IPA3

MODULE

TOPIC 1. Excretion System

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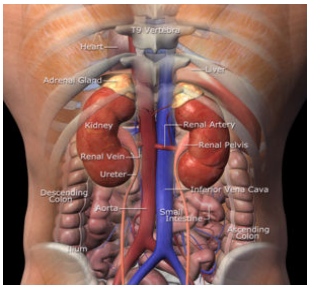


Excretion System

Learning objectives:

After this lesson, students are expected:

1. Identify and explain functions organs of human excretion system.
2. Explain the urine formation.
3. Explain disorder and disfunction excretion system

Overview

What we're dealing with here are the organs in the body that have a role in removing *metabolic wastes*. . Metabolic wastes are by-products of metabolism. **metabolism** is the sum total of the chemical reactions that keep an organism alive.

Examples of these "chemical reactions" would be things like synthesis, respiration, hydrolysis, & neutralization reactions. Each of them have a role in keeping a living thing ticking; and in so doing, each produces certain waste products. These waste products are referred to as metabolic wastes.

Excretion in Human

The nitrogenous waste materials produced in the animal body due to metabolic reactions are of no use to the cell. These waste materials if allowed to accumulate in the body, may become toxic. Therefore, they must be removed from the body. The process of elimination of metabolic waster products from the animal body to regulate the composition of the body fluids and tissues is called excretion.

*The **excretory system** is a biological system that removes excess, unnecessary or dangerous materials from an organism.*

Excretory Function

The Excretory System removes waste or garbage and maintains the internal stability of the cell. Excretion may occur by diffusion through the cell membrane or by means of specialized structures and system.

Excretion Organs

Kidneys

The kidneys are kidney bean-shaped organs located on either side of the vertebral column or spine near the small of the back (the beans were so named because they resembled small kidneys). The left kidney usually sits slightly higher than the right one. The size of an adult kidney is approximately 4 inches (10 centimeters) long, 2.5 inches (6 centimeters) wide, and 1 inch (2.5 centimeters) thick.

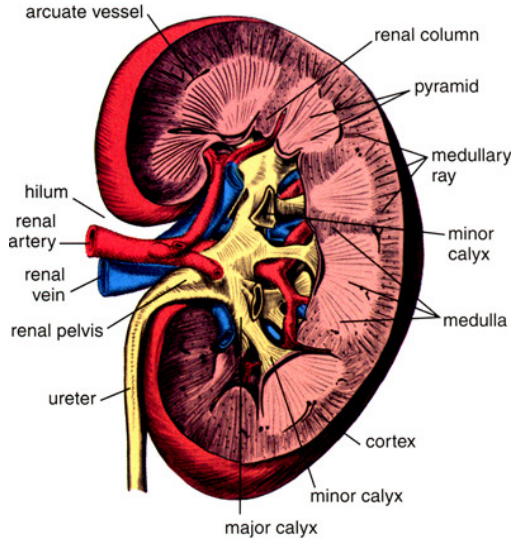


Figure Structure Anatomy of Kidney

Structure of Kidneys

The kidneys are kidney bean-shaped organs located on either side of the vertebral column or spine near the small of the back (the beans were so named because they resembled small kidneys). The left kidney usually sits slightly higher than the right one. The size of an adult kidney is approximately 4 inches (10 centimeters) long, 2.5 inches (6 centimeters) wide, and 1 inch (2.5 centimeters) thick.

The kidney itself is divided into three regions. The outermost region is called the **renal cortex**, which has a somewhat granular appearance. To the inside of the cortex is the **renal medulla**. The medulla is divided into the cone-shaped **renal pyramids**, each of which terminates as a renal papilla. Extending down between the pyramids are the **renal columns**. The central cream-colored region of the kidney is the **renal pelvis**. The outer portions of the pelvis divide into short tubes, the

calyces (singular - calyx). The papillae extend into the calyces, and at this site the calyces receive urine from the papillae.

