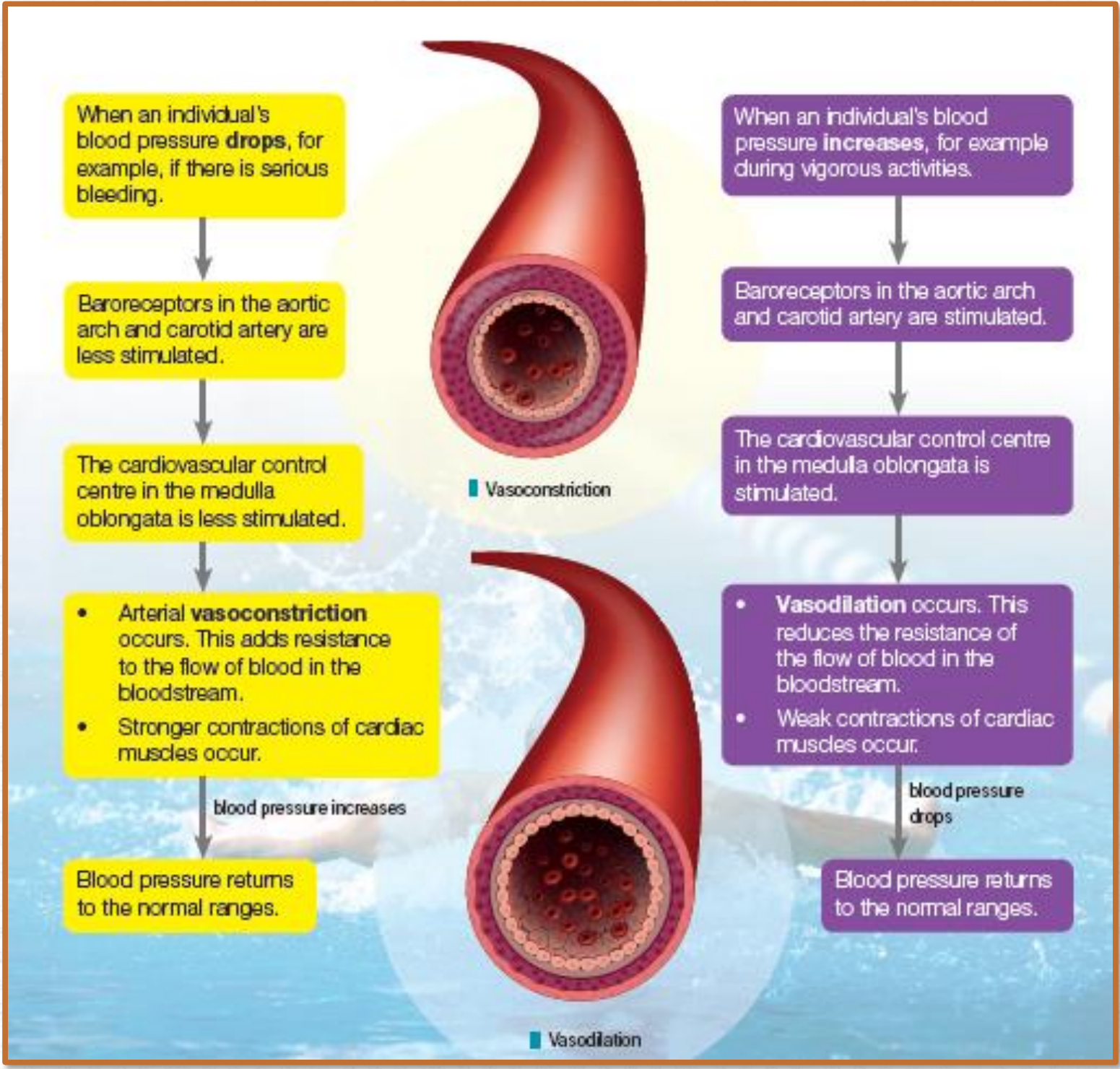
3. The change in carbon dioxide partial pressure can be detected by peripheral chemoreceptors located at aorta body and carotid bodies.
4. Central chemoreceptors located in medulla oblongata detect the pH change of cerebrospinal fluid.
5. The main effectors in regulating carbon dioxide partial pressure are intercostal muscles and diaphragm.
6. The intercostal muscles and diaphragm contract and relax repeatedly and rapidly.
7. This increases the rate of breathing to remove excess carbon dioxide from body and returning carbon dioxide partial pressure to normal level.
8. In regulation of carbon dioxide partial pressure, respiratory control center coordinates with cardiovascular control center. The rates of oxygen uptake and carbon dioxide removal in lungs increased with high rate of heartbeat.

