

# RENAL SYSTEM



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It is one of the four excretory systems in our body. The other three are bowel, lungs and skin.

The system ***produces***, ***stores*** and ***eliminates*** urine.

Purpose:

- Eliminate waste from the body
- Regulate blood volume
- Regulate blood pressure
- Control levels of electrolytes and metabolites.
- Regulate blood pH.

# Components of the renal system

## Kidney (Function)

Produce urine by filtering wastes and extra water from blood.

## Ureter (Transport)

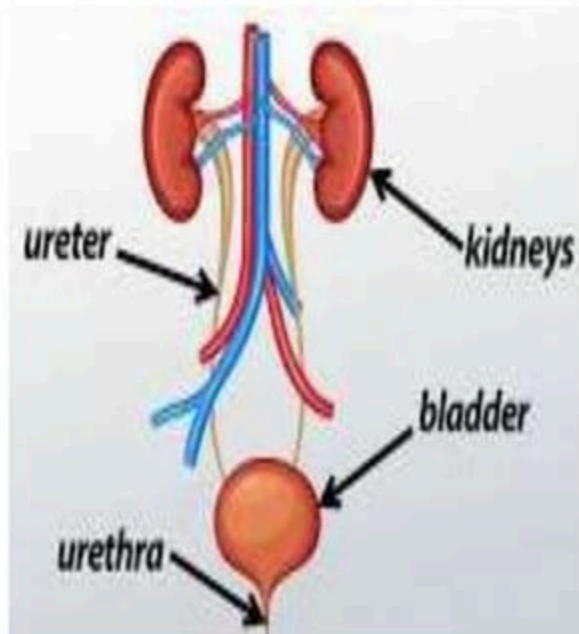
Convey urine from the kidneys to the urinary bladder

## Urinary Bladder (Storage)

Muscular reservoir of urine

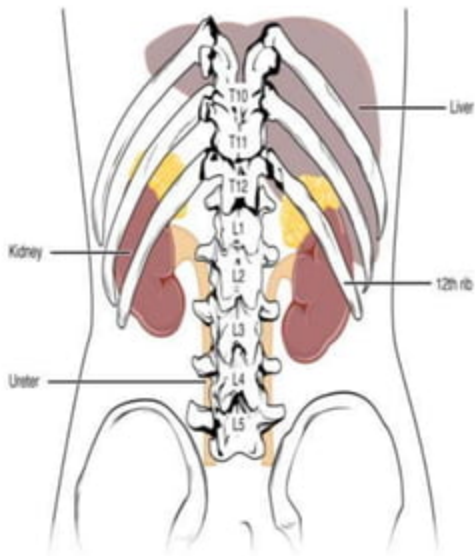
## Urethra (Excretion)

Conducts urine to the exterior



# KIDNEY: Location in the body

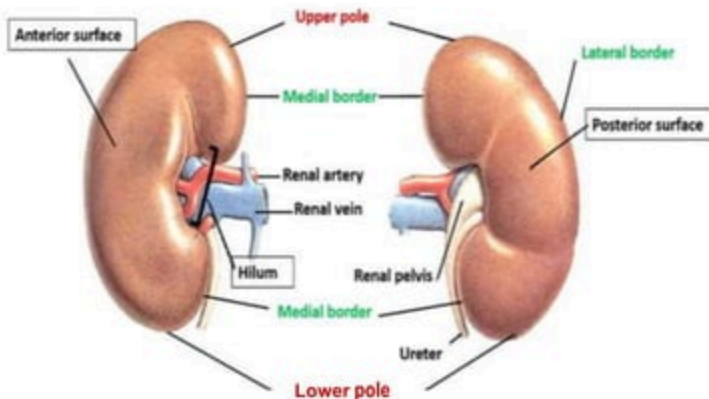
- A pair of organs found along the posterior muscular wall of the abdominal cavity, one on each side of the vertebral column, behind peritoneum **retroperitoneal organ**.
- The ribs (11 and 12) and muscle of the back protect the kidneys from external damage
- Left kidney is located slightly more superior than the right kidney and the left kidney is little nearer to the median than the right.
- Adipose tissue (perirenal fat) surrounds the kidney and act as protective padding.