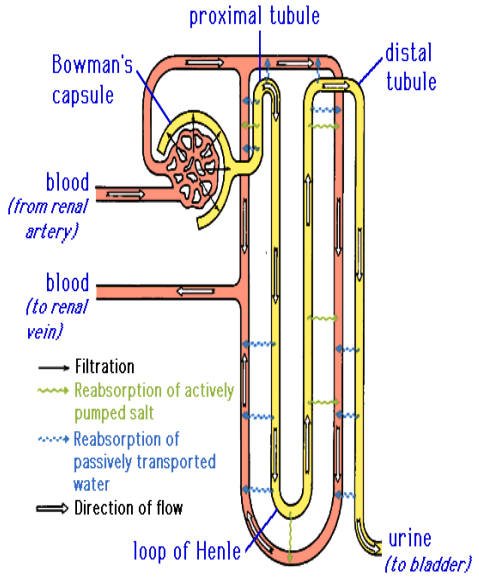


Figure Mechanism Urine Formed

The functional unit of the kidney is the **nephron**. There are approximately one million nephrons in each kidney. Most nephrons are contained within the cortex, however, about 20% of them lie partially in both the cortex and medulla. At one end of the nephron is a bulbous structure, the **renal corpuscle**, which is composed of 2 parts, an outer **glomerular (or Bowman's) capsule**, and an inner tuft of capillaries, the **glomerulus**. An **afferent arteriole** leads into the glomerulus and the **efferent arteriole** leads out of the glomerulus. The efferent arteriole then branches into many fine **peritubular capillaries**. The glomerular capsule leads into the **proximal convoluted tubule**, followed by **Henle's loop**, which is divided, into a **descending loop** and an **ascending loop**. Henle's loop leads into the **distal convoluted tubule** and finally into the **collecting duct**, which eventually ends at the renal papilla.

The function of kidneys are:

- To filtrate blood and forming urine
- Waste dangerous substances from human body (urea, uric acid)
- Waste over substance in human body. (example: over amount of glucose)
- Maintain osmosis pressure on extracellular liquid
- Maintain the balance of acid and base

Mechanism Urine Formed

Blood enters the glomerulus through the afferent arteriole. High pressure within the glomerulus causes a considerable amount of blood fluid to be forced into the glomerular capsule. Only blood cells and large protein molecules cannot pass from the glomerulus into the glomerular capsule. The fluid within the glomerulus contains glucose, amino acids,

urea, salts, and a large amount of water. While we want to eliminate urea from the body, we cannot afford to lose large quantities of the other substances. The challenge for the nephron is to eliminate the urea while reclaiming the other substances. As the filtrate passes into the proximal convoluted tubule, essentially all the glucose and most of the water, salts, and amino acids are reabsorbed. However, we are still losing too much water and sodium. The descending loop of Henle is very permeable to water but not very permeable to sodium. Consequently water moves out of the tubule, but sodium remains in the tubule. The fluid in the tubule becomes more concentrated as it reaches the bottom of the loop. The ascending loop is relatively impermeable to water, but sodium is actively pumped out of the tubule.

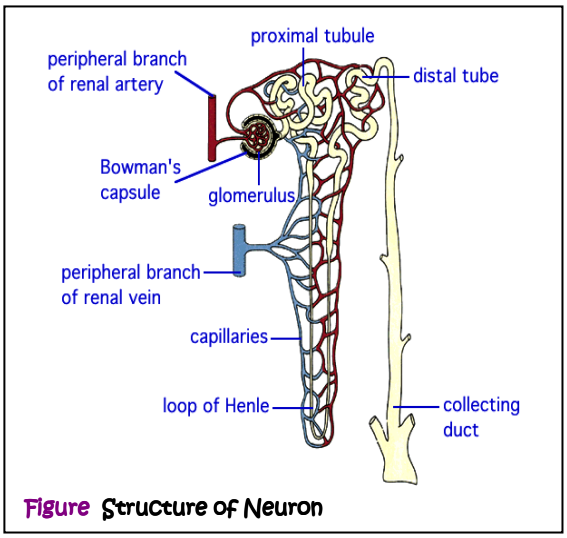


Figure Structure of Neuron

As the fluid moves up the ascending loop, it becomes less concentrated, and by the time it reaches the distal convoluted tubule, the composition of the fluid is little different from the fluid that entered the descending loop. However, considerable amounts of water and sodium have been reclaimed as the fluid passes through Henle's loop.

After Henle's loop, the fluid enters the distal convoluted tubule. Water reabsorption here is facilitated by **antidiuretic hormone (ADH),** which is released by the pituitary gland. The more ADH released from the pituitary, the greater the water reabsorption in the distal tubule, and the more concentrated the urine. The amount of ADH released is dependent on the hydration state of the individual.

If you have been eating large amounts of watermelon, little ADH would be released, less water would be reabsorbed in the distal tubule, and a dilute urine would be produced. If you are dehydrated due to bouncing your buns off in aerobics class, more ADH would be released, more water would be reabsorbed in the distal tubule, and a more concentrated urine would be produced. Following the distal convoluted tubule, the fluid enters the collecting duct, and eventually leaves the nephron at the renal papillae.

