13 Excretion

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BIOLOGY

13.1 Excretion

Describe excretion as the removal of toxic materials and the waste products of metabolism from organisms.

State that carbon dioxide is a waste product of respiration, which is excreted through the lungs.

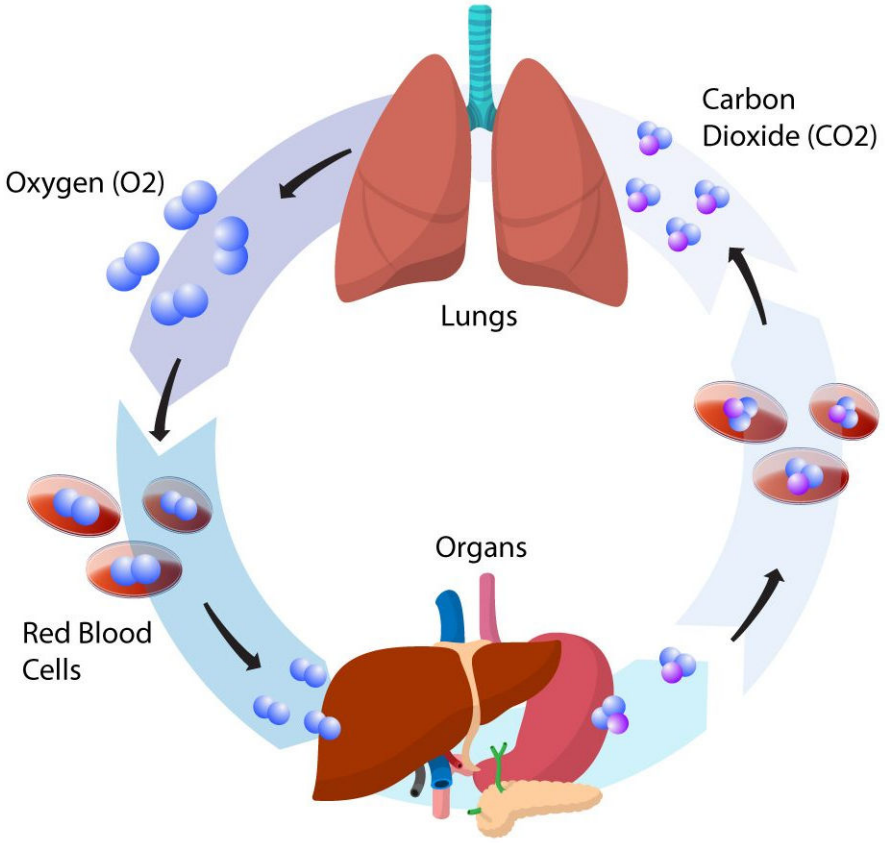
Excretion

Excretion is the removal of toxic materials and the waste products of metabolism from organisms.
Excretory materials include

- The waste products of metabolic chemical reactions
- The excess water and ions taken in with the diet.
- Hormones not able to be used again.
- Carbon dioxide produced as a result of respiration.

Excretion also includes the removal of drugs or other foreign substances taken into the alimentary canal and absorbed by the blood.

