

LESSON NOTE FOR WEEK TWO (2)

SUBJECT: Biology

SUBJECT TEACHER: Mr. Princewill Wilson

TOPIC: Regulation of the Internal Environment, Structure and Function of the Kidney, Diseases, Effects and Remedy

OBJECTIVES

In today's class, we will be talking about regulation of the internal environment, structures and function of the kidney, diseases, effects and remedy. Enjoy the class!

CONTENT

- ✓ Homeostasis, mechanism and structures of homeostasis
- ✓ Structures of the Kidney
- ✓ Functions of the Kidney
- ✓ Kidney diseases, effects and remedy

Homeostasis

Homeostasis is the process by which a fairly constant internal environment is maintained in an organism. The internal environment of an organism is made up of the body fluid such as blood, lymph and tissue fluid. For efficient functions of body cells and healthy growth, a living organism must be able to adjust to any change in the physical and chemical conditions of its body fluids. These conditions include temperature, PH, osmotic pressure, concentrations of dissolved substances and mineral ions.

Mechanism of homeostasis

Homeostatic processes are control mechanisms which are used to detect and adjust to changes in the internal environment of the organism. These mechanisms usually include:

1. Sensory detectors which recognize a change in a given condition and stimulate the relevant body parts.
2. Effectors organs or glands which react and restore the normal state.

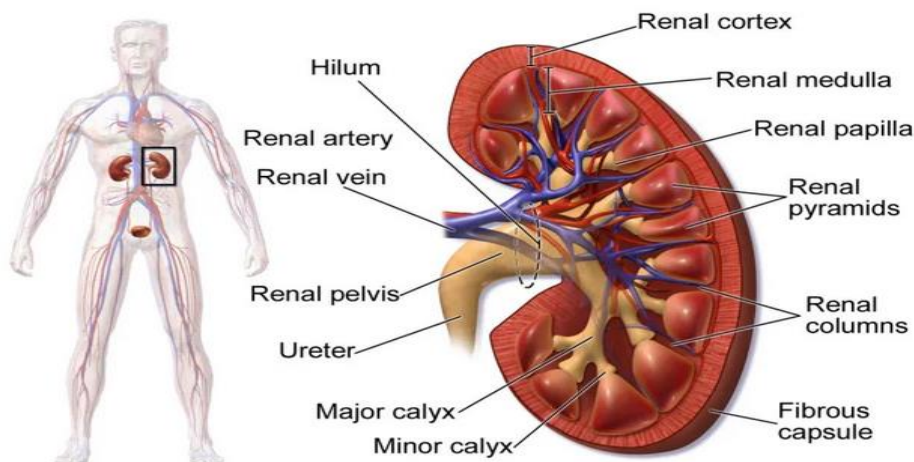
Structures of homeostasis

Osmoregulation (homeostasis) in unicellular organisms is ensured by the use of contractile vacuole. The main organs involved in homeostasis in multicellular organisms include; kidney, liver, skin, ductless glands (hormones) and the brain which has the overall control of the homeostatic process in the body.

Structure of the kidney

The mammalian kidney is a bean-shaped, reddish-brown organ located in the posterior end of the abdomen. The right kidney is slightly lower in the body than the left. Cutting a kidney longitudinally, two distinct regions are observed; an **outer cortex** and an **inner medulla**. Several narrow tubules called urinary tubules (nephrons) pass through the two regions stated above. The tubules open at the tips of triangular-shaped masses of tissues called pyramids. The pyramids open into a funnel-shaped cavity called the **pelvis**. The kidney has many tiny capillaries which are branches of the renal artery and the renal vein. The pelvis continues as the ureter, a long narrow tube connecting the kidney to the urinary bladder.

kidney anatomy regulation of internal environment biology



Kidney Anatomy

Functions of the kidney

The kidney serves as the chief osmoregulator and excretory organ in the body of mammals, performing the following functions:

1. It removes toxic wastes and harmful substances.
2. It produces heat during cold.
3. It excretes nitrogenous wastes like urea.
4. It regulates the water level in the body
5. It assists to regulate the pH of the body.
- _. It maintains salt or ion-balance in the body.