# KIDNEY: Surface Anatomy

## External Features:

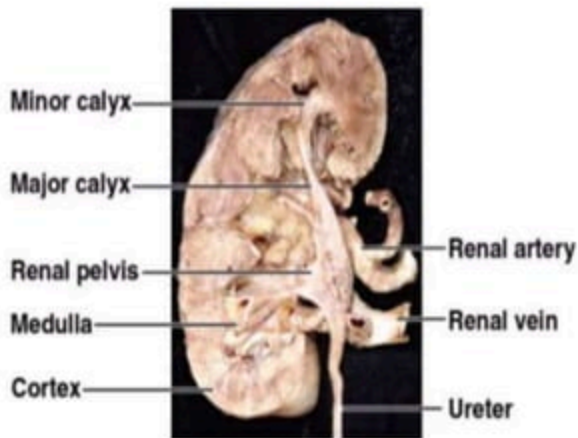
- It is bean-shaped
- It has upper and lower poles anterior and posterior surfaces.
- At its superior end lies the adrenal gland.



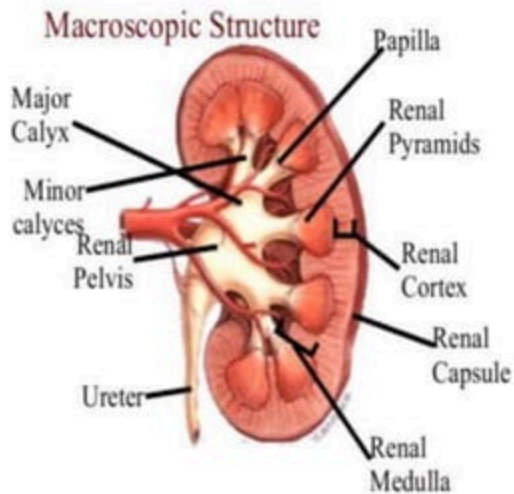
- It has lateral and medial borders
  - Lateral border is convex
  - Medial border is concave
- The middle part of the medial border is depressed and is known as hilum.

# KIDNEY: Macroscopic Structure

Photograph of kidney



Diagrammatic view



*Frontal sections of Kidney*

# KIDNEY: Microscopic Structure

## Urineferous tubule:

Microscopic structural and functional unit of the kidney. It is made up of nephrons and collecting tubules.

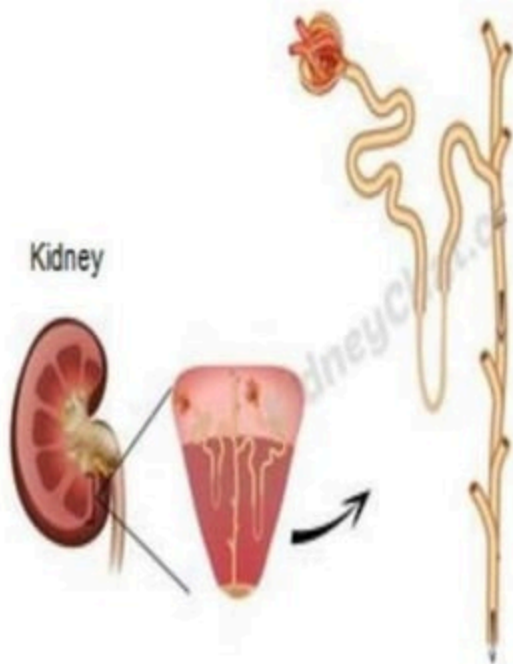
Each kidney contains over 1-2 million nephrons and thousands of collecting ducts