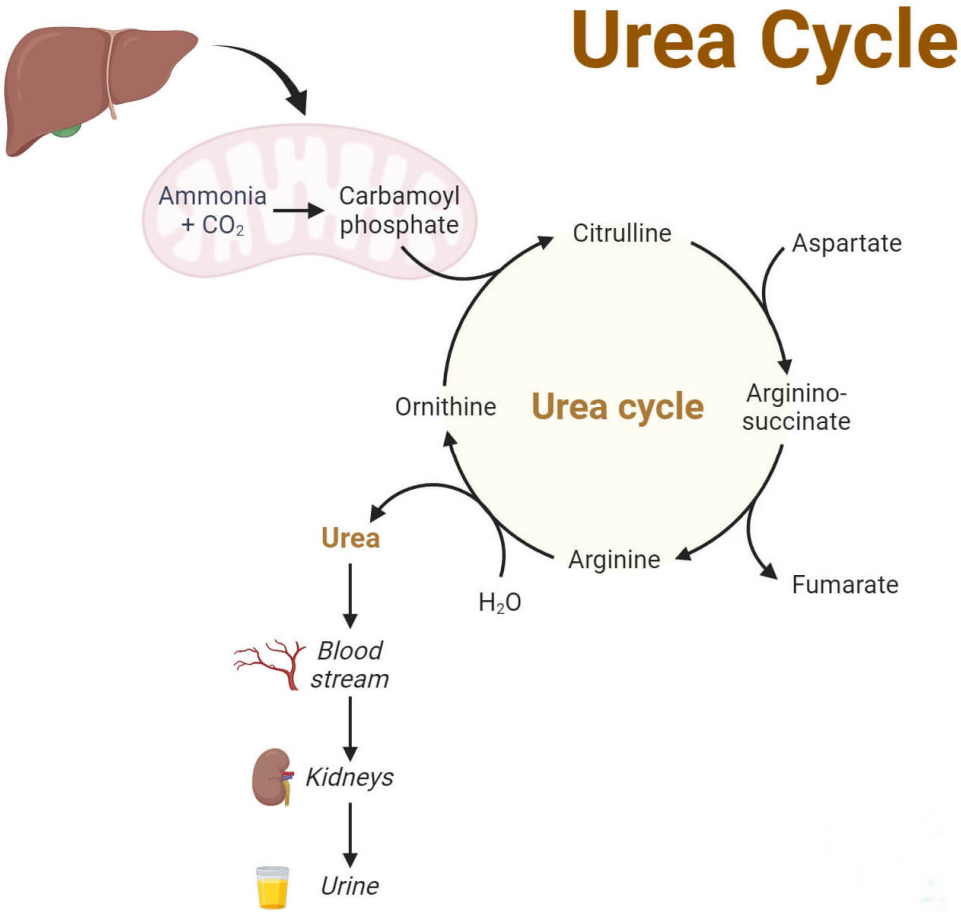
During cellular respiration, cells utilize oxygen to produce energy, releasing carbon dioxide as a metabolic waste product. This carbon dioxide is transported via the bloodstream to the lungs, where it is exhaled out of the body during breathing.



State that urea is a toxic waste product produced in the liver from the breakdown of excess amino acids .

Describe deamination in the liver as the removal of the nitrogen-containing part of amino acids, resulting in the formation of urea.

Urea is a compound formed as a result of the breakdown of excess amino acids in the liver. Excess amino acids are the deaminated in the liver to form glycogen and urea. This conversion occurs in the liver, where amino acids lose their amino groups, forming ammonia. Ammonia is toxic to the body, so it is quickly converted into urea, a much less toxic compound. The urea is removed from the tissues by blood and expelled through the kidneys. Urea and some other similar products from the breakdown of proteins or amino acids contain nitrogen and for this reason they are often termed as nitrogenous waste products.



13.2 Urinary system

Identify, on diagrams, the kidneys, ureters, bladder and urethra and state the function of each (the function of the kidney should be described simply as removing urea and excess salts and water from the blood as urine)

Functions of all the urinary system associated organs are as follows.

Kidneys

There are two oval shaped kidneys located in the upper abdominal cavity on either side of the spine, behind the peritoneum and below the lower ribs. Kidneys filter the blood and remove excess water, salts and urea. Kidneys also regulate the acid base balance by excreting hydrogen ions in the urine.