Excretory systems are diverse, but nearly all produce fluid waste urine in process involving several steps:

- **Filtration**: Body fluid (blood, coelomic fluid, or hemolymph) is collected involving filtration through selectively permeable membranes. Hydrostatic pressure (blood pressure) forces water and small solutes into excretory system. Fluid = filtrate.
- **Selective Reabsorption**: excretory systems use active transport to reabsorb valuable solutes from the filtrate and returns them to body fluids.
- **Secretion**: Other substances like toxins or excess ions are extracted from body fluids and added to filtrate using active transport
- **Excretion**: filtrate leaves system and body as urine

Kidneys Disorder

- Cystitis : Inflammation of the urinary bladder caused by a bacterial infection
- Glomerulonephritis : Inflammation of the glomeruli in the renal corpuscles of the kidneys.
- Kidney cancer develops when cells in certain tissues in the kidneys become abnormal and grow uncontrollably, forming tumors.
- Kidney stones: Large accumulations of calcium salt crystals from urine that may form in the kidneys.
- Pyelonephritis : Inflammation of the kidneys caused by a bacterial infection.
- Urethritis : Inflammation of the urethra caused by a bacterial infection.
- Urinary incontinence: Involuntary and unintentional passage or urine.
- Albuminuria : showed by albumin or protein molecules in urine
- Glukosaria : showed by glucose molecules in urine
- Hematuria showed by erythrocytes in urine.

Lungs

The human lungs are the organs of respiration and excretion humans. Humans have two lungs, with the left being divided into two lobes and the right into three lobes.

Oxygen (O_2) from air breathed in goes into the red blood cell via alveoli. Carbon dioxide (CO_2) goes from the red blood cell into alveoli and breathed out. As respiration occurs **carbon dioxide** is produced as a waste product. As the carbon dioxide accumulates in body cells, it eventually diffuses out of the cells & into the bloodstream, which eventually circulates to the lungs. And here, in the alveoli of the lungs, carbon dioxide diffuses from the blood, into the lung tissue, and then leaves the body every time we exhale. We should note that some **water vapor** also exits the body during exhalation. Functions of Lungs are: (1) supply oxygen to the cells and tissues of the body; (2) dispose of the carbon dioxide.

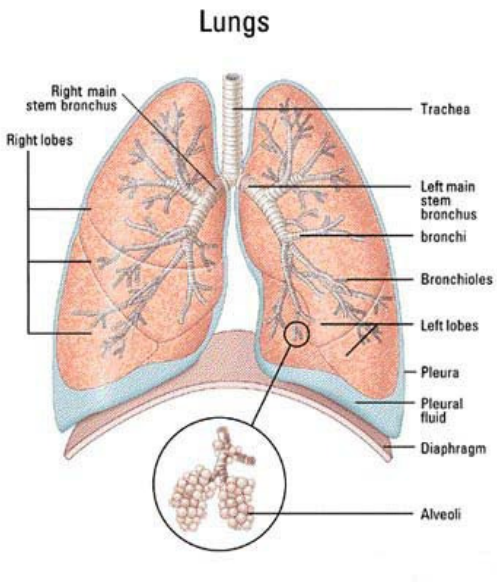


Figure Structure of Lungs

Disfunctions of Lungs are:

- TBC

  Tuberculosis (TB) is an infectious disease caused by bacteria whose scientific name is *Mycobacterium tuberculosis*.
- Pneumonia

  Pneumonia is an inflammation of the lung, usually caused by an infection. Three common causes are bacteria, viruses and fungi.
- Lungs cancer caused by smoke, gases, cigarette.
- Emphysema the lungs Frozen because contain of air

Skin

The skin acts as an organ of excretion by removing water and small amounts of urea and salts (as sweat). Function of Skin are: (1) produce sweat; (2) protect our

body; (3)save fat surplus; (4) control body temperature; (5) place where vitamin D is made; (6) sense of touch.

