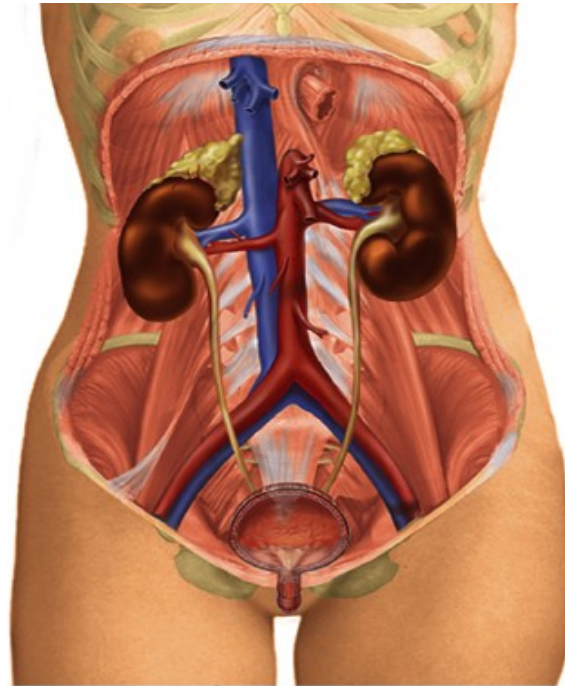


# Urinary System



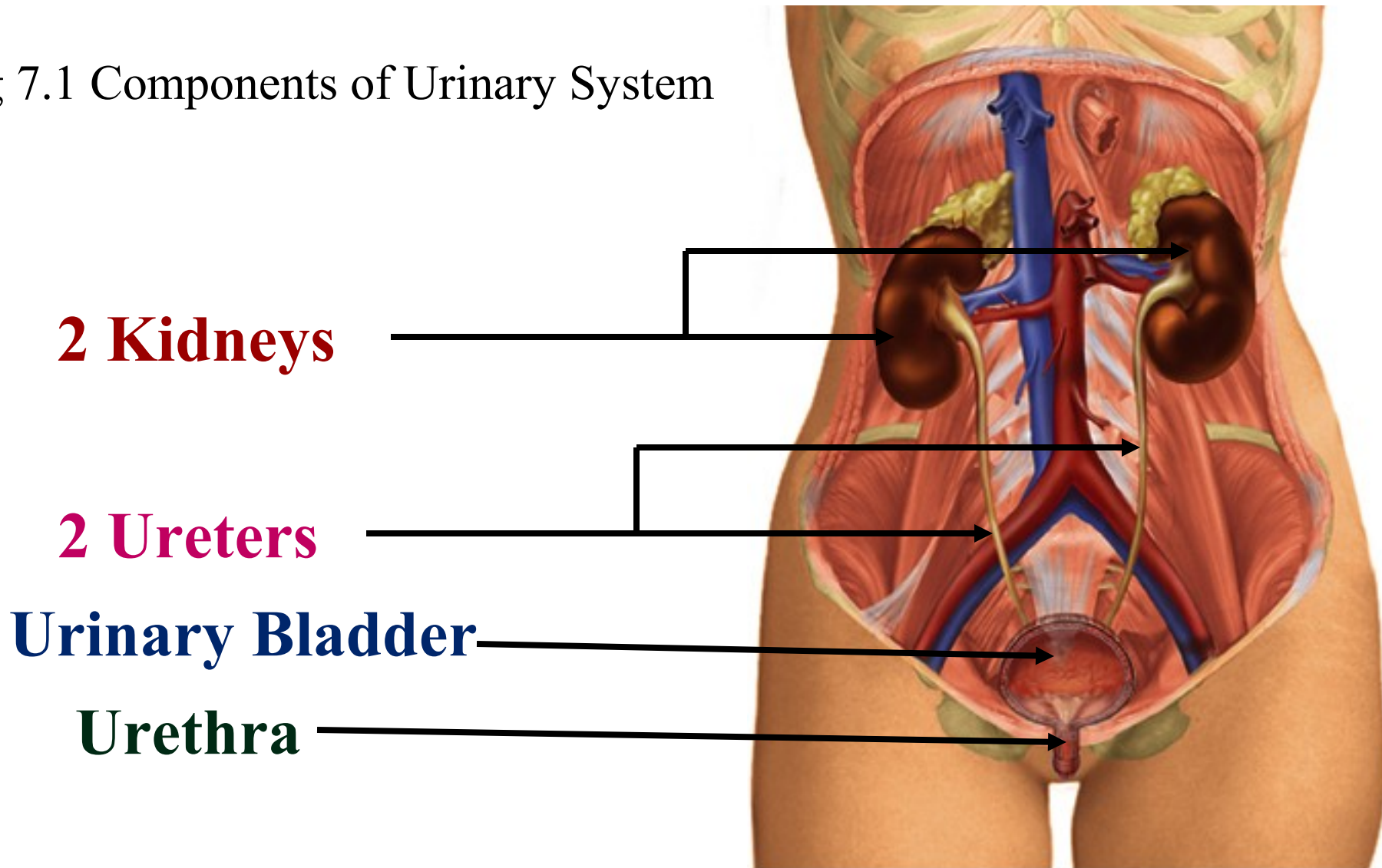
*Mr. Visanth V S  
Mayo school of Nursing  
Lucknow*

# The Urinary System

- Urinary System is one of the four excretory systems in our body. The other three are bowel, lungs & skin.

# Components of Urinary System

Fig 7.1 Components of Urinary System



- ❖ The **kidneys** remove waste products of metabolism, excess water and salts from blood and maintain the pH .
- ❖ **Ureters** convey urine from the kidneys to the urinary bladder.
- ❖ The **urinary bladder** is the muscular reservoir of urine.
- ❖ **Urethra** is the channel to the exterior.

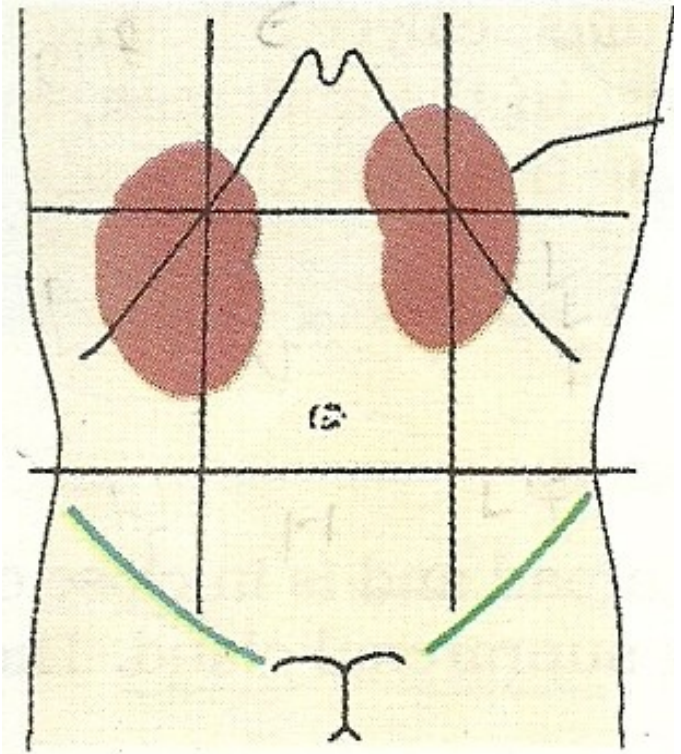
# The Kidneys/Renes

- *Definition*

- *The kidneys are a pair of excretory organs situated on the posterior abdominal wall, one on each side of the vertebral column, behind the peritoneum.*

