

# The excretory system

Excretion is the removal of the waste products of metabolism.

The excretory system is made up of the urinary system and a number of other organs and systems that contribute to the excretion of waste products.

- **The respiratory system** (removing CO<sub>2</sub> from the blood)
- **Sweat glands** (remove various waste products together with the sweat)
- **Liver** (Removes products left after the breakdown of hemoglobin from old red blood cells. It also eliminates a small amount of cholesterol and some toxic substances)

But the most important part of the excretory system is the **Urinary system**.

The urinary system eliminates excretory products in the form of urine. The excretory products released include, CO<sub>2</sub>, urea, uric acid and other substances. It is necessary to keep the body's vital functions in balance. It regulates the amount of water in tissues (water homeostasis), the concentration and type of mineral salts in the blood and the blood's pH levels.

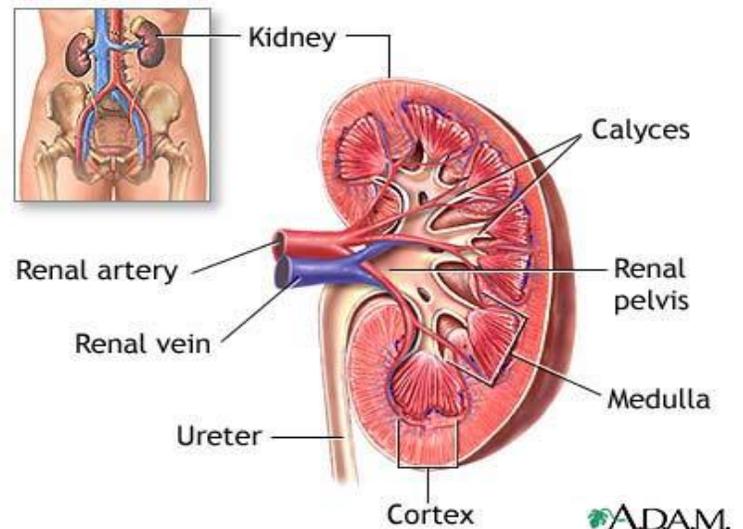
## Anatomy and physiology of the kidney

The kidneys and their blood vessels are located in the abdomen. They constantly produce urine which then passes to the **bladder**.

The kidneys are specialised organs that:

- Remove the toxic waste product urea from the blood
- Regulate the water content of the blood (osmoregulation)

They are well adapted to enable them to carry out these processes.



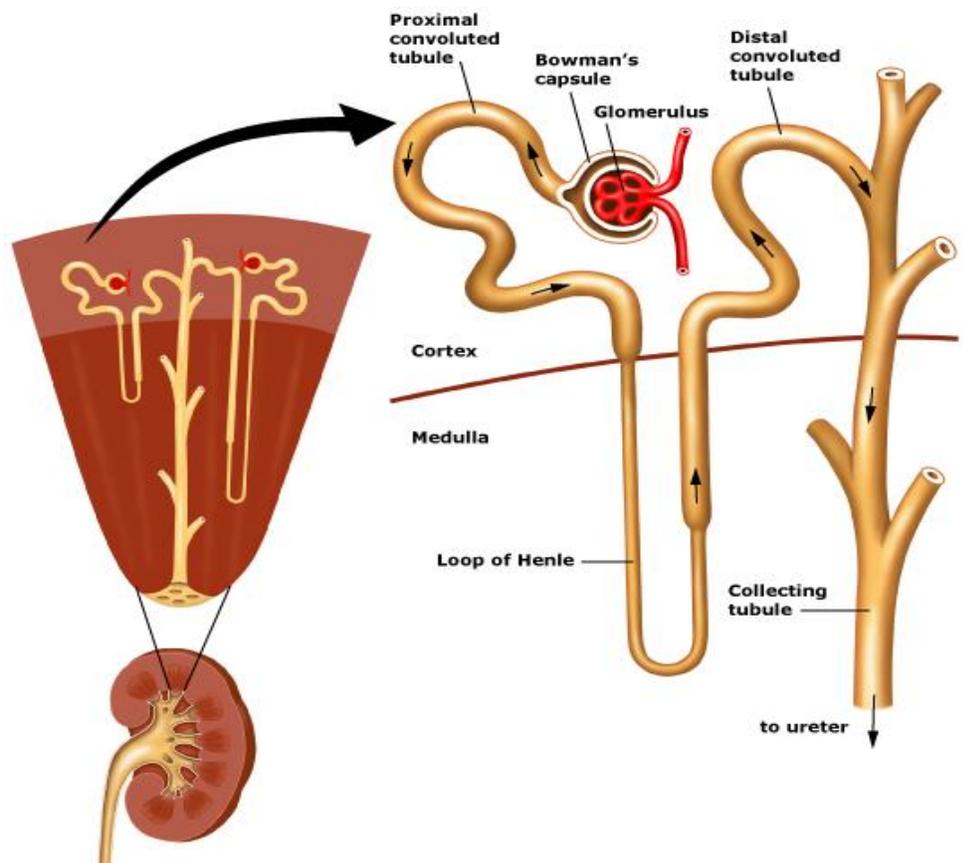
- Each kidney receives a good supply of blood at high pressure through the **renal artery**.
- Each kidney contains hundreds of thousands of tubes, the **nephrons**, that can filter substances from the blood.
- Each kidney has an exit tube, the **ureter**, to carry away the **urine** (solution of wastes dissolved in water)
- The kidney is under close control by a feedback system so that water saving is always exactly balanced to the body's needs