Structure of Skin

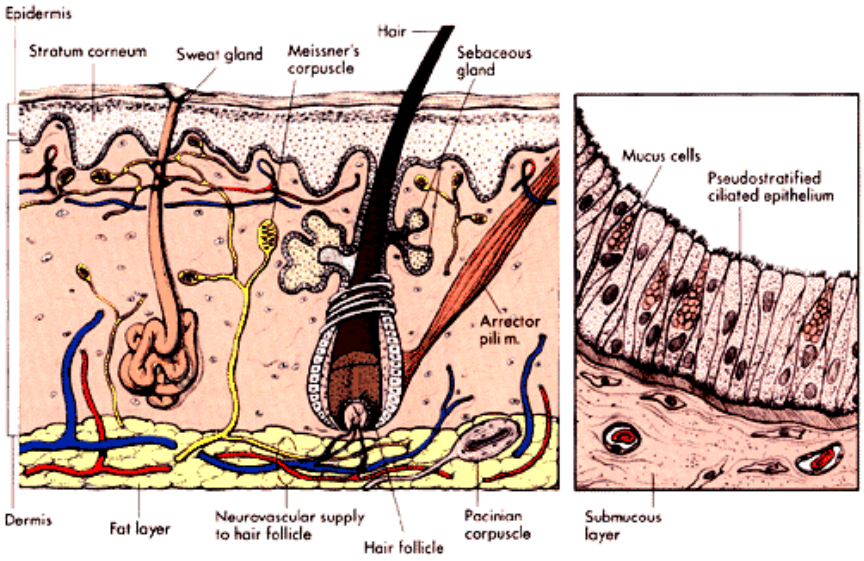


Figure Structure Anatomy of Skin

The skin has a slightly acidic coating of oil at the surface. This coating protects the skin against some bacteria. Below the surface is a complex of sweat and oil glands, hair follicles, blood vessels, nerves, and muscle tissue. These are held together by a tough connective tissue called collagen. Below the collagen is a layer of fat and muscle, which provides some contour and acts as a cushion and as insulation.

The skin has three layers. The inner most layer is known as the lower dermis, the middle layer is called the dermis, and the outer layer is known as the epidermis.

(1) Lower Dermis

The various glands such as the oil and sweat glands originate in the lower dermis. From here, they rise to the surface of the skin to eliminate waste matter. Lower dermis also acts as a cushion for the rest of the skin. It contains the finely distributed muscles of the skin which regulate body temperature.

(2) Dermis

The dermis is the layer that lies underneath the epidermis, and it is composed entirely of living cells. It consists of bundles of tough fibers which give your skin its

elasticity, firmness and strength. There are also blood vessels, which feed vital nutrients to these areas.

The most important function of dermis is respiration. The countless tiny blood vessels, or capillaries end here in finely-drawn networks, from where they feed the outer skin layer. Dermis also determines the tone of the skin.

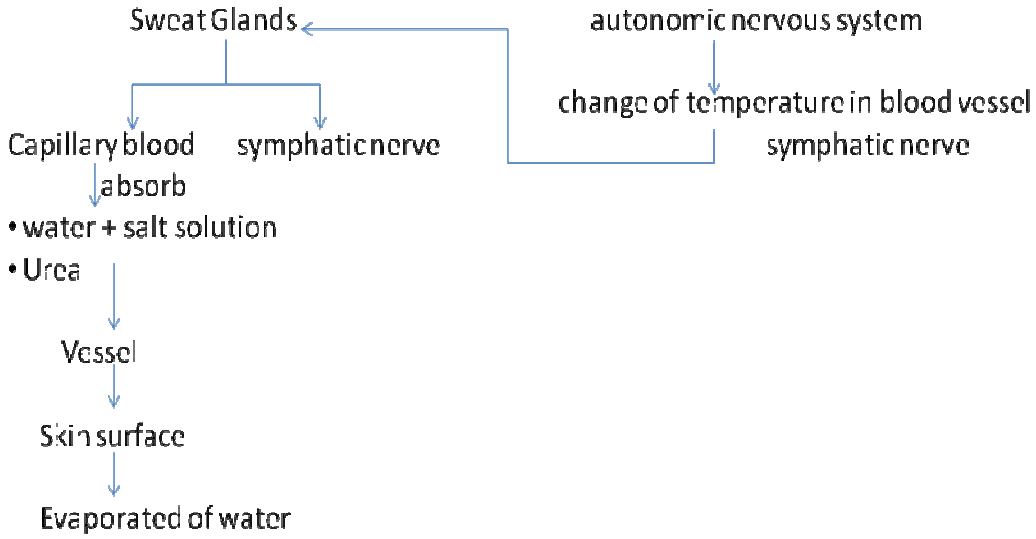
(3) Epidermis

This is the top layer of skin and the one you can actually see. It protects your body from invasion and infection and helps to seal in moisture. It's built up of several layers of living cells which are then topped by sheets of dead cells. It's constantly growing, with new cells being produced at its base. They quickly die, and are pushed up to the surface by the arrival of new ones, These dead cells eventually flake away, which means that every new layer of skin is another chance to have a soft, glowing complexion.

