Chapter 19 Excretory Products and Their Elimination

The solutions for CBSE Class 11 Biology Notes Chapter 19 "Excretory Products and Their Elimination" are available below. This chapter helps us understand how our bodies get rid of waste. It talks about organs like the kidneys, ureters, bladder, and urethra, which work together to filter blood, remove waste, and make urine.

The notes also explain how hormones control kidney function and keep our body's water and electrolyte levels in balance. Overall, these solutions make it easier to understand how our bodies get rid of waste and keep us healthy.

Excretory Organs Are Found In A Wide Range Of Organisms

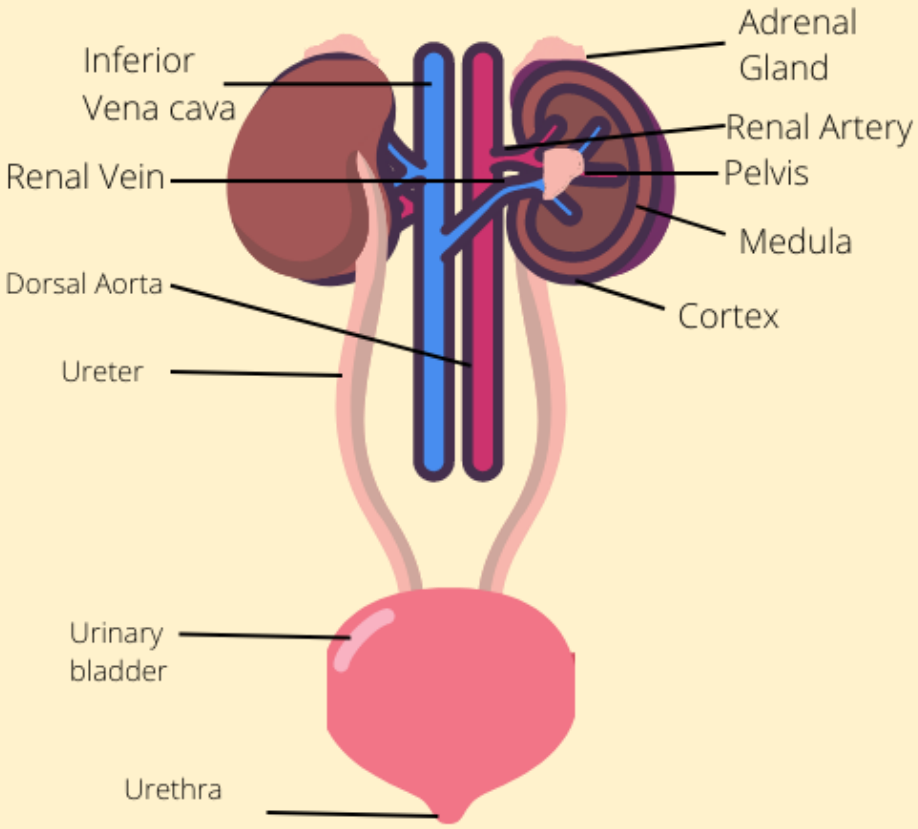
The excretory structures across various organisms showcase remarkable diversity and adaptation to their respective environments. Amoeba and Paramecium, for instance, utilize contractile vacuoles to expel excess water and waste products, ensuring osmotic balance within their single-celled bodies. Sponges employ a canal system for excretion, where water currents transport waste materials out of the organism.

The coelenteron of Hydra serves an excretory function, facilitating the removal of metabolic wastes. Platyhelminthes, like flatworms, feature flame cells that eliminate nitrogenous waste through specialized structures called protonephridia. Annelids, exemplified by earthworms, possess nephridia, which filter waste products from the coelomic fluid and excrete them out of the body.

Prawns exhibit green excretory glands, likely associated with the elimination of waste products accumulated in their aquatic habitats. Insects, including beetles and grasshoppers, rely on malpighian tubules to remove nitrogenous waste and maintain internal homeostasis, reflecting the diverse adaptations of excretory systems across the animal kingdom.

The Excretory System Of Humans

The human excretory system is a complex network of organs vital for filtering waste from the body and maintaining internal balance. It includes two kidneys, two ureters, a urinary bladder, and a urethra. Kidneys, shaped like beans, are situated in the abdominal cavity.