### ❖ Renal Cortex:

Bowman's capsule, glomerulus, proximal and distal tubule

### ❖ Renal Medulla:

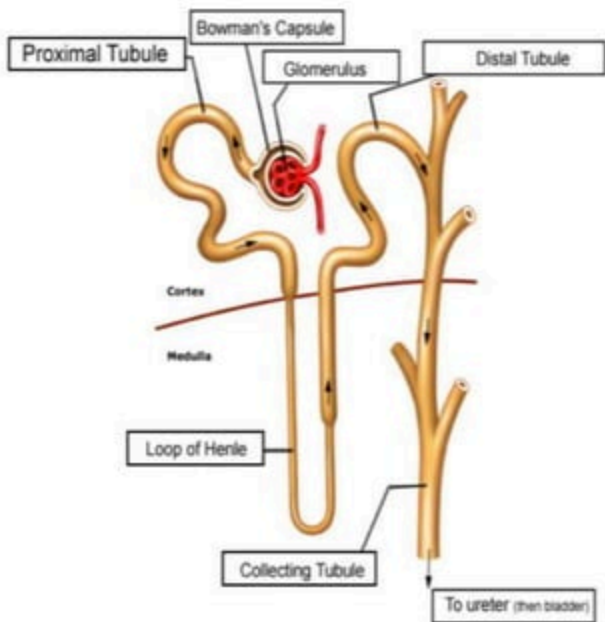
Loop of Henle & collecting ducts



# Structure of Nephron

Nephron functions through Ultra filtration and Reabsorption

- **Bowman's capsule:**  
A cup-shaped structure at one end of nephron.
- **Glomerulus:**  
A cluster of capillaries surrounded by the bowman's capsule
- **Proximal tubule:**  
Segment of nephron between Bowman's capsule and loop of Henle.
- **Distal tubule:**  
Segment of nephron between the loop of Henle and the collecting tubule
- **Loop of Henle:**  
Descending and ascending parts
- **Collecting tubule:**  
Consist of a series of tubules and ducts



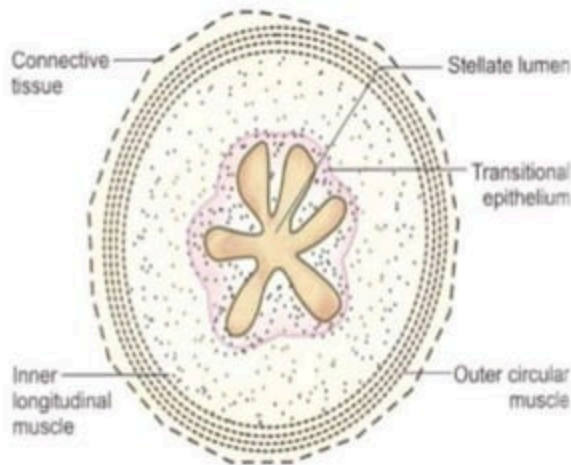
# URETER

- There are two ureters one attached to each kidney.
- Ureter is divided into two parts:
  - Abdominal part: (upper half)  
From the site of origin to pelvic brim
  - Pelvic part: (lower half)  
From pelvic brim to entry into urinary bladder
- The ureter is about 10-12 inches (25cm) long in the average adult. The ureters are thick walled muscular tubes composed of a fibrous, muscular and mucus coat, which are able to contract.

# Cross-sectional area of ureter (Microscopic structure)

## 3 Layers of tissue

- **Inner Layer**  
Transitional epithelium  
(Mucosa)
- **Middle Layer**  
Inner longitudinal muscle  
(Muscular)
- **Outer Layer**  
Outer circular muscle  
(Fibrous connective tissue)



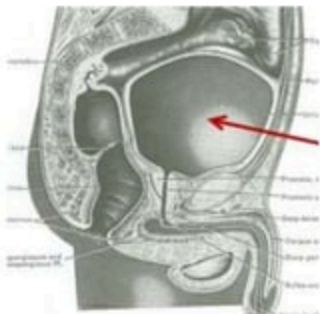
# URINARY BLADDER

- The urinary bladder is a hollow muscular organ that collects and stores urine from kidneys before disposal by urination. Urine enters the bladder via the ureters and exits via the urethra.
- ***In Child,***
  - it is an **abdominal organ till the age of 6 years.**
  - It begins to enter the enlarging pelvis at 6 years of age.
  - It is found entirely **in pelvis at puberty.**

# Position and Capacity

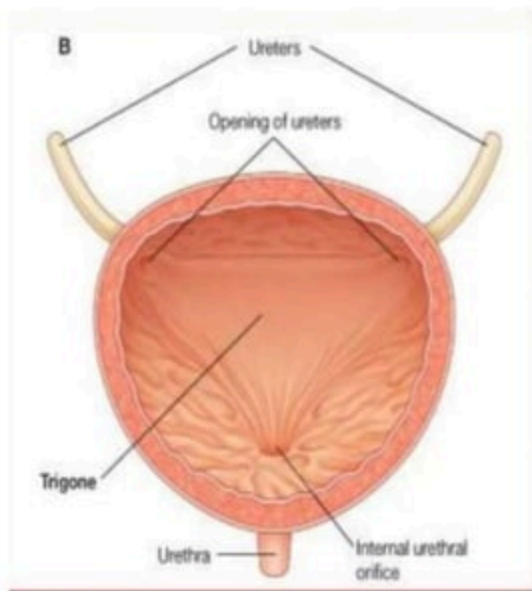
## In an adult,

- Empty
  - Empty bladder is pelvic organ.
  - Accommodates from 300–500 ml of urine.



- Distended
  - Is circular in shape
  - Bulges into abdominal cavity

# Interior of the bladder (Internal Anatomy)



- Ureteric openings:

At the upper lateral angles of the trigone.