Ureters

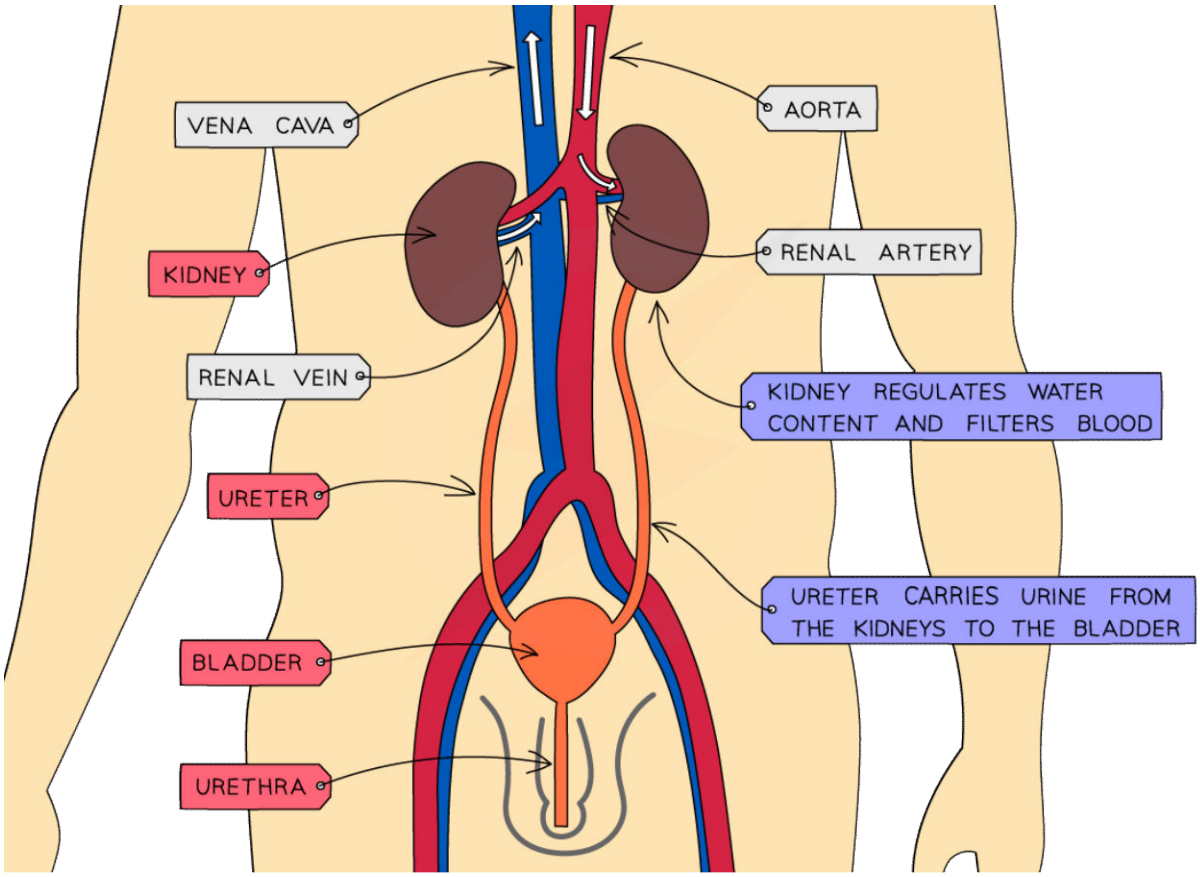
There is a tube that connects kidneys to the urinary bladder, it is called as a ureter. There are two ureters in a human body. These transport urine from kidneys to the bladder.

Urinary Bladder

It stores urine and control the process of excretion.