MECHANISM OF REGULATION OF BLOOD PRESSURE



1. A normal blood pressure for an adult is 120/80 mmHg.
2. Change in blood pressure from normal level can be detected by baroreceptors found in aortic arch and carotid arteries.
3. The stimulated baroreceptors send nerve impulse to cardiovascular control center and vasomotor center in the medulla oblongata.
4. The main effectors in regulating blood pressure are sinoatrium node (SA node), smooth muscle of afferent arteriole and adrenal gland

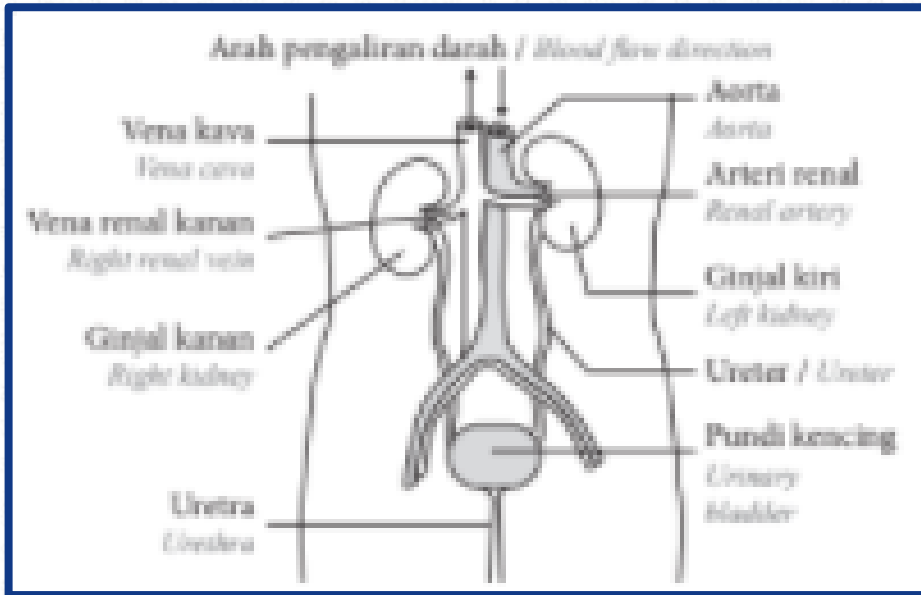




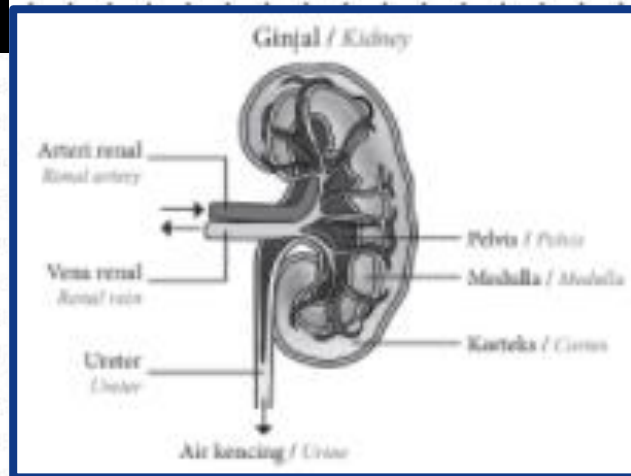
13.2 The Urinary System



1. Important organs involved in homeostasis are kidney and heart.
2. Functions of kidney:
 - (a) Control the composition of water and salts in the body (osmotic pressure).
 - (b) Controls blood pH..
 - (c) Removal of excrete waste by the formation of urine.
3. Structure of kidney



1. Kidney is bean-shaped and located in the dorsal portion of the abdominal cavity.
2. Filtration of blood
3. Osmoregulation
4. Produce urine which exits through the ureters, urinary bladder, and urethra.



4. Each kidney consists of millions of nephrons..
5. Nephron consists of::
 - (a) Bowman's capsule
 - (b) Proximal convoluted tubule
 - (c) Loop of Henle
 - (e) Glomerulus
 - (d) Distal convoluted tubule

6. Inside the Bowman's capsule, there is a tangled capillary network called glomerulus

PROCESS OF URINE FORMATION

Ultrafiltration:

- a) Afferent arteriole has a larger diameter than the efferent arteriole
- b) Thus, it results in high pressure on the blood flow in the glomerulus
- c) This causes certain blood components to filter out into the Bowman's capsule
- d) The glomerulus filtrate inside the Bowman's capsule is the same as the blood plasma, except it does not contain:
 - (i) Plasma protein
 - (ii) Red blood cells
 - (iii) Platelets