- Internal urethral orifice:

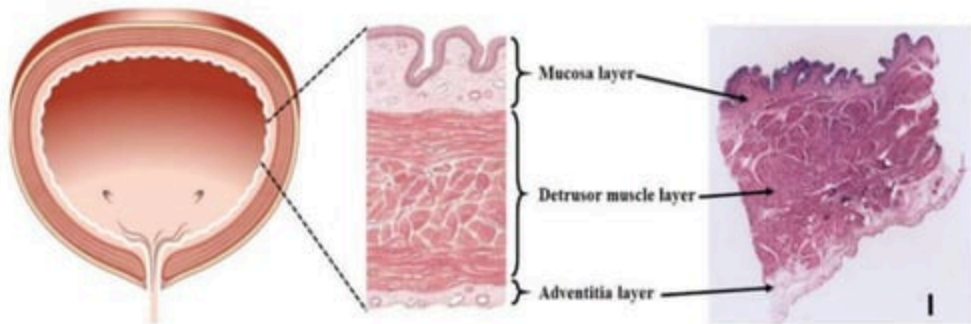
At the inferior angle of the trigone

- Trigone:

The posterior wall shows a smooth triangular area called trigone. There are no mucous folds in this region.

# Wall of Bladder(Histology)

STRUCTURE: 3 Layers of tissues



## ➤ Inner Layer:

- Mucosa layer containing a transitional epithelium
- It lines the hollow lumen.
- Rugae(numerous folds on mucosa) and transitional epithelium allow bladder to expand as it fills.
- Mucosal membrane consisting of a surface glycocalyx that protects the cells beneath it from urine.

➤ **Middle Layer:**

*detrusor muscle*

- Thick muscular layer.
- Remains relax allowing bladder to store urine.
- Contracts during urination to release urine.

➤ **Outer Layer:**

*Fibrous Adventitia or serosa*

- *Serosa:*  
A thin membrane that covers the top part of the bladder
- *Adventitia:*  
Loose connective tissue that covers areas of the bladder where there is no serosa
- *Perivesicle fat:*  
A layer of fat surrounding the bladder.

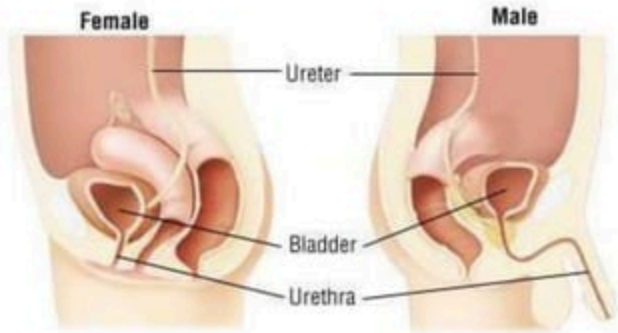
# URETHRA

Urethra is a duct extending from the neck of the bladder to the exterior at the external urethral orifice

It transmits urine from the bladder to the exterior of the body during urination

- Main difference between male and female renal system is urethra length.

- Males: 18-20cm
- Females: 3-4cm



# Male Urethra

- The urethral sphincters are two muscles used to control the exit of urine in the urinary bladder through the urethra.

Contraction of these muscles seal the urethra

- These two muscles are male/female
  - External urethral sphincter
  - Internal urethral sphincter
- Male urethra passes along the length of the penis before emptying.
- Male urethra is divided into 3 parts:



# Female Urethra

Begins at the bladder neck and opens to the exterior just after passing through the urethral sphincter

The female urethra is embedded within the vaginal wall, and its opening is situated between the labia.

- **External Urethral orifice:**

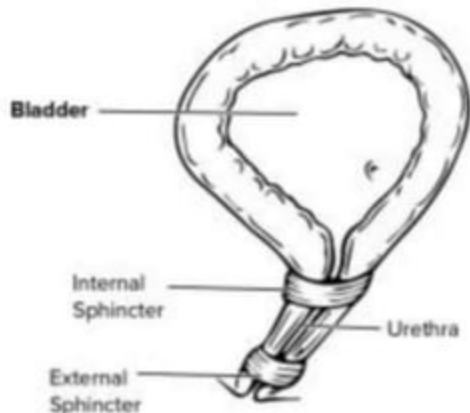
Located anteriorly to the vaginal opening and posteriorly to the clitoris.

- **Internal Urethral sphincter:**

Detrusor muscle thickened, smooth muscle, involuntary control

- **External urethral sphincter:**

Skeletal muscle, voluntary control





**THANK YOU**