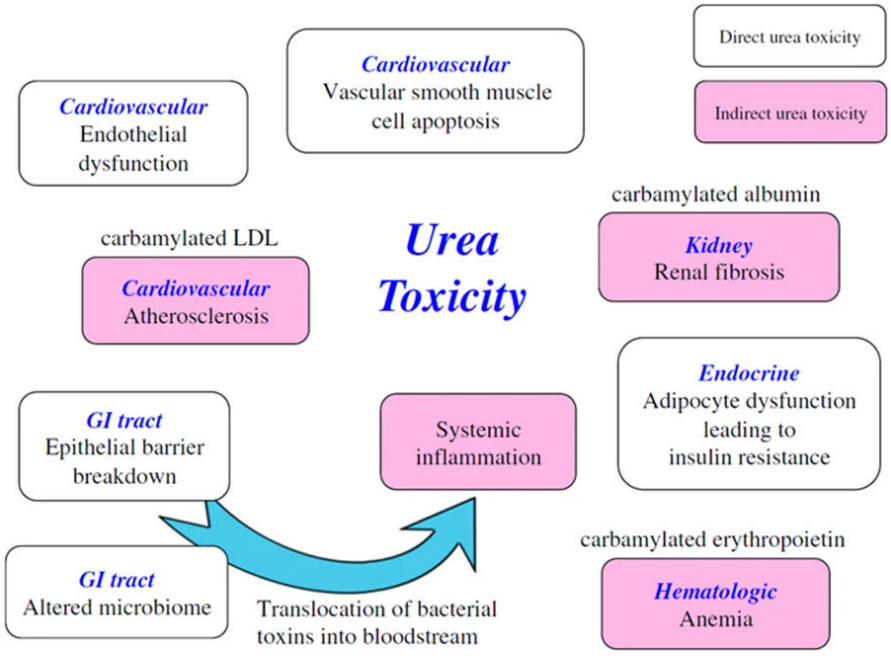
Urethra

Urethra is a tube-like structure that carries urine from the urinary bladder to the outside of the body during urination. It serves as a transport organ for the excretion of urine out of the body.



Explain the need for excretion, limited to toxicity of urea.

Some of the compounds made in reactions in the body can be toxic (poisonous) if their concentrations build up. For example, ammonia is made in the liver when excess amino acids are broken down. However, ammonia is very alkaline and toxic. It is converted to urea. Urea is much less poisonous (still being poisonous) than ammonia, so it is a safe way of excreting excess nitrogen. Excretion regarding the toxicity of urea, is still essential for maintaining the body's internal environment and overall health. When excess amino acids are broken down in the liver, urea is formed as a waste product. If urea is not efficiently excreted from the body, it can accumulate in the bloodstream, leading to a condition called uremia.
Uremia occurs when urea levels become abnormally high, resulting in various adverse effects on the body.



Outline the structure of a nephron and its associated blood vessels, limited to: Bowman's capsule, glomerulus, tubules, loop of Henle and collecting duct.

The kidney is divided into two major parts. The outer darker portion is called as the cortex and the lighter inner zone is called as the medulla. The functional unit of kidney is a nephron which begins in the cortex, loops down into the medulla, back into the cortex and then goes down again through the medulla to the pelvis. In the pelvis the tubules join up with the ureter.
The structure of nephron is divided into two parts.

- Renal Capsule.
- Renal Tubule.

Renal capsule consists of glomerulus and bowmen's capsule while renal tubule consists of the tabular part which includes proximal and distal convulated tubules and loop of Henle. The details structure of the following is explained below.

Bowman's Capsule.

- It is located at the beginning of the nephron.
- It encloses glomerulus and has a double-walled cup shaped structure.

Glomerulus:

- It is a network of capillaries formed by the division of renal arteries and arterioles.
- It functions in the initial filtration of blood to form urine.

Tubules:

- Proximal convoluted tubule is adjacent to Bowman's capsule.
- Distal convoluted tubule is located after the loop of Henle.

Loop of Henle:

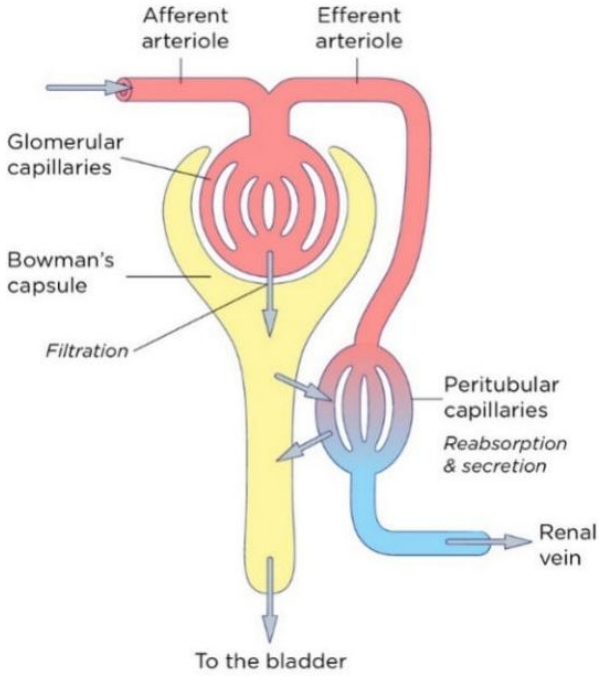
- It is present in between proximal convoluted tubule and distal convoluted tubule.
- The descending limb of loop of Henle descends into the medulla of the kidney and the ascending limb moves back into the cortex.