The lower levels of living cells are fed by the blood supply from underneath,whereas the upper dead cells only need water to ensure they're kept plump and smooth. The epidermis is responsible for your coloring, as it holds the skin's pigment. It ranges in thickness from l/20-th of an inch on the palms and soles, to 1/200-th of an inch on the face.

The skin contains the following specialized organs: (1) **Sebaceous glands** are tiny organs which usually open into hair follicles on the surface of your skin. They produce an oily secretion, called sebum, which is your skin's natural lubricant; (2) The sebaceous glands are most concentrated on the scalp and face - particularly around the nose, cheeks, chin and forehead, which is why these are usually the most oily areas of your skin; (3) **Sweat glands** are all over your body. There are millions of them and their main function is to regulate your body temperature. When sweat evaporates on the skin's surface, the temperature of your skin drops; (4) **Hairs** grow from the hair follicles. They can help keep your body warm by trapping air underneath them. There are no hairs on the soles of your feet and palms of your hands.

How does sweat produce?



Liver

The liver is a reddish brown organ with four lobes of unequal size and shape. It is the largest gland in the body . It is located in the right upper quadrant of the abdominal cavity, resting just below the diaphragm.

Functions of Liver

Liver regulates glycogen storage, plasma protein synthesis, and drug detoxification. The liver secretes bile, a base used for breaking down fats. It helps get rid of unneeded wastes in the body. It changes toxic ammonia, which is a poisonous gas , to urea, a harmless fluid. Bile pigments (biliverdin and bilirubin) are produced as a result of break down of haemoglobin in the worn out red blood cells in the liver and excreted with the bile into the duodenum and removed along with the faeces. Liver also excretes cholesterol, various inactivated products of steroid hormones and harmful products like alcohol, nicotine and several drugs.

The liver is also responsible for converting ammonia produced by deamination into less toxic urea by combining it with carbon dioxide.

Assignment

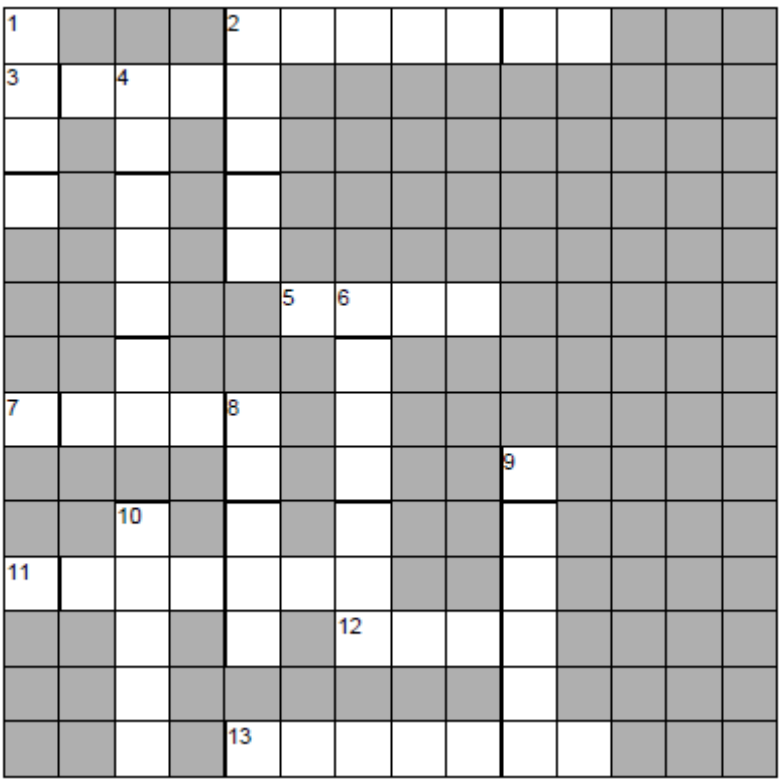
Cross of Excression

Across

2. Storage organ for urine is the urinary ____.[7]
3. Relating to the kidneys.[5]
5. Largest organ of the body.[4]
7. Organs that excrete carbon dioxide.[5]
11. System that makes urine.[7]
12. Sweat and urine contain excess water, excess ____, urea and uric acid.[4]
13. Tube between urinary bladder and outside of body.[7]

Down

1. Urea and ____ acid are nitrogenous wastes.[4]
2. Excretion is the removal of wastes that have travelled in the ____ at some time.[5]
4. Small filtering unit of the kidney.[7]
6. Organs that filter blood.[7]
8. Liquid excreted by skin.[5]
9. Tube between kidney and urinary bladder.[6]
10. Organ that detoxifies the body of poisons such as alcohol.[5]



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