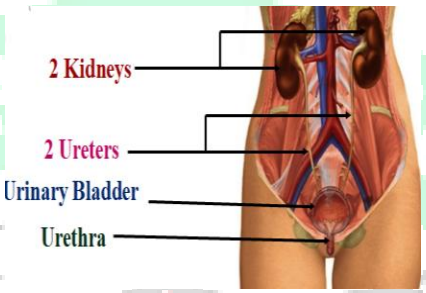
UNIT-3 ANATOMY OF URINARY TRACT WITH SPECIAL REFERENCE TO ANATOMY OF KIDNEY

The **urinary system**, also known as the **renal system** or **urinary tract**, consists of



- The kidneys **(two)**
- Ureters **(two)**
- Bladder **(one)**
- The urethra**(one)**

The purpose of the urinary system is to

a) eliminate waste from the body,

b) regulate blood volume and blood pressure,

c) control levels of electrolytes and metabolites, and

d) regulate blood pH.

The urinary tract is the **body's drainage system** for the eventual removal of urine.

- **Nephrology** is the scientific study of the anatomy, physiology, and pathology of the kidneys.
- The branch of medicine that deals with the male and female urinary systems and the male reproductive system is called **urology**.

A physician who specializes in this branch of medicine is called a **urologist.**

THE KIDNEYS:

- The **kidneys** are two bean shaped organs found on the left and right sides of the body in vertebrates.
- They are located at the back of the abdominal cavity in the **retroperitoneal** space (posterior to the peritoneum of the abdominal cavity)
- The asymmetry within the abdominal cavity, caused by **the position of the liver**, typically results in the **right kidney being slightly lower and smaller than the left**, and being placed slightly more to the middle than the left kidney

ORGANS ASSOCIATED WITH KIDNEY:

Right kidney

a) **Anteriorly:**the duodenum,hepatic flexure of the colon & right lobe of the liver.

b) **Posteriorly:** Diaphragm,muscles of posterior abdominal wall

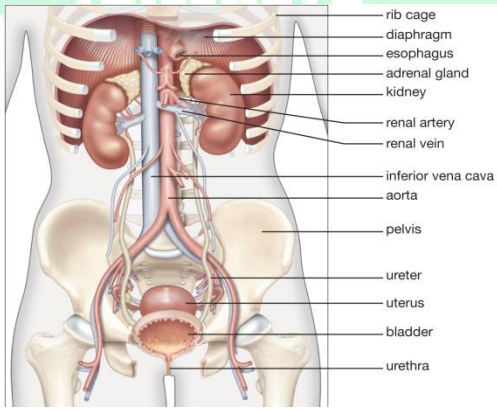
c) **Superiorly:** the right adrenal gland

Left kidney

a) **Anteriorly:**the spleen & splenic vessels,jejunum splenic flexure of the colon,pancreas & stomach.

b) **Posteriorly:** Diaphragm,muscles of posterior abdominal wall

c) **Superiorly:** the left adrenal gland

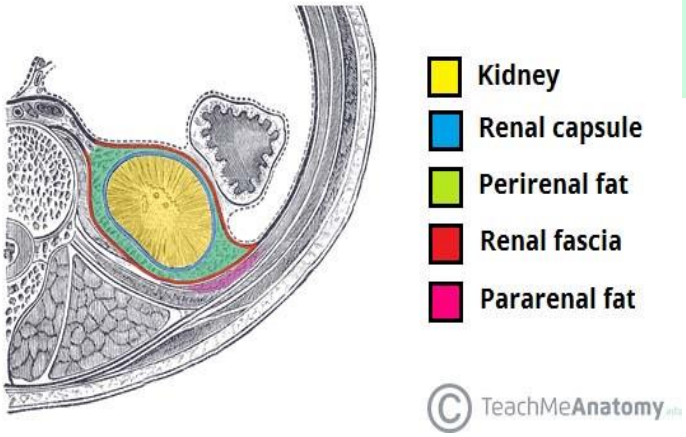


ANATOMY OF KIDNEY:

- A typical kidney in an adult is **10–12 cm long, 5–7 cm wide, and 3 cm thick** and weighs about **125–170 g.**
- The lateral border is convex.
- The medial border is concave.
- The middle part of the medial border is depressed and is known as **hilum** (hilus) through which the ureter emerges from the kidney along with blood vessels, lymphatic vessels, and nerves.
- The concave medial border of each kidney faces the vertebral column.