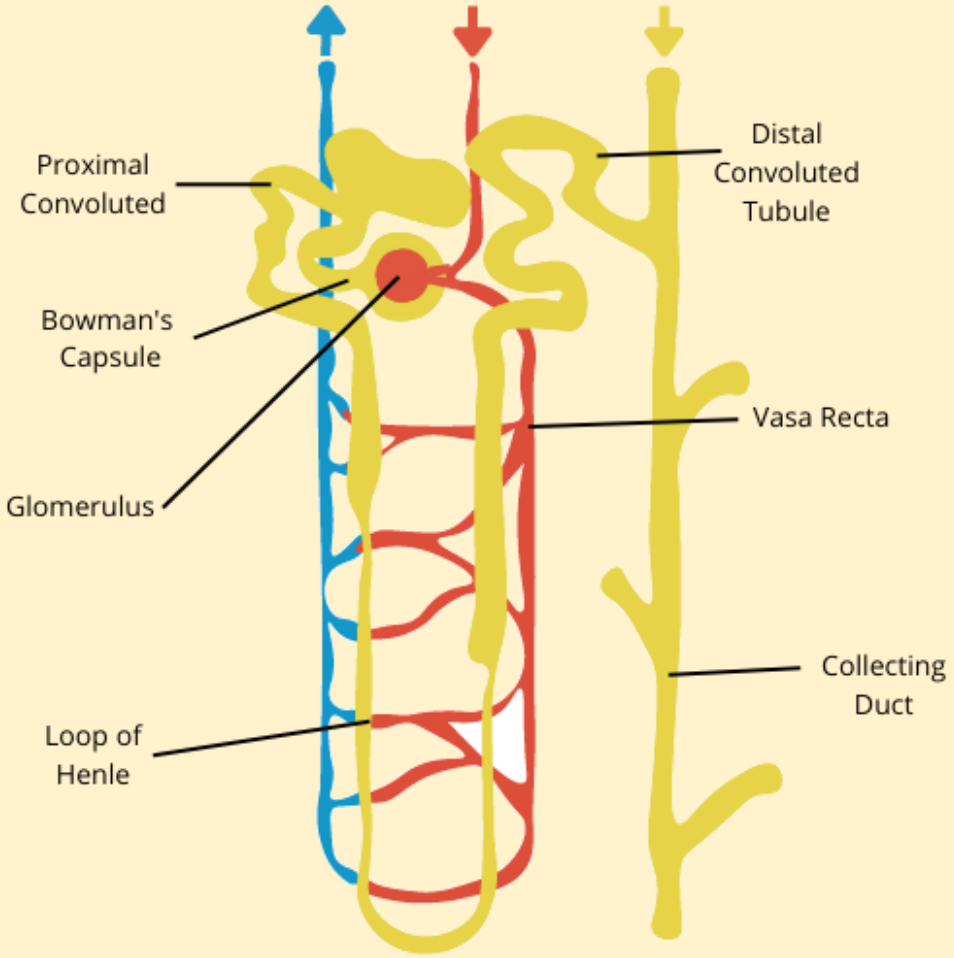
The right kidney is positioned slightly lower than the left one. Each kidney has a concave inner surface and a convex outer surface, with a notch called the hilum located in the center of the inner concave surface. The hilum serves as the entry point for the ureter, blood vessels, and nerves. Within the hilum lies the renal pelvis, a funnel-shaped space connected to calyces, which collect urine. The kidneys are further divided into the outer cortex and inner medulla.

The medulla consists of medullary pyramids, conical structures that help in urine formation. Separating these pyramids is the column of Bertini, an extension of the renal cortex. Together, these structures play a crucial role in filtering blood, removing waste, and regulating fluid balance in the body.

Labeled Diagram of Human Excretory System

The nephron is the fundamental unit responsible for the filtration and processing of blood in the kidneys. It consists of two main components: the renal corpuscle and the renal tubule.

The renal corpuscle includes a cluster of capillaries called the glomerulus. Blood is brought into the glomerulus through the afferent arteriole and exits through the efferent arteriole. Surrounding the glomerulus is Bowman's capsule, a cup-shaped structure that collects the filtrate from the blood. Together, the glomerulus and Bowman's capsule form the renal corpuscle, also known as the Malpighian body.



Labeled Diagram of Nephron of Human Kidney

The proximal convoluted tubule (PCT) is a tightly coiled segment that follows Bowman's capsule in the nephron. Next in line is Henle's loop, composed of an ascending limb and a descending limb. The ascending limb leads to the distal convoluted tubule (DCT), which ultimately connects to the collecting duct.