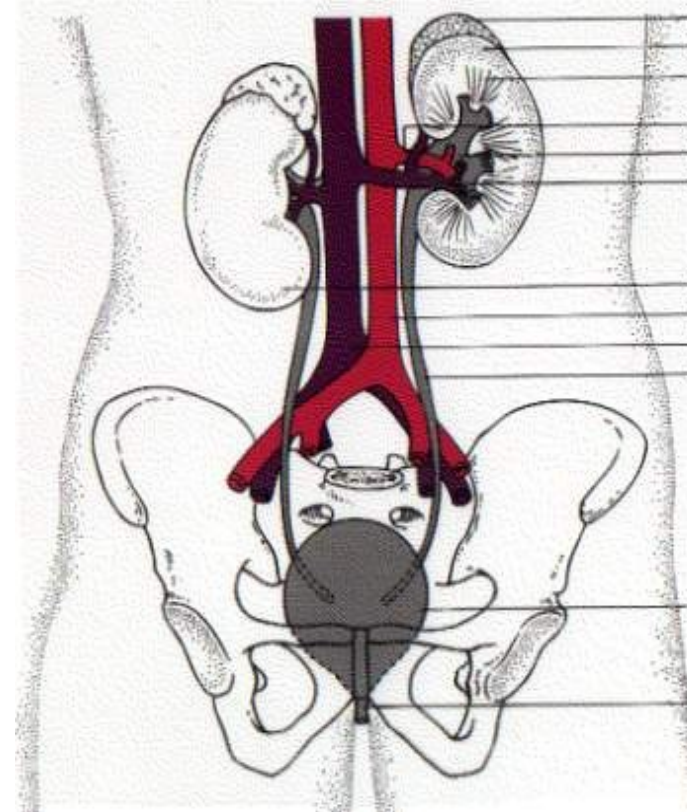
# Location

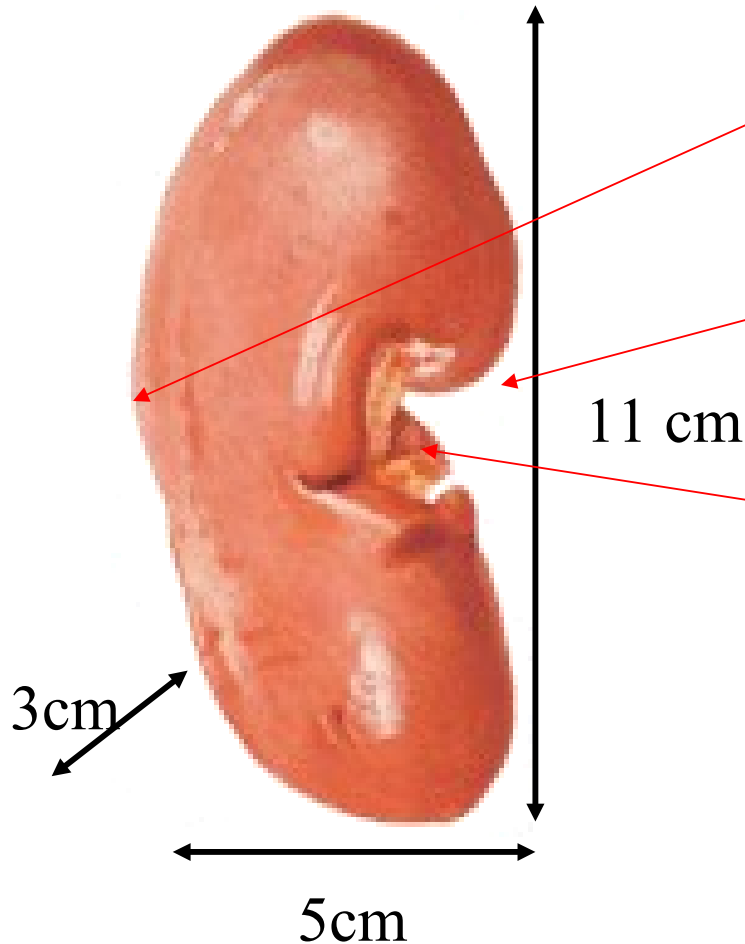
- The kidneys occupies the epigastric , hypochondriac, lumbar & umbilical regions.
- Vertically they extends from upper border of twelfth thoracic vertebra to the center of the body of third lumbar vertebra.
- The right kidney is slightly lower than the left, & the left kidney is little nearer to the median plane than the right.



# The Kidneys- Surface Anatomy

- External Features
  - Each kidney is bean shaped.
  - It has upper & lower poles, medial and lateral borders, and anterior and posterior surfaces.
  - The upper pole is broad & is in close contact with the corresponding suprarenal glands.
  - The lower pole is pointed.





- 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)

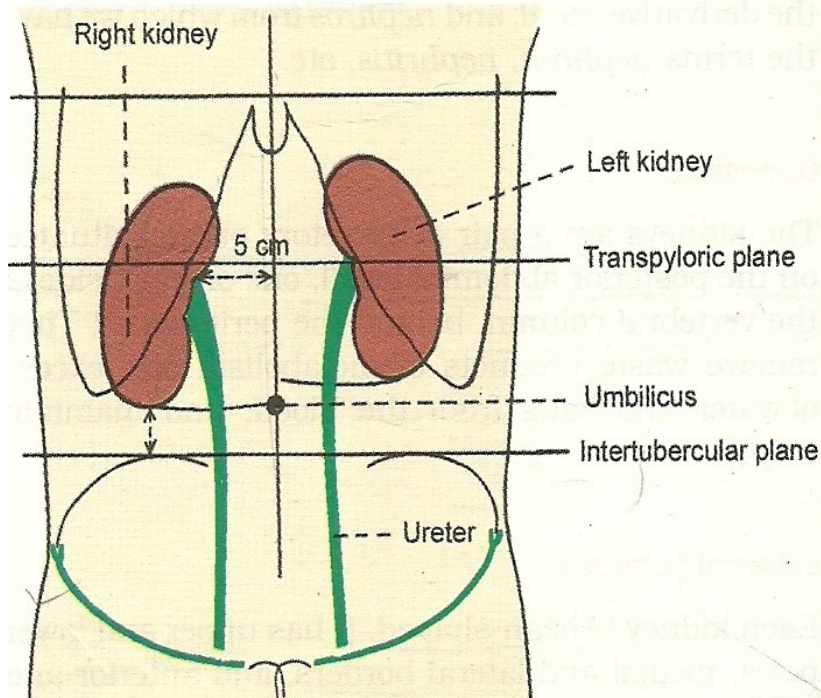


# Measurements

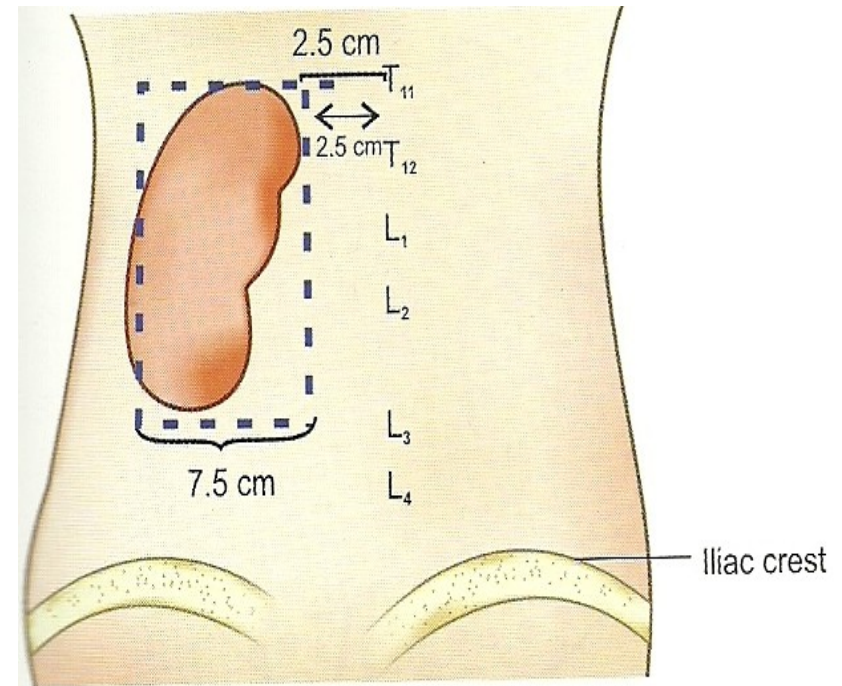
- Color : **Reddish Brown**
- Length : About 11 cm long( the left kidney is little longer & narrower than right )
- Width : 6cm broad
- Thickness : 3cm thick
- Weight
  - Males : 150gm
  - Females : 135gm