## The nephron- the functional unit

The functional unit of the kidney is the **nephron**. The nephrons are small tubes surrounded by blood capillaries which filter the blood and produce urine.

the nephron is made up out of several parts:

- **Bowman's capsule.** This is the first part of the nephron. It is a round sac which contains a curled-up capillary called the **Glomerulus**.
- **Convolved tubule.** This is a long, twisted tube with two distinct sections: **proximal** and **distal tubule**.
- **Loop of Henle.** This u-shaped portion of the nephron is located between the proximal and distal convoluted tubes.

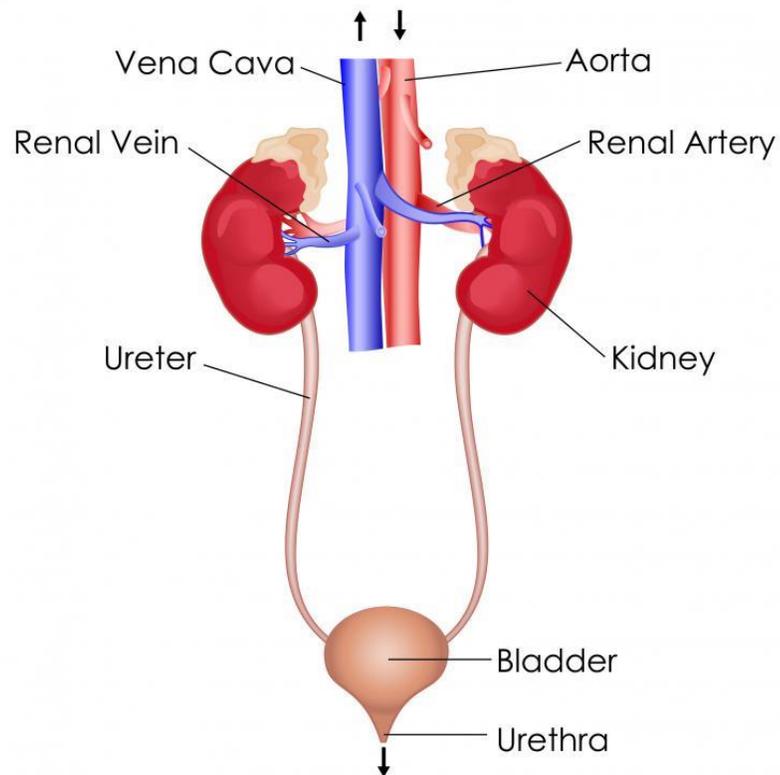


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## The urinary tracts

**Ureters:** these two narrow tubes, around 28 cm long, connect the renal pelvis of the kidney to the urinary **bladder**; an elastic sac where urine is stored before it is expelled from the body.

**Urethra:** this duct leads to the outside of the body. At the beginning of the urethra there is a sphincter which stays closed as long as the brain does not send a nervous stimulus to open it (*the micturition reflex*).



## Production of urine

Urine is a liquid obtained from the blood and made up of water, various amounts of mineral salts, urea and uric acid and other substances. Urine is produced in two phases:

**Glomerular filtration (ultrafiltration):** In this phase certain substances in the blood in the renal corpuscle pass through into the Bowman's capsule. This process filters the water and most other **soluble** substances circulating in the blood plasma.

**Tubular reabsorption:** As they travel through the nephron's tubule, a lot of the filtered substances are reabsorbed, meaning that they go back into the blood in the surrounding capillaries. These substances include nutrients (glucose, vitamins, amino acids, etc). Some water and mineral salts are also reabsorbed to keep their levels in the blood constant. Water molecules are reabsorbed in the loop of Henle, other substances are reabsorbed in the proximal tubule. Waste products are not reabsorbed.

[VIDEO](#)

[ANIMATION](#)