The first three are excretory functions while the last three are osmoregulatory functions of the kidney

Kidney as an osmeoregulator

The kidney is an osmoregulator by maintaining the water, salt and pH balance of the blood and this occurs in the distal tubules and collecting ducts of urinary tubules.

Water balance:

When the body is dehydrated (little water in the body) which results from drinking a small quantity of water or losing water through sweat on a hot day, the osmotic pressure of the blood increased. The osmoreceptors in the hypothalamus detect the changes and stimulate the pituitary gland to secrete more antidiuretic hormone (ADH) which makes the walls of the urinary tubules more permeable so that more water is reabsorbed into the blood; therefore less water is lost from the body as concentrated urine.

When the body is hydrated (too much water in the body) which results from drinking a large quantity of water or on cold days when we sweat less, the osmotic pressure of the blood is lowered and less ADH is secreted and the wall of the kidney becomes less permeable and more water is lost from the body as dilute urine.

Control of blood sodium ions and pH levels:

When the concentration of sodium ion in the blood is higher than normal, the excess is excreted. If it is lower, then more sodium ions are reabsorbed. This process is regulated by inhibiting or stimulating the secretion of the hormone aldosterone.

The normal pH of the blood is 7.4. When the pH becomes acidic, the hydrogen ions are excreted and when it becomes alkaline, the hydrogen carbonate ions are excreted.

Kidney (renal) diseases, effects and remedy

Renal diseases

- 1. Nephritis:** This is the inflammation of the blood vessels (glomeruli) in Bowman's capsule of nephron caused by bacteria (streptococci). The blood vessels become porous and useful materials from the blood are leaked into the glomerular filtrate. Inflamed blood vessels can also be blocked as a result of the accumulation of dead cells which can lead to kidney failure.
- 2. Diuresis:** This is a condition in which large quantities of dilute urine are produced because the cells of the kidney tubules are not reabsorbing water from the glomerular filtrate. Diuresis is common in patients suffering from diabetes insipidus.
- 3. Kidney stones:** These are stony masses of minerals and organic matter formed in the urinary tubules. Low water intake with high salt intake predisposes someone to this disease by causing crystallization of mineral salts which disturb the free flow of urine.
- 4. Dropsy (oedema):** This is a disease condition in which the cells of Bowman's capsule are unable to absorb water from the blood in the urinary tubules. This causes water retention in the blood or tissue and resulting swelling of some body parts

Effects of kidney diseases

1. Presence of proteins and blood cells in the urine (nephritis).
2. Swollen face and ankles resulting in constant weakness and sluggishness (oedema).
3. Excessive urination with resulting weight loss (diuresis).
4. Abdominal pain due to obstruction to the passage of urine. Also, high blood pressure and bloody urine may result (kidney stone).
5. General body pains and fever (any of the renal disease)
- _ . High blood pressure, dizziness and fatigue

Remedy

1. Use of drugs e.g. antibiotics (nephritis), diuretics (oedema)
2. Kidney transplant (diuresis, nephritis)
3. Dialysis: use of dialysis machine (artificial kidney) to filter waste out of the patient's blood (nephritis).
4. Reduction in water intake (oedema)
5. Taking excess water, and avoiding excessive intake of food containing calcium (kidney stone)
- _ . A surgical operation called nephrectomy (kidney stones)

ASSIGNMENT

1. 1. What is homeostasis? List four factors of homeostasis.
2. 2. List four structures of homeostasis in multicellular animals
3. Outline five functions of the mammalian kidney
4. Describe how a kidney act as an osmoregulator
5. List four kidney diseases and explain two
6. List four effects of kidney diseases and four remedies of kidney diseases
7. The kidney is both excretory and osmoregulatory in its function.” Explain