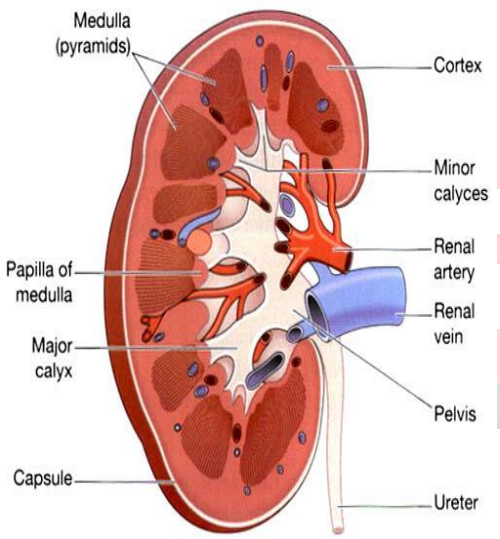
Three layers of tissue surround each kidney

1) The **renal capsule (**deep layer) - smooth, transparent sheet of dense irregular connective tissue that is continuous with the outer coat of the ureter. It serves as a barrier against trauma and helps maintain the shape of the kidney.
2) The **adipose capsule (**middle layer) - mass of fatty tissue surrounding the renal capsule. It also protects the kidney from trauma and holds it firmly in place within the abdominal cavity.
3) The **renal fascia** (superficial layer) - another thin layer of dense irregular connective tissue that anchors the kidney to the surrounding structures and to the abdominal wall.



There are three areas of tissue which can be distinguished when a longitudinal section of the kidney is viewed with the naked eye

- *a fibrous* ***capsule,*** surrounding the kidney
- the ***cortex,*** a reddish-brown layer of tissue immediately below the capsule and outside the pyramids
- the ***medulla***, the innermost layer, consisting of pale conical-shaped striations, the ***renal pyramids.***
- *The renal pelvis* is the funnel-shaped structure which acts as a receptacle for the urine formed by the kidney. It has a number of distal branches called *calyces,* each of which surrounds the apex of a renal pyramid.



- Urine formed in the kidney passes through a ***papilla*** at the apex of a pyramid into a minor calyx, then into a major calyx before passing through the pelvis into the ureter.
- The walls of the pelvis contain smooth muscle and are lined with transitional epithelium. Peristalsis of the smooth muscle originating in pacemaker cells in the walls of the calyces propels urine through the pelvis and ureters to the bladder.
- This is an intrinsic property of the smooth muscle, and is not under nerve control.

FUNCTIONS OF KIDNEY:

1) **Regulation of blood ionic composition**.

The kidneys help regulate the blood levels of several ions, most importantly sodium ions (Na), potassium ions (K), calcium ions (Ca2), chloride ions (Cl), and phosphate ions.

2) **Regulation of blood pH.**

The kidneys excrete a variable amount of hydrogen ions (H) into the urine and conserve bicarbonate ions (HCO3). Both of these activities help regulate blood pH.

3) **Regulation of blood volume.**

The kidneys adjust blood volume by conserving or eliminating water in the urine. An increase in blood volume increases blood pressure; a decrease in blood volume decreases blood pressure.

4) **Maintenance of blood osmolarity.**

By separately regulating loss of water and loss of solutes in the urine, the kidneys maintain a relatively constant blood osmolarity. The **osmolarity** of a solution is a measure of the total number of dissolved particles per liter of solution.

5) **Production of hormones.**

The kidneys produce two hormones. *Calcitriol,* the active form of vitamin D, helps regulate calcium homeostasis, and *erythropoietin* stimulates the production of red blood cells.

6) **Regulation of blood glucose level.**

Like the liver, the kidneys can use the amino acid glutamine in *gluconeogenesis,* the synthesis of new glucose molecules. They can then release glucose into the blood to help maintain a normal blood glucose level.

7) **Enzymatic regulation of blood pressure.**

The kidneys *also* help regulate blood pressure by secreting the enzyme renin, which indirectly causes an increase in blood pressure.

8) **Excretion of wastes and foreign substances.**

By forming urine, the kidneys help excrete **wastes**—substances that have no useful function in the body. Some wastes excreted in urine result from metabolic reactions in the body.

These include ammonia and urea from the deamination of amino acids; bilirubin from the catabolism of hemoglobin; creatinine from the breakdown of creatine phosphate in muscle fibers; and uric acid from the catabolism of nucleic acids.

Other wastes excreted in urine are foreign substances from the diet, such as drugs and environmental toxins.