(In fetus the kidney is lobulated & is made up of about 12 lobules. After birth the lobules fuse , so that in adults the kidney is uniformly smooth)

# Surface Marking- Morris Parallelogram



Anterior aspect

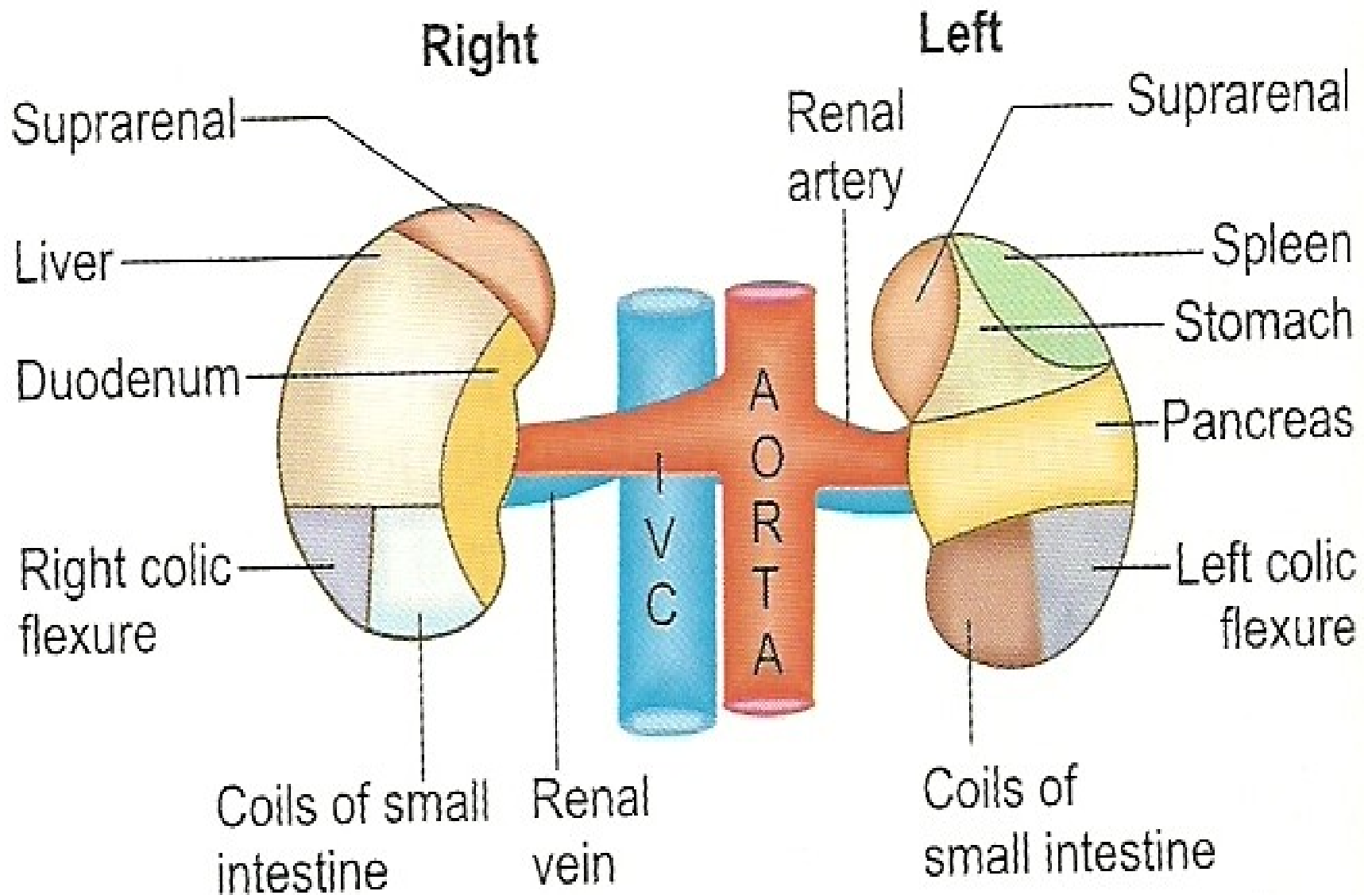


Posterior aspect

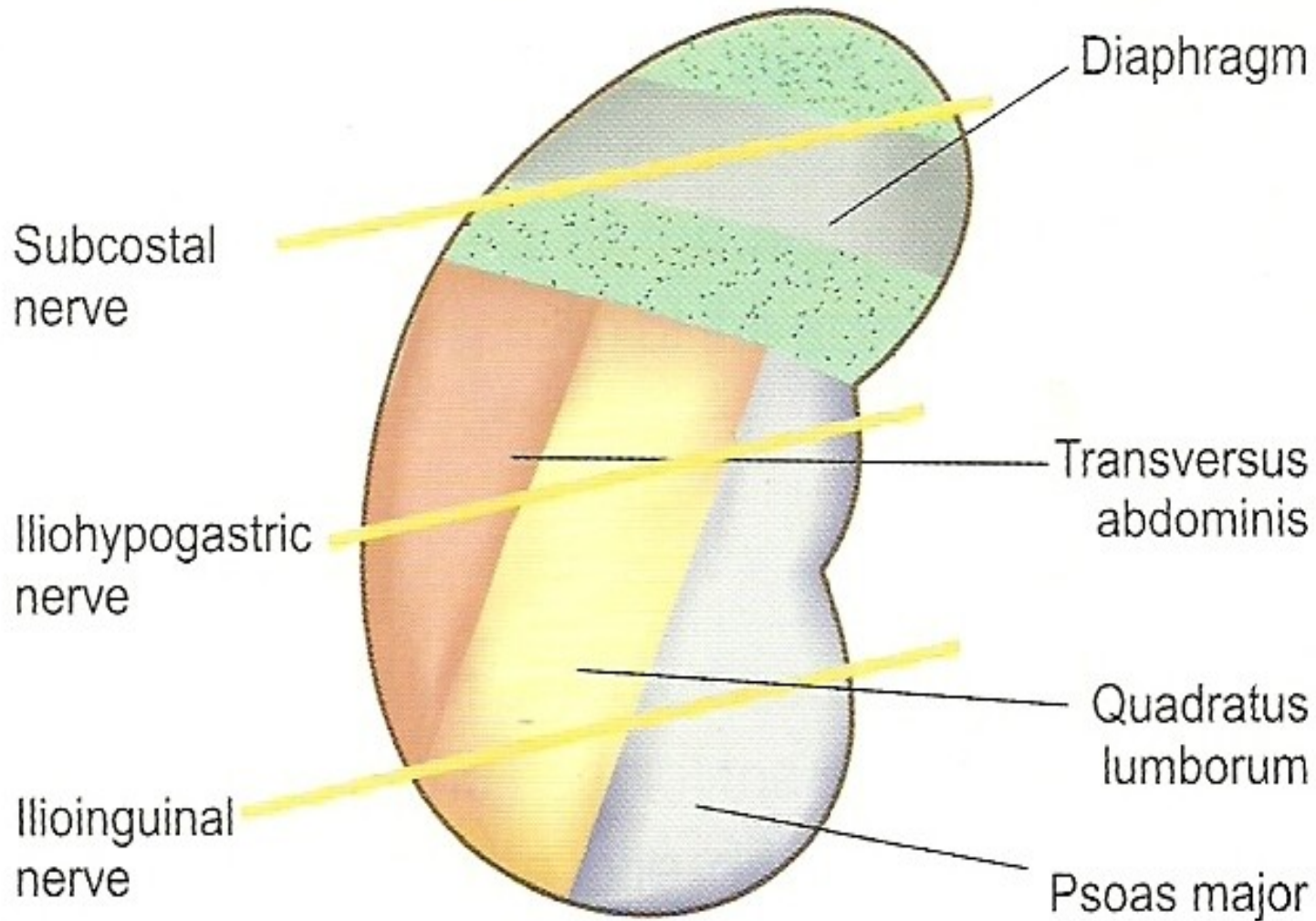
# Coverings

- It has 3 coverings
  1. Innermost fibrous capsule or true capsule
  2. Middle fatty capsule / perinephric fat-it is a collection of fatty tissue. (It acts as a shock absorber & helps to maintain the kidney in its position)
  3. The false capsule – made of renal fascia .It has two layers-*Anterior & Posterior*.  
(Superiorly the two layers enclose the supra renal gland & then merge with diaphragmatic fascia, that is why the kidneys move with respiration)