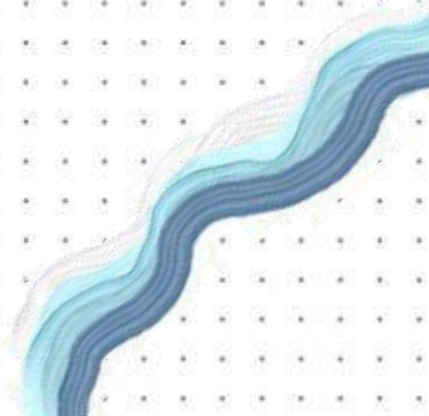


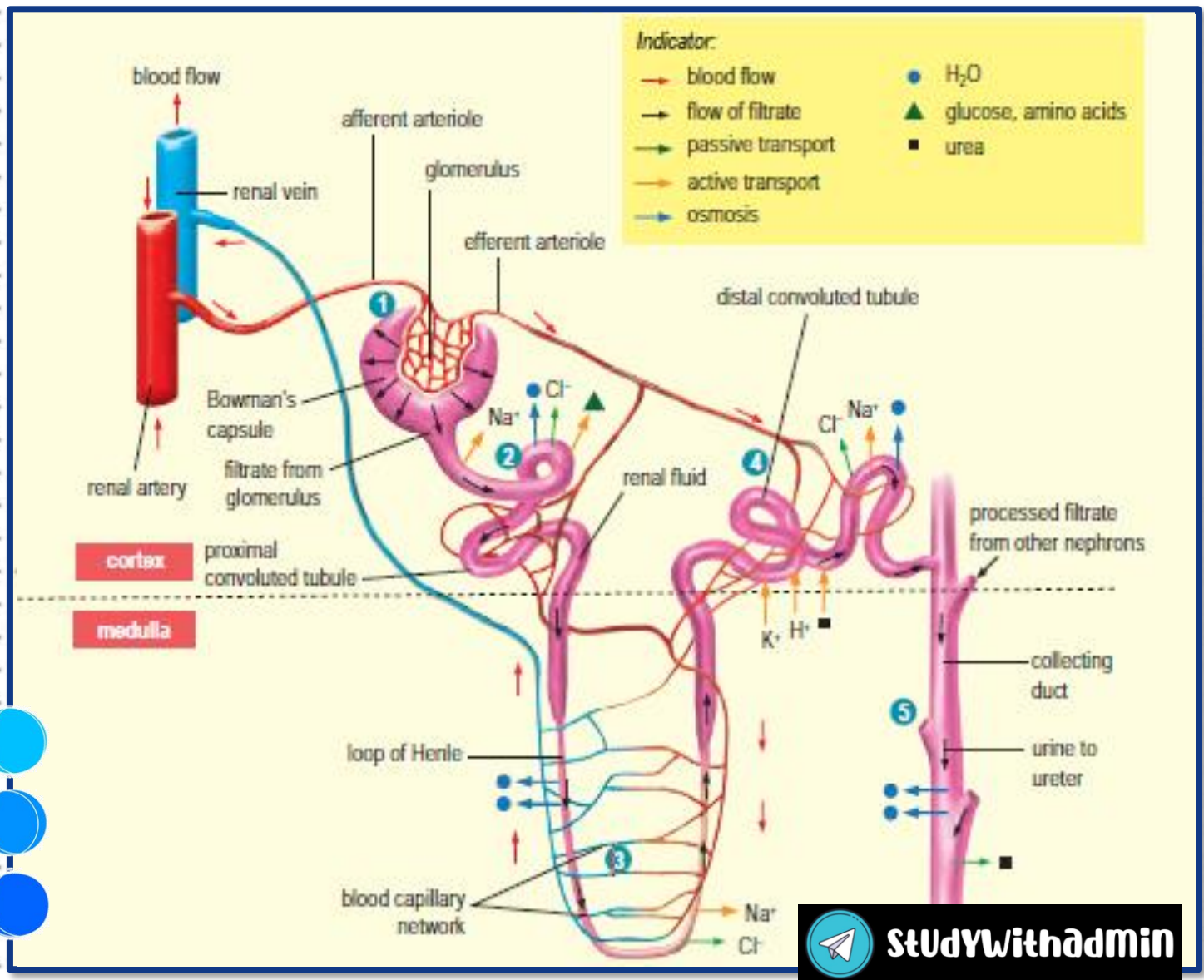
Reabsorption:

- a) Components in the glomerulus filtrate are water, urea, glucose, amino acids and salt (sodium ions).
- b) Reabsorption occurs when the substances re-enter the blood capillaries along the renal tubule.

Secretion:

- a) Secretion occurs when waste substances (hydrogen ions, potassium ions, ammonium ions, urea, creatinine, toxic substances and some drugs) are secreted out from the blood capillaries and into the renal tubule (distal convoluted tubule).





MECHANISM OF HOMEOSTASIS AND OSMOREGULATION

Osmoregulation

A process which regulates salt and water balance in the body in order to maintain a normal blood osmotic pressure..

- a) When water content is more, salt content is less
 - Low blood osmotic pressure
- b) When salt content is more, water content is less
 - High blood osmotic pressure

Osmoregulation Mechanism

Two hormones involved through a negative feedback mechanism :

- a) Antidiuretic hormone (ADH)
 - regulates water reabsorption..
- b) Aldosterone
 - regulates salt reabsorption..



13.3 Health Issues Related To the Urinary System

1. Health issues related to urinary system are such as kidney stone, urinary tract infections, prostatitis, kidney failure and bladder cancer.
2. Kidney stone is formed from minerals and precipitation of salt in kidney.
 - (a) Example of kidney stone such as calcium oxalate is formed when concentration of calcium ion in urine was high and causes mineral crystallisation in kidney.
 - (b) It causes pain in the side and dorsal parts of body, pain during urination, bad smell of urine and urine with blood