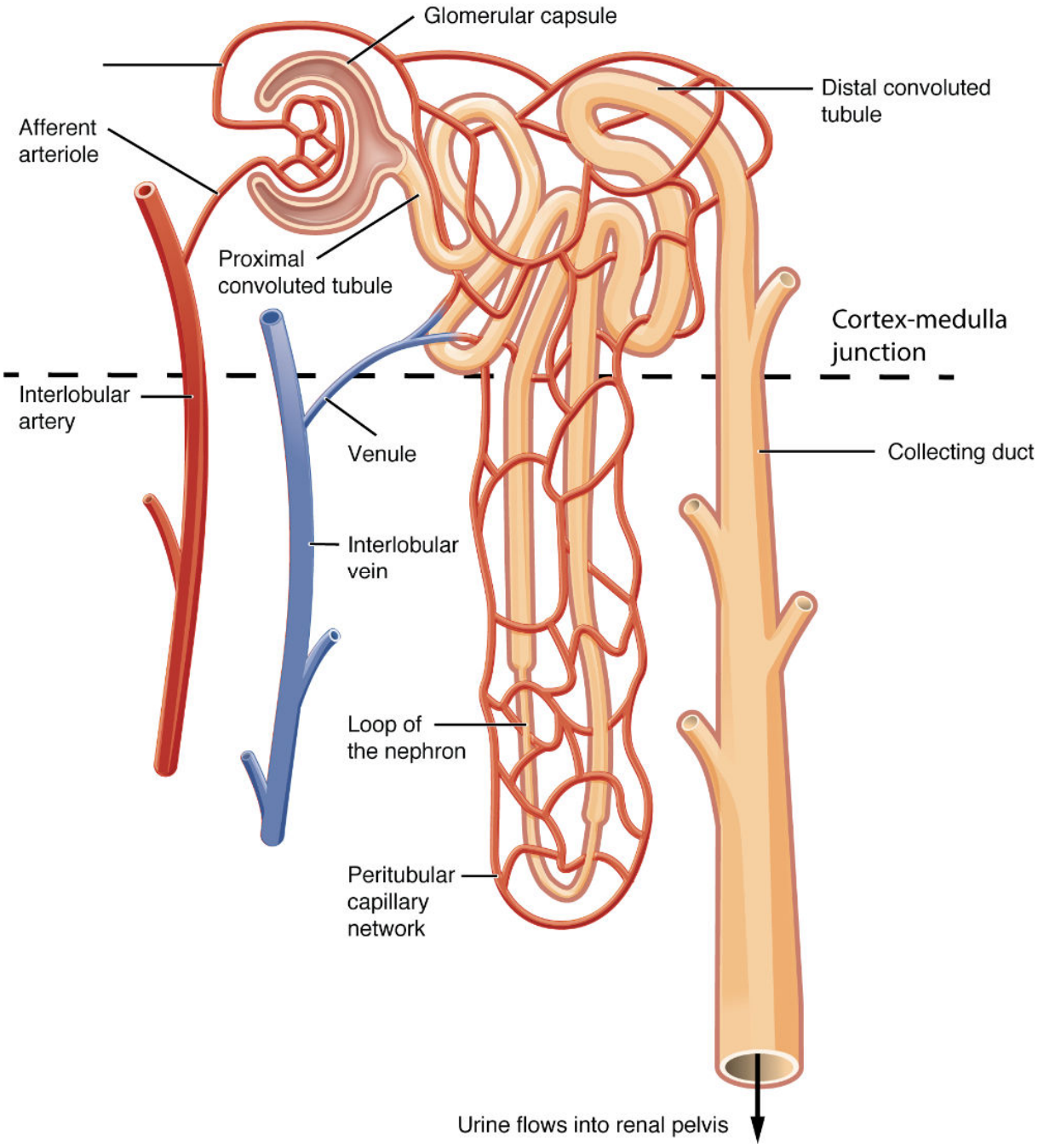
Collecting Duct:

- It receives filtrate from multiple nephrons and drains into the renal pelvis.
- It contributes to the final concentration and volume of urine.