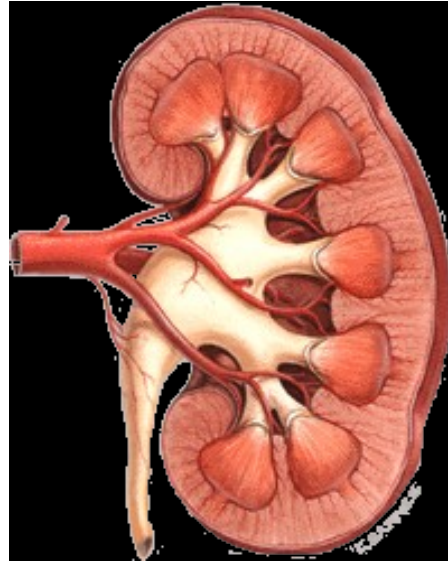
# Relations - Anterior



# Relations - Posterior

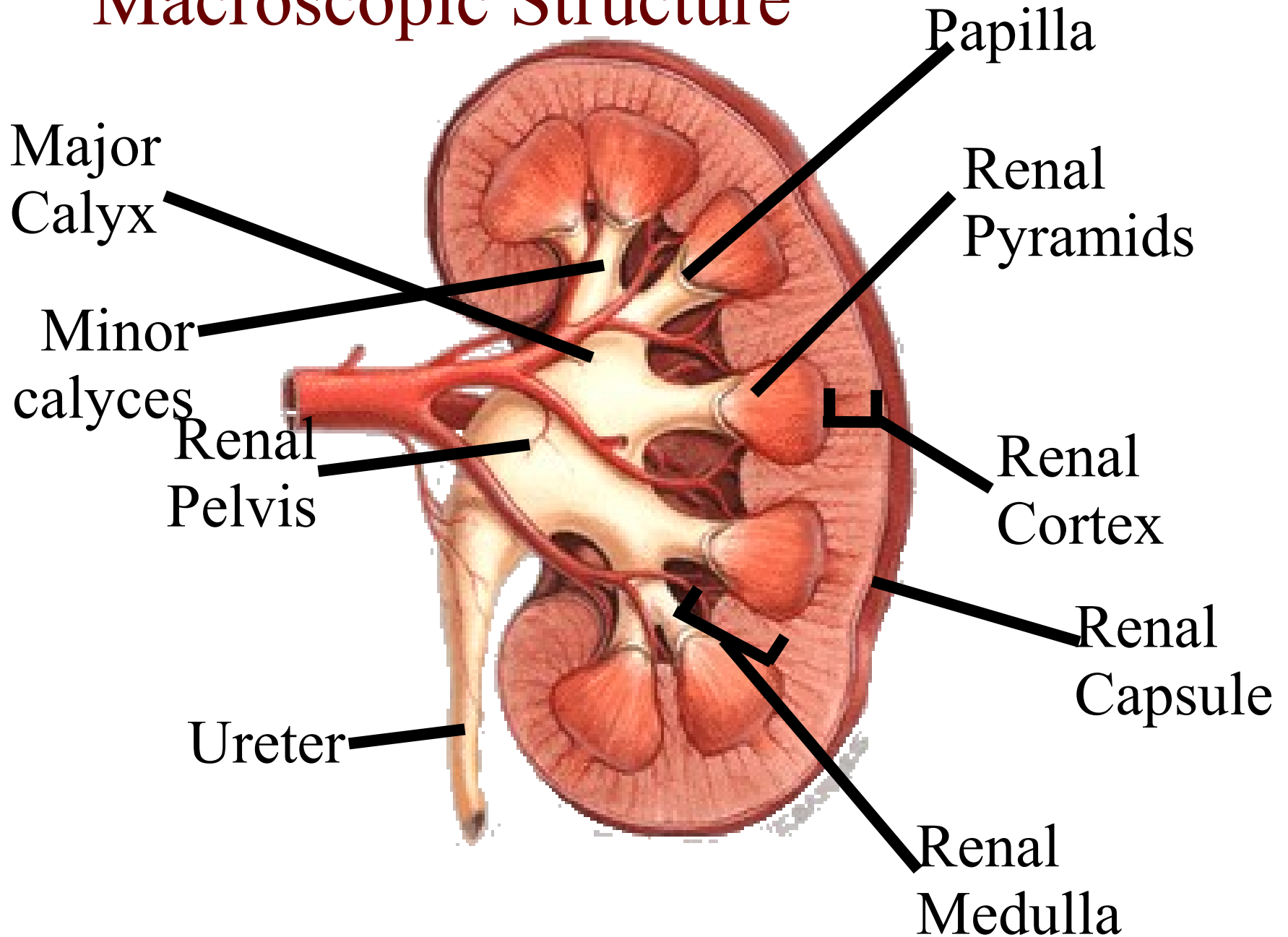


# Anatomy of Kidney



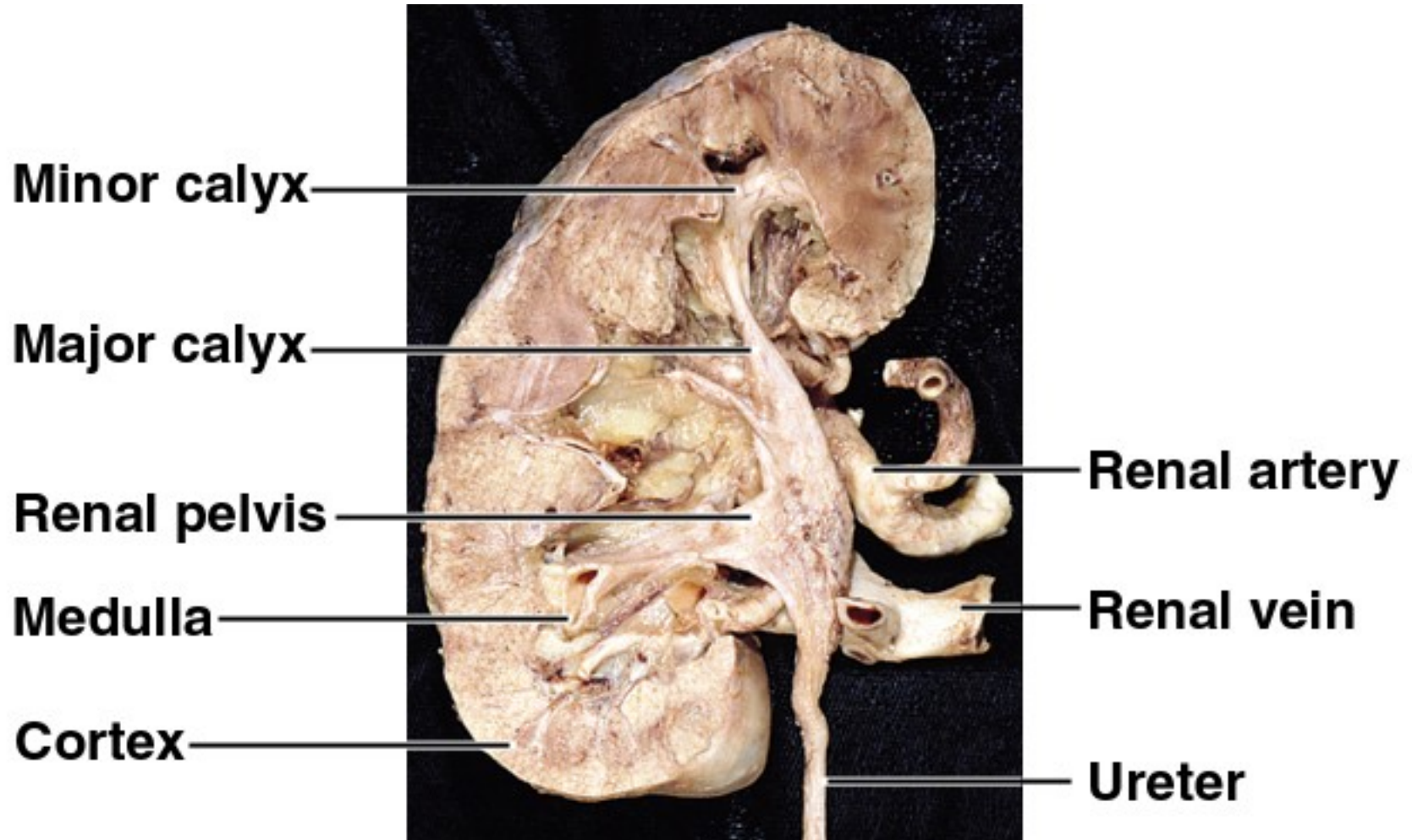
## Macroscopic Structure

# Macroscopic Structure





# Kidney: Frontal Section



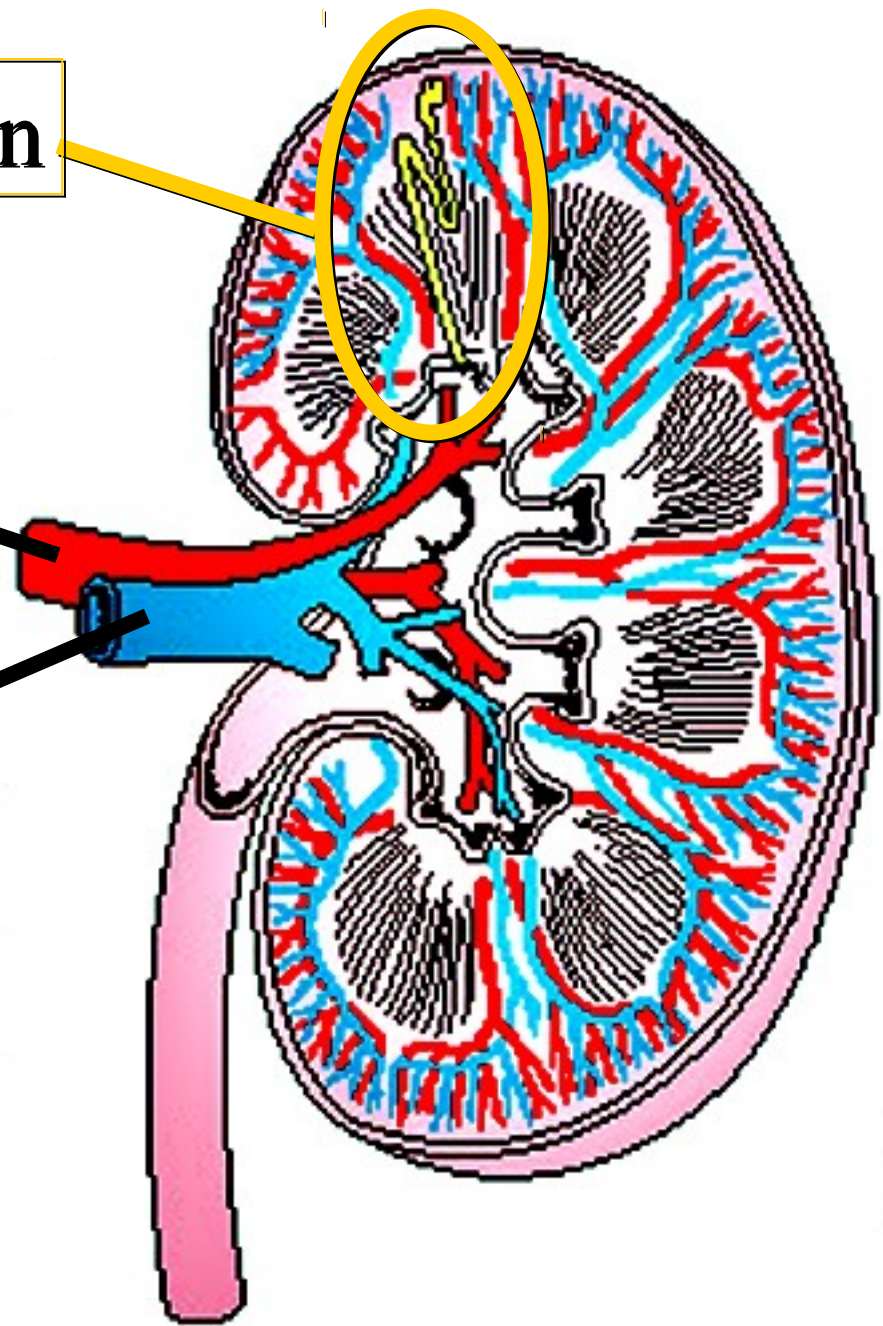
- Minor calyx: cup over papilla collects urine



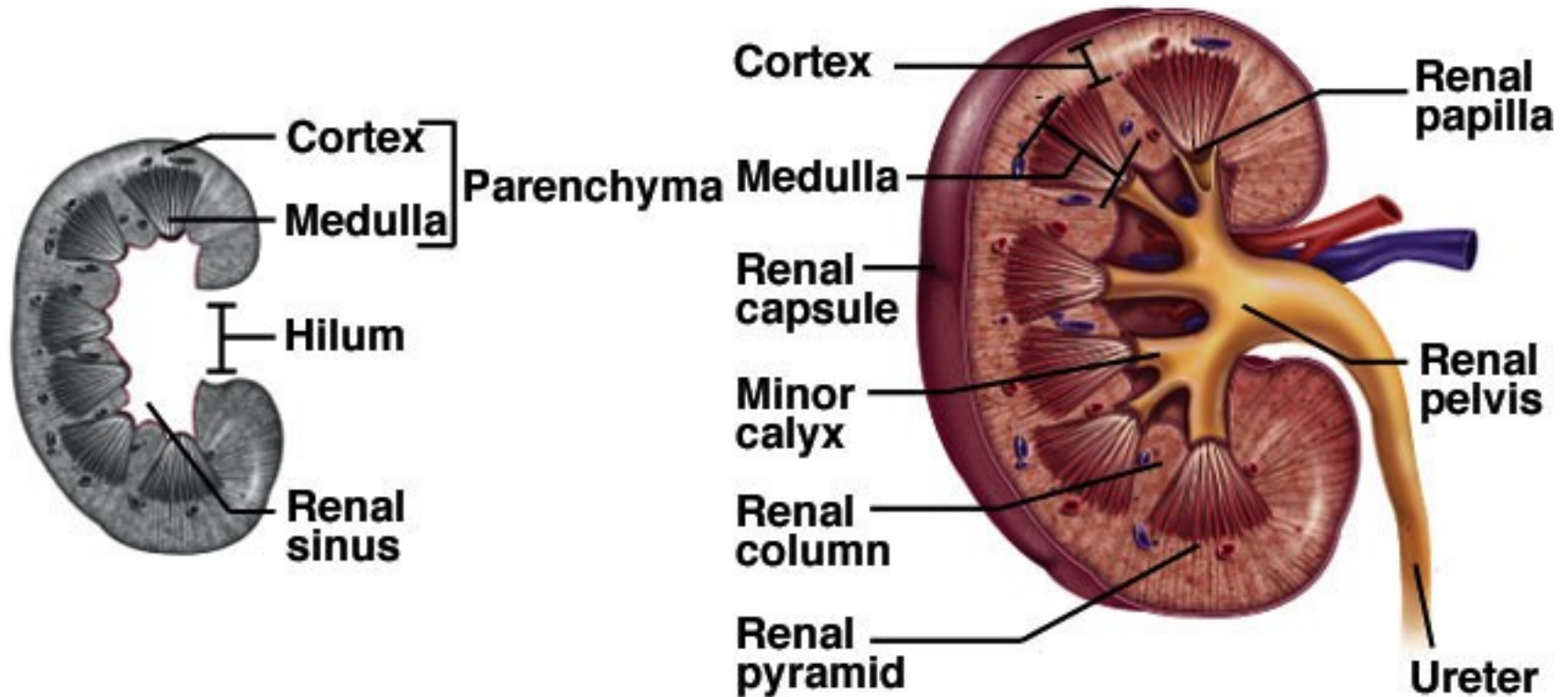
Nephron

Renal Artery

Renal Vein



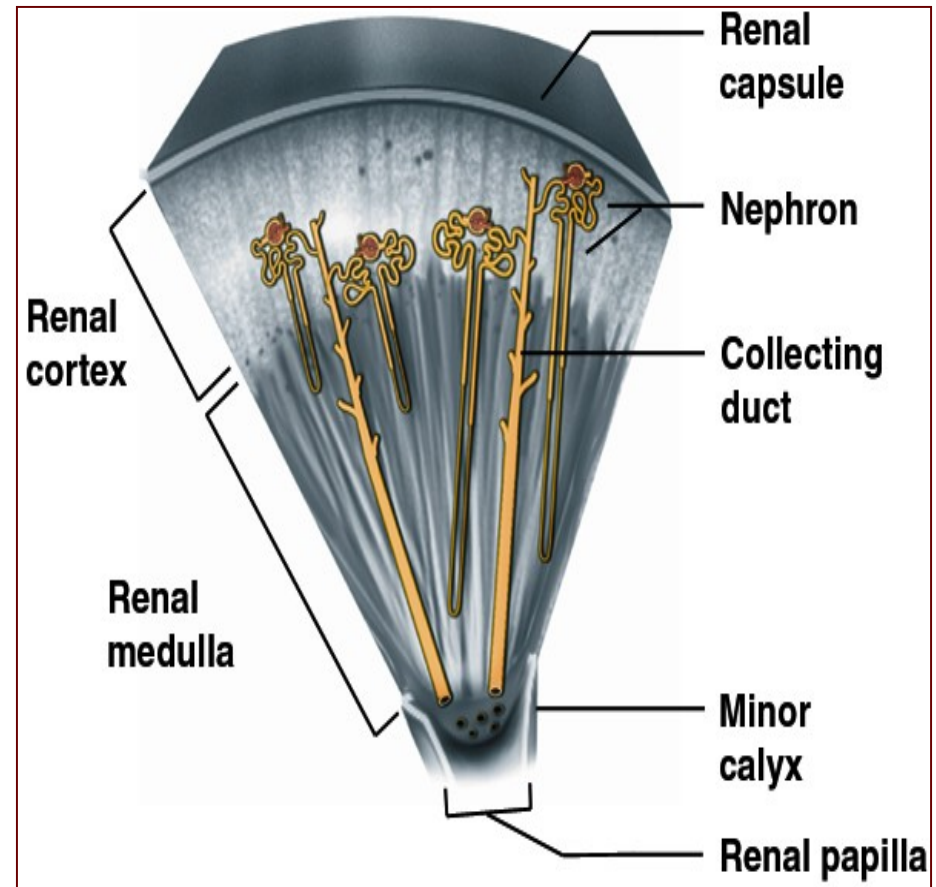
# Anatomy of Kidney



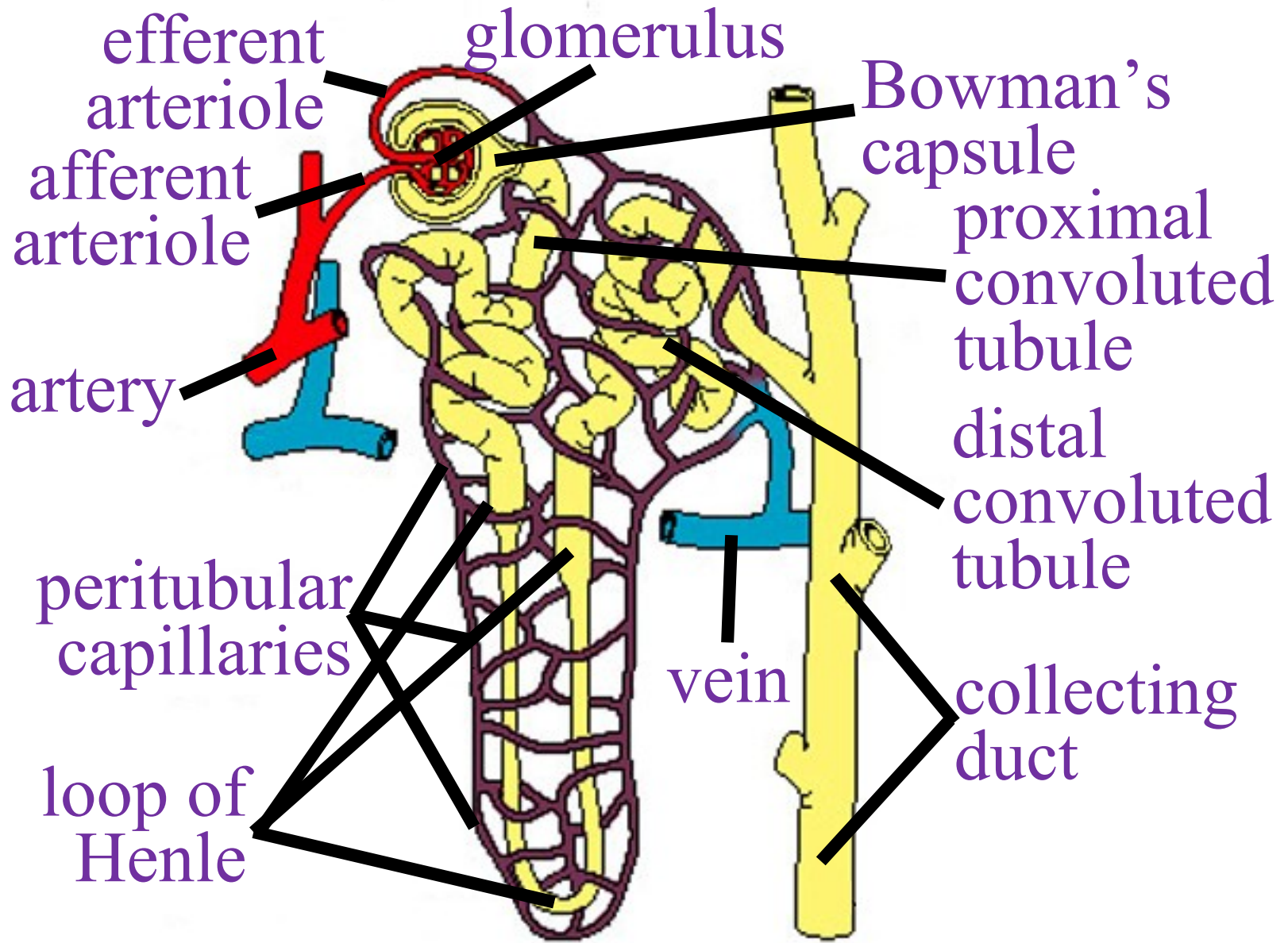
- Renal cortex: outer 1 cm
- Renal medulla: renal columns, pyramids - papilla
- Lobe of kidney: pyramid and it's overlying cortex

# Microscopic Structure(Histology)

- The kidney may be regarded as a collection of millions of uriniferous tubules.
- Each uriniferous tubule consists of an excretory part called *nephron* and of a collecting tubule.
- Each kidney contains over 1(1-2 millions) million nephrons and thousands of collecting ducts

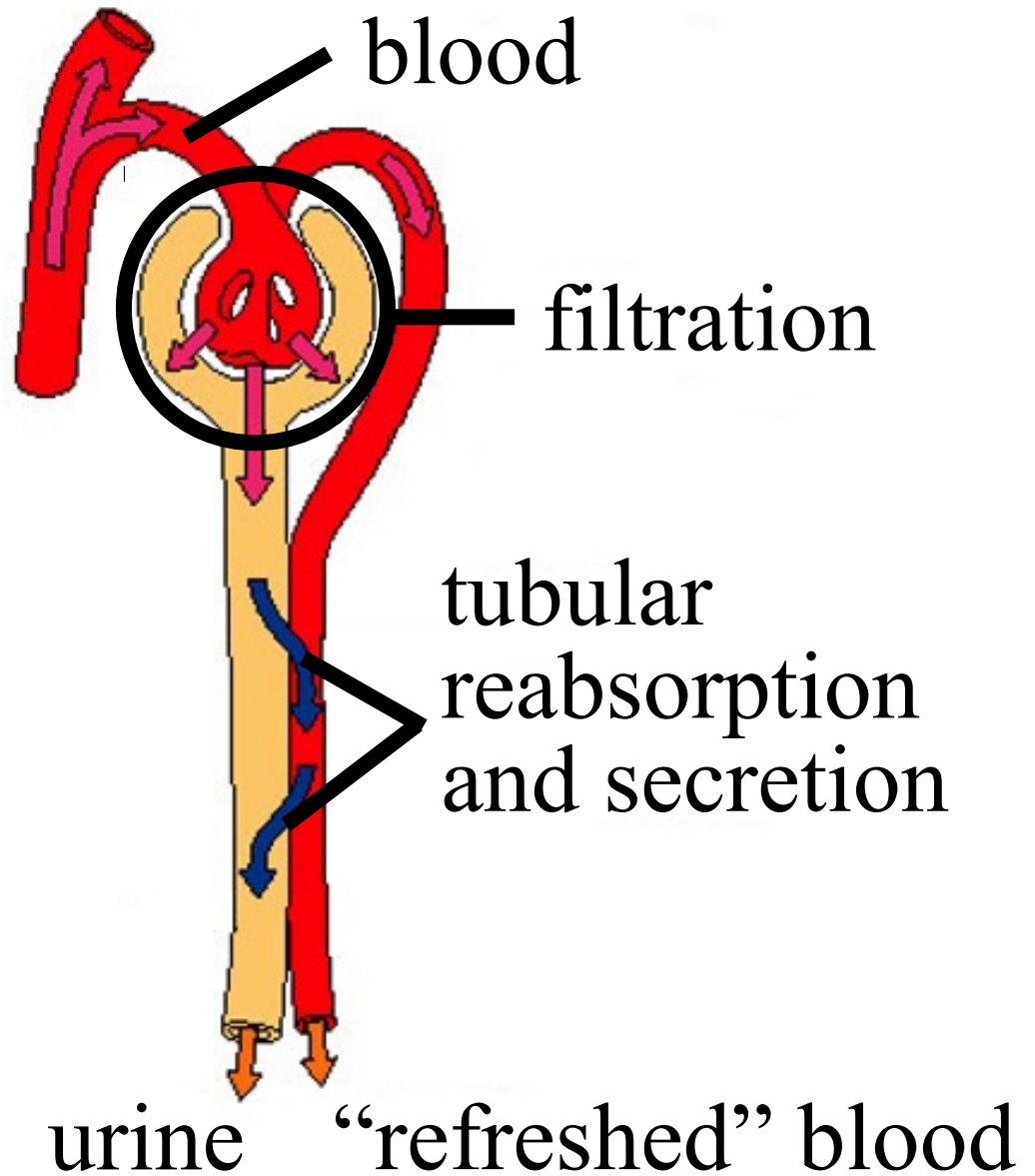


# Structure of Nephron



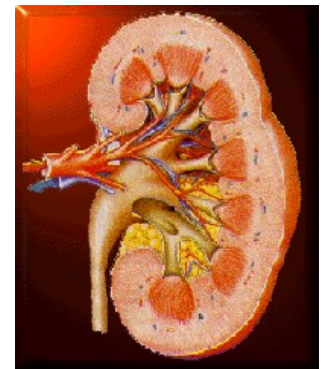


# Nephron Functioning



# Kidney Functions

- Filters blood plasma, eliminates waste, returns useful chemicals to blood
- Regulates blood volume and pressure
- Regulates osmolarity of body fluids
- Secretes renin, activates angiotensin, aldosterone
  - controls BP, electrolyte balance
- Secretes erythropoietin, controls RBC count
- Regulates  $P_{CO_2}$  and acid base balance
- Detoxifies free radicals and drugs
- Gluconeogenesis



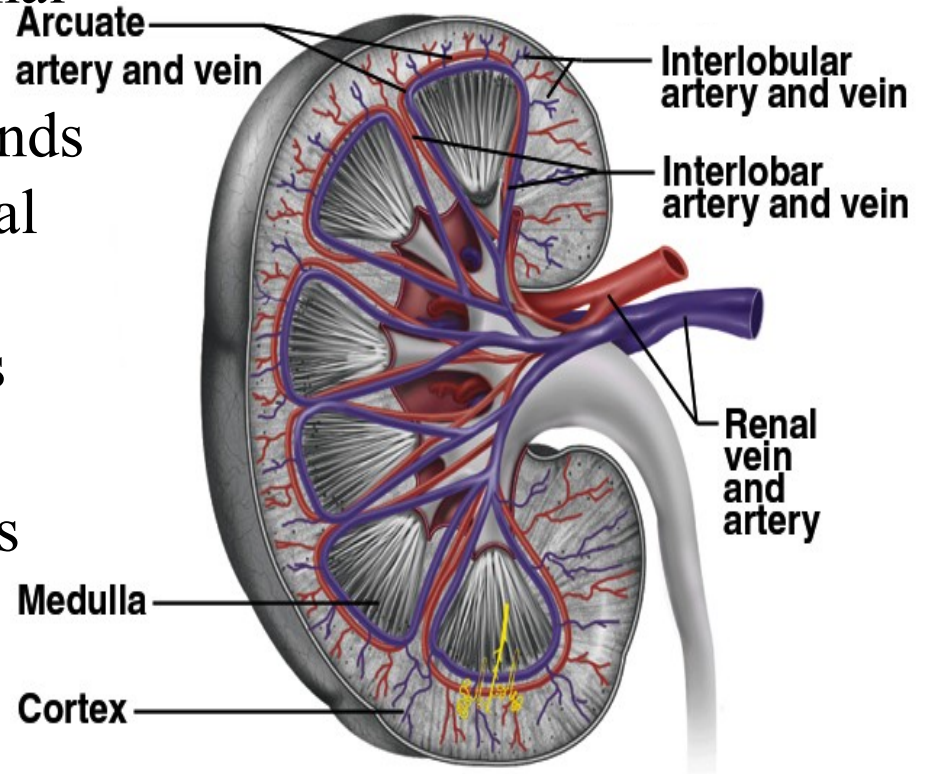
# Blood Supply Diagram

**Arterial Supply:** Renal arteries which are the direct branches of abdominal aorta & are large in size.

**Venous Drainage:** Renal veins, ends in inferior vena cava. The left renal vein is longer than the right.

**Nerve Supply:** Sympathetic fibers derived from T<sub>10</sub>, L<sub>1</sub> segments and parasympathetic fibers from vagus nerve.

**Lymphatic drainage:** into lateral aortic nodes.





# Applied Anatomy

## 1. Congenital Anomalies

1. Unilateral/ Bilateral agenesis
2. Horse shoe kidney
3. Congenital poly cystic disease
4. Ectopic kidney
5. Abnormal renal arteries may arise from aorta or superior mesenteric artery

## 2. Infections

## 3. Renal Failure

# THE URETERS

- Definition

The Ureters are a pair of narrow , thick walled muscular tubes which convey urine from the kidneys to urinary bladder.

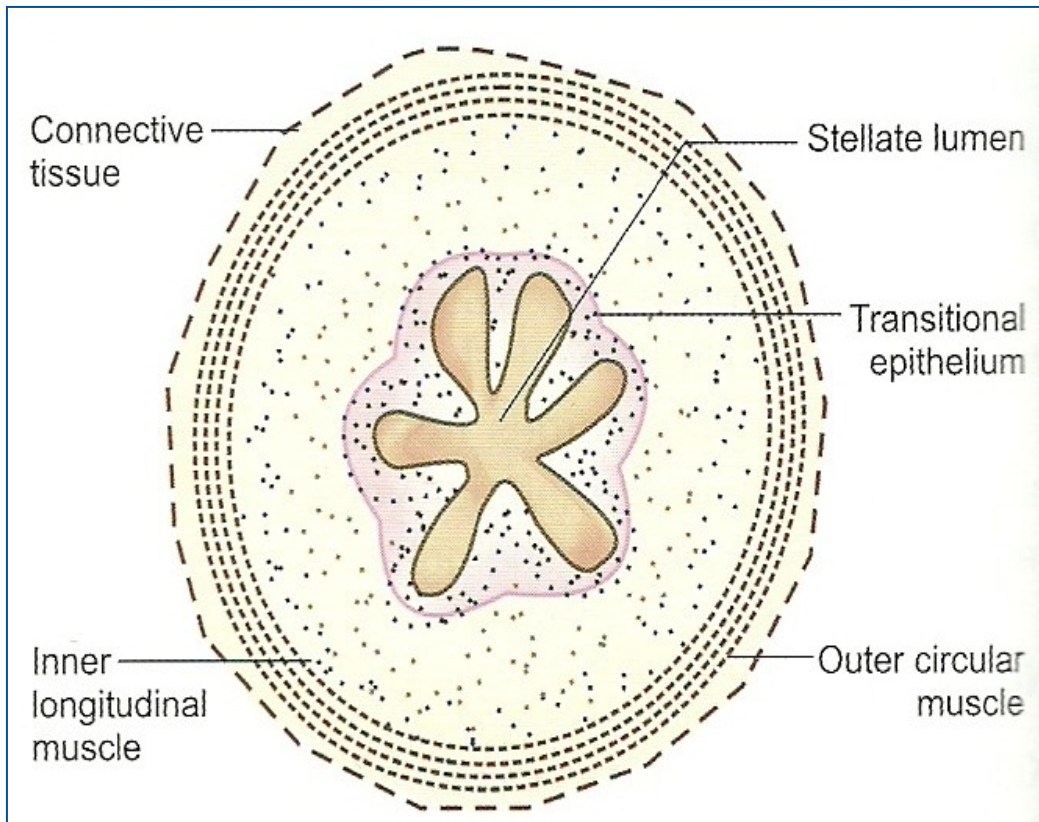
# Dimensions

- Each Ureters is about 25cm (10 inch)long.
- The upper half lies in the abdomen and the lower half in the pelvis.
- It measures 3mm diameter, but it slightly constricted at three places.
  - At the pelviureteric junction
  - At the brim of lesser pelvis
  - At its passage through the bladder wall

# Parts

- For the purpose of description, ureter is divided into 2 parts
  - From the site of origin to pelvic brim- abdominal part
  - From pelvic brim to entry into urinary bladder- pelvic part

# Ureter- Cross Section



- 3 layers of tissue
  - Outer layer
    - Fibrous tissue
  - Middle layer
    - Muscle
  - Inner layer
    - Epithelium

- **Blood Supply**

- Ureter is supplied by branches of

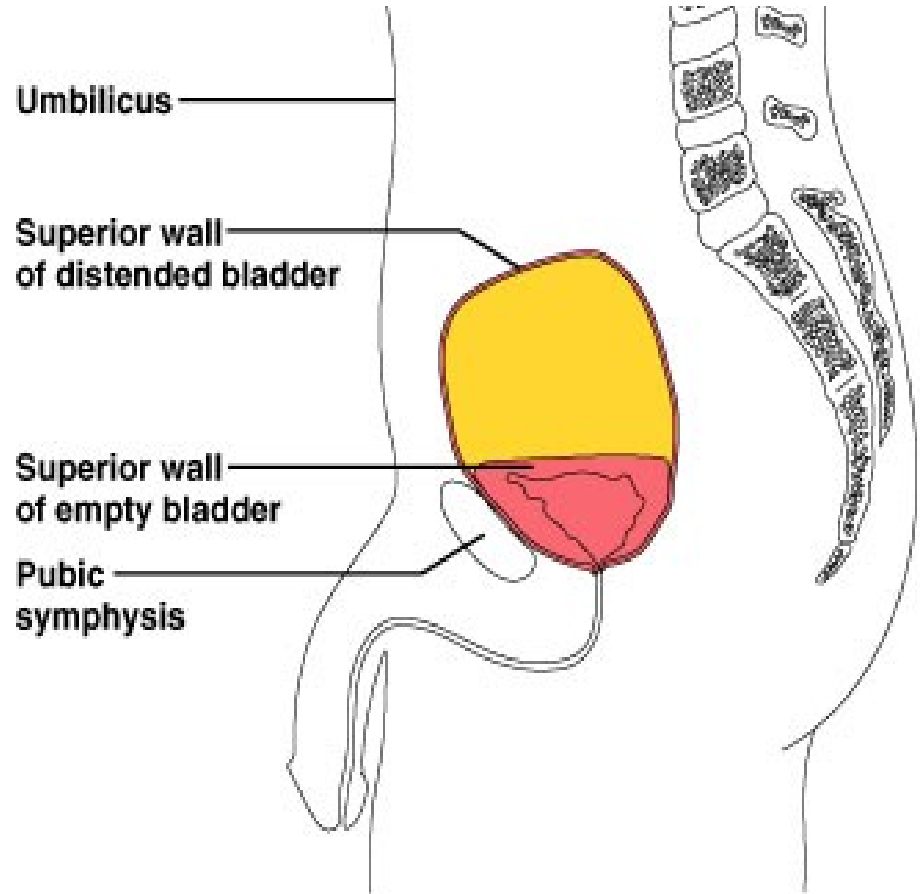
- » Renal artery
    - » Abdominal aorta
    - » Gonadal artery
    - » Common iliac artery
    - » Internal iliac artery
    - » Inferior vesical artery

- **Nerve Supply**

- Autonomic nervous system

# Urinary Bladder

- The urinary bladder is a hollow, muscular organ, which functions as the reservoir for the urine received from the kidneys and to discharge it out periodically



# Position