Nephrons come in two main types: cortical nephrons and medullary nephrons. Cortical nephrons have a short loop of Henle, mostly located in the cortex, while medullary nephrons have a longer loop that extends into the medulla.

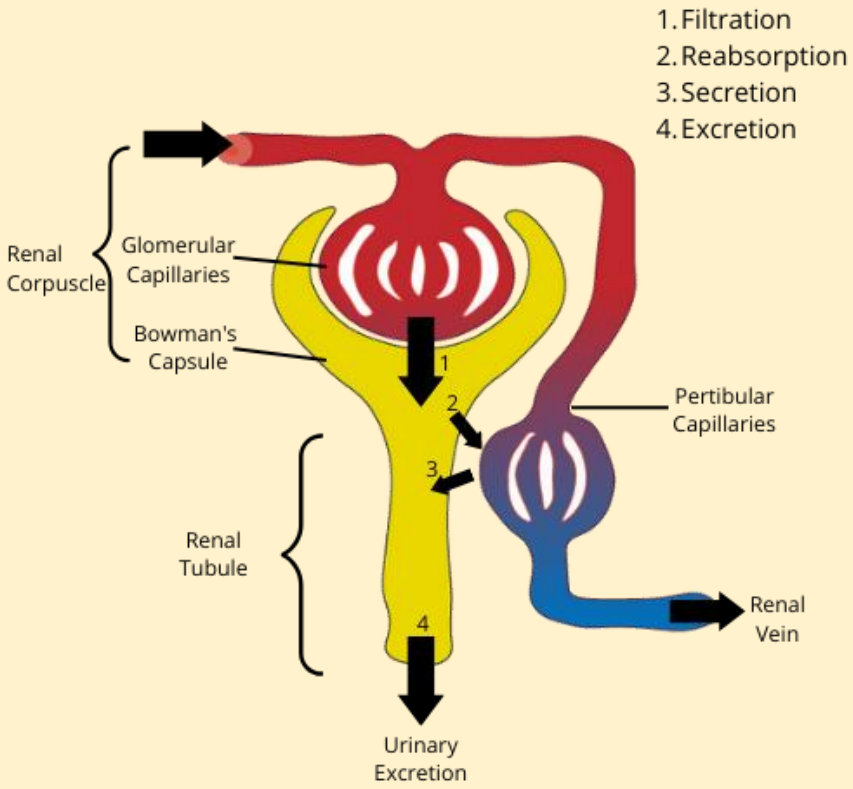
Urine production involves three key processes: glomerular filtration, tubular reabsorption, and tubular secretion.

Glomerular Filtration: Blood enters the glomerulus, where small molecules like water and waste products are filtered out into Bowman's capsule. Larger molecules, including proteins, are retained in the bloodstream. This filtration occurs due to pressure differences across the glomerular capillaries and the filtration slits in the Bowman's capsule.

Tubular Reabsorption: As the filtrate passes through the renal tubules, essential substances such as glucose, ions, and water are reabsorbed back into the bloodstream. This helps maintain the body's balance of fluids and electrolytes.

Tubular Secretion: Certain substances, including drugs and excess ions, are actively transported from the bloodstream into the renal tubules for excretion in the urine. This process helps eliminate waste and regulate the body's acid-base balance.

Overall, these processes work together to produce urine while maintaining the body's internal environment in balance.



Labeled Diagram Of Steps Involved In Formation Of Urine

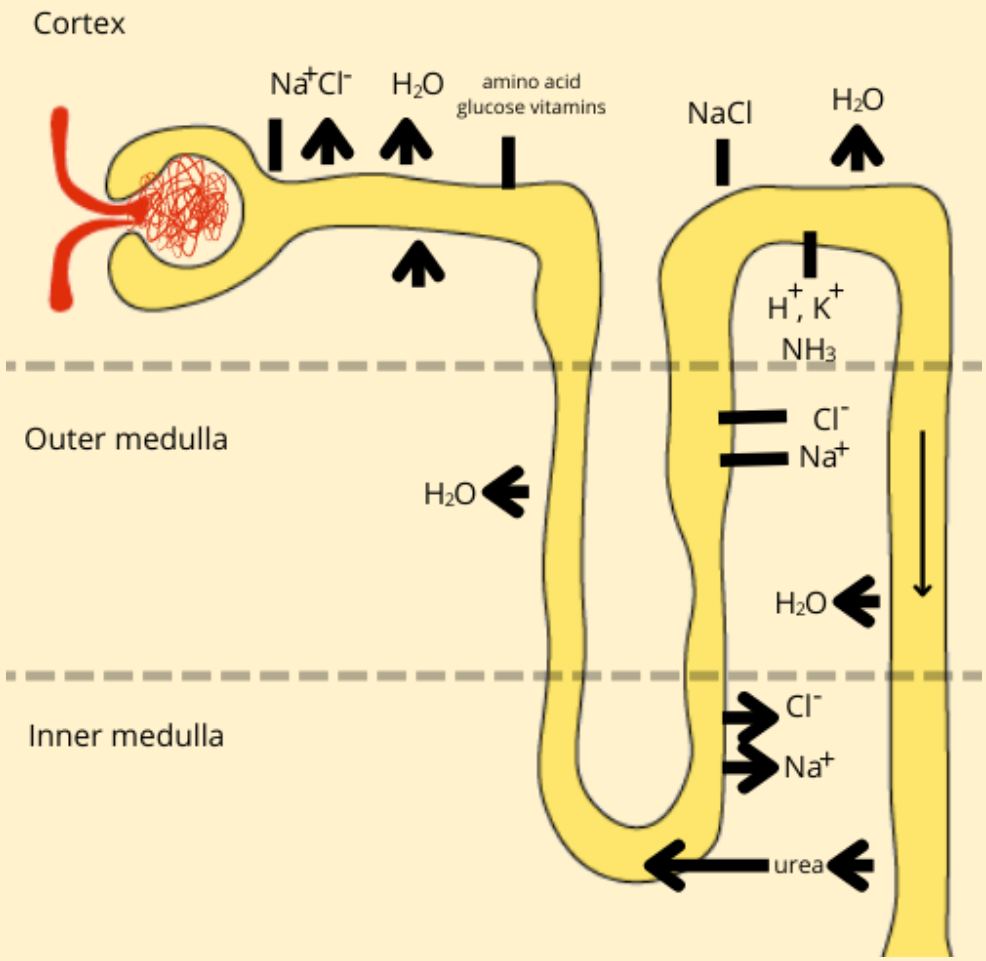
Tubular reabsorption is a crucial process in kidney function, where necessary molecules like glucose and amino acids, as well as ions like sodium ions, are absorbed back into the bloodstream. Some substances are actively absorbed, while others are passively absorbed. Glucose and amino acids are actively absorbed, while water is passively absorbed.

Urine Secretion: The final step in urine formation is secretion, where substances like potassium ions, hydrogen ions, and ammonia are released to maintain the body's ionic and acid-base balance.

Functions Of Tubules:

Proximal Convoluted Tubules (PCT): The PCT is lined with simple cuboidal brush border epithelium, providing a large surface area for reabsorption. It primarily reabsorbs electrolytes and water, contributing to the body's pH and ionic balance by secreting hydrogen ions, potassium ions, and ammonium ions into the filtrate.

Henle's Loop: Henle's loop plays a vital role in maintaining fluid osmolarity. The ascending limb is impermeable to water but permeable to electrolytes, while the descending limb absorbs most of the water, concentrating the filtrate. Different segments of Henle's loop absorb differently, ensuring effective water and electrolyte balance.

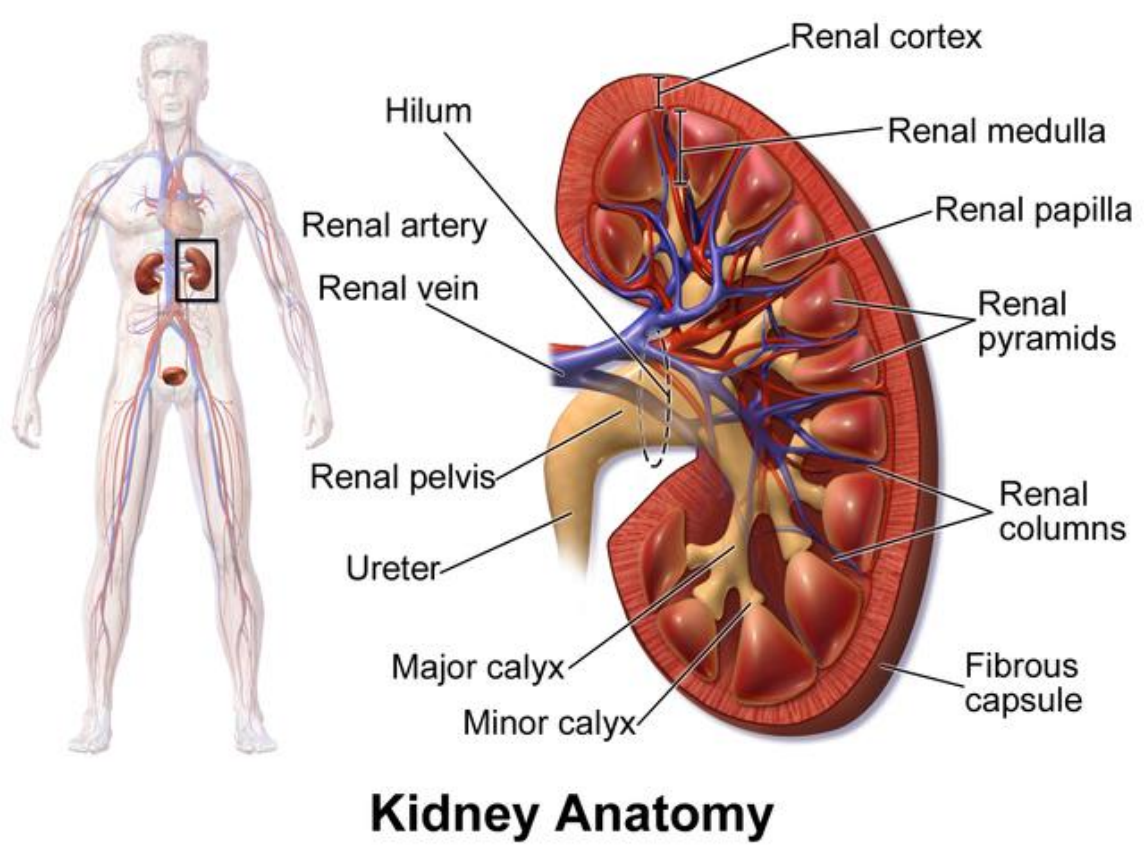


Functions Of Tubules Of Nephron

Distal Convoluted Tubule (DCT): The DCT plays a role in maintaining the body's ionic balance by absorbing water, sodium ions, and bicarbonate ions while excreting potassium ions and hydrogen ions.

Collecting Ducts: The collecting duct is responsible for reabsorbing a significant amount of water to concentrate urine. It also secretes hydrogen ions and potassium ions, helping to maintain stable blood ionic balance and pH.

Regulation Of Kidney Function



Kidney Anatomy

Hormones released by the hypothalamus, juxtaglomerular apparatus (JGA), and heart regulate kidney function. Changes in blood volume or ionic balance activate the body's osmoreceptors. In response, the hypothalamus produces antidiuretic hormone (ADH)/vasopressin,

which promotes water reabsorption from the tubules, increasing blood volume. This action is regulated by a negative feedback mechanism.

When glomerular blood pressure drops, the juxtaglomerular apparatus is activated. Juxtaglomerular cells release an enzyme called Renin, which converts angiotensinogen in the blood to angiotensin I, then to angiotensin II.

Angiotensin II is a potent vasoconstrictor that increases glomerular blood pressure. It also stimulates the adrenal cortex to produce aldosterone, which enhances sodium ion and water reabsorption from the distal tubules. This mechanism is known as the renin-angiotensin-aldosterone system (RAAS).

Renin-Angiotensin-Aldosterone System (RAAS) regulates kidney functions

A polypeptide hormone called atrial natriuretic factor (ANF) is produced by the heart, acting as a vasodilator to lower blood pressure. It functions as a negative feedback mechanism for the renin-angiotensin system.

Micturition, the process of excreting or releasing urine from the body, is controlled by the central nervous system through various neural mechanisms.

In addition to the kidneys, other organs such as the lungs, liver, and skin also play a role in eliminating waste products like carbon dioxide, toxins, and urea.

Excretory System Dysfunctions

Uremia: Accumulation of urea in the blood due to kidney failure.
Acute renal failure: Failure of one or both kidneys to filter urine due to various reasons.
Renal calculi: Formation of kidney stones due to the accumulation of insoluble crystals.
Glomerulonephritis: Inflammation of the glomerulus.

In cases of kidney failure, hemodialysis can be used to remove excess urea from the blood. This involves removing blood from the body, passing it through dialysis membranes to remove waste products, and then returning it to the body.