Associated Blood Vessels:

- There are blood vessels associated with the nephron for its proper functioning.
- These vessels supply blood and oxygen to the nephron and are also involved in the reabsorption of minerals and ions.




Glomerular capsule
Distal convoluted tubule
Afferent arteriole
Proximal convoluted tubule
Cortex-medulla junction
Interlobular artery
Venule
Collecting duct
Interlobular vein
Loop of the nephron
Peritubular capillary network
Urine flows into renal pelvis

Outline the function of a nephron and its associated blood vessels, limited to:

(a) the role of the glomerulus in the filtration from the blood of water, glucose, urea and ions.

(b) the role of the nephron in the reabsorption of all of the glucose, some of the ions and most of the water back into the blood.

(c) the formation of urine containing urea, excess water and excess ions.

Role of the Glomerulus in Filtration:

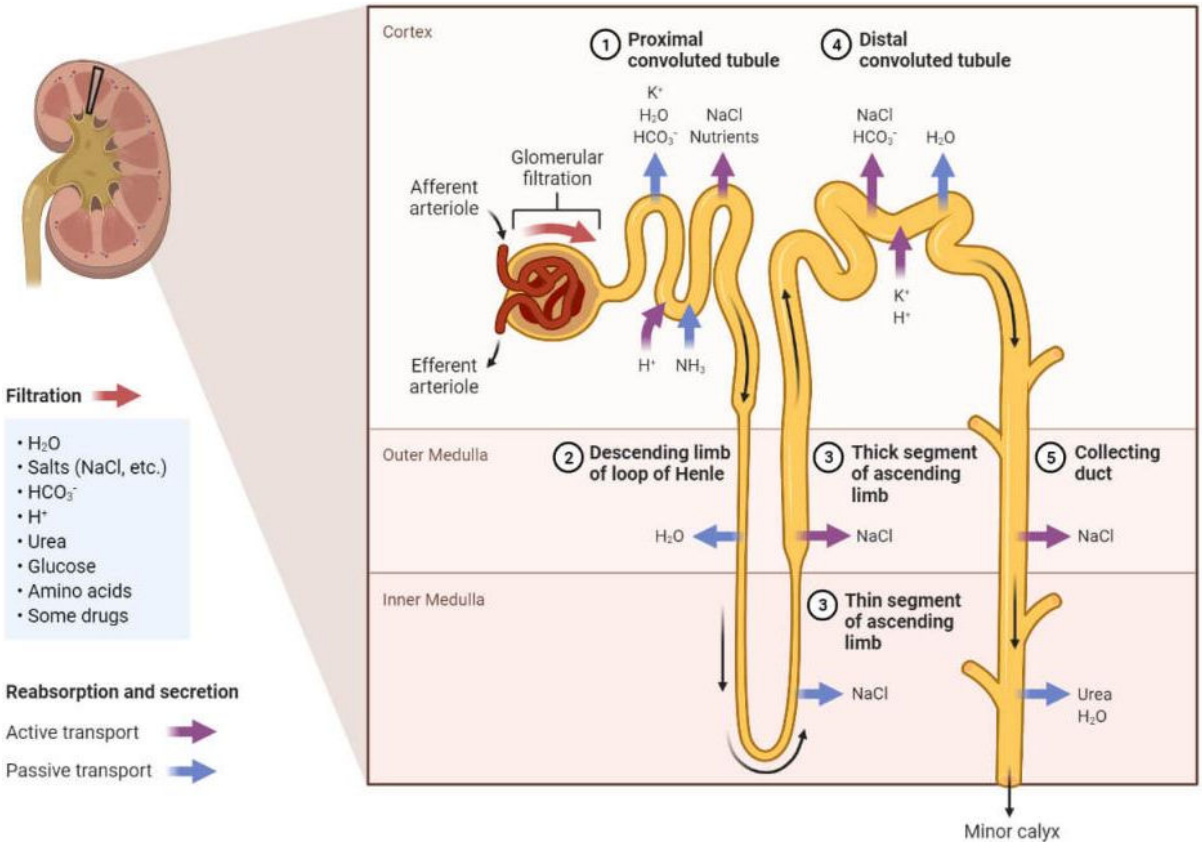
Glomerulus contains lots of tiny pores through which it functions as a filtration unit, allowing small molecules such as water, glucose, urea, ions, and waste products to pass from the blood into the renal tubules (plasma proteins cannot pass into the bowman's capsule). Filtration occurs due to a pressure gradient across the glomerular capillaries, driven by blood pressure. This process is known as glomerular filtration and the filtrate produced is known as the glomerular filtrate which move into the Bowman's capsule and then into the renal tubules for further processing.

Role of the Nephron in Reabsorption:

The tubular part of the nephron reabsorbs the majority of filtered glucose, amino acids, and ions back into the bloodstream. The loop of Henle establishes and maintains an osmotic gradient through which it reabsorbs high amount of water.

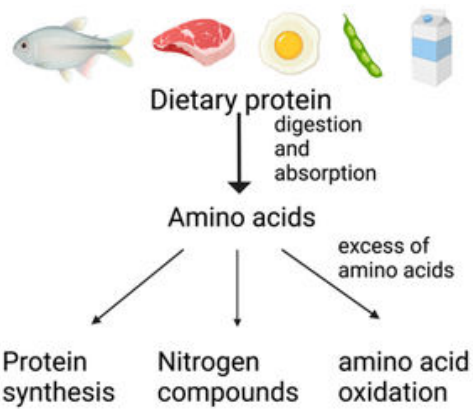
Formation of Urine:

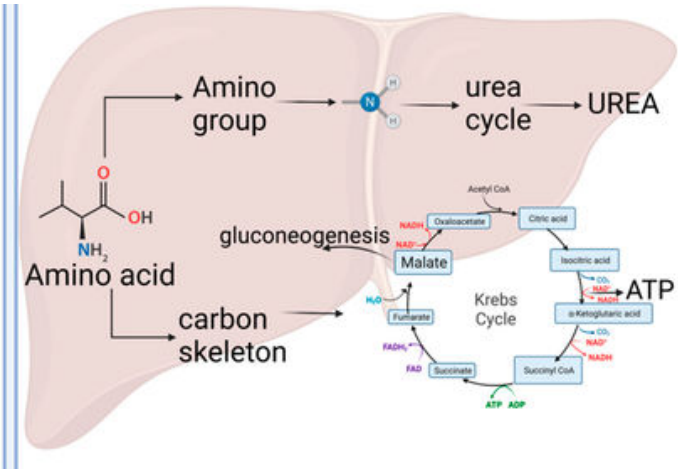
As the filtrate moves through the nephron tubules, water and solutes are reabsorbed into the bloodstream, leading to the accumulation of waste products such as urea, excess water, and ions. Hydrogen ions are also added into urine to maintain the pH of blood. This concentrated solution is now referred to as urine. It is guided towards the urinary bladder where it is stored temporarily. The bladder can expand to hold about 400 cm^3 of urine. The urine cannot escape from the bladder because a band of circular muscle, called a sphincter, is contracted. This shuts off the exit. When this sphincter muscle relaxes, the muscular walls of the bladder expire the urine through the urethra.



Describe the role of the liver in the assimilation of amino acids by converting them to proteins.

Assimilation means the absorption of substances, which are then built into other compounds in the organism. The liver assimilates amino acids by converting them into proteins through protein synthesis. It regulates protein production based on the body's needs and can synthesize specific proteins required for various functions. Once synthesized, proteins are exported into the bloodstream for distribution to other tissues and organs. Additionally, the liver serves as a storage site for amino acids and proteins, releasing them into the bloodstream as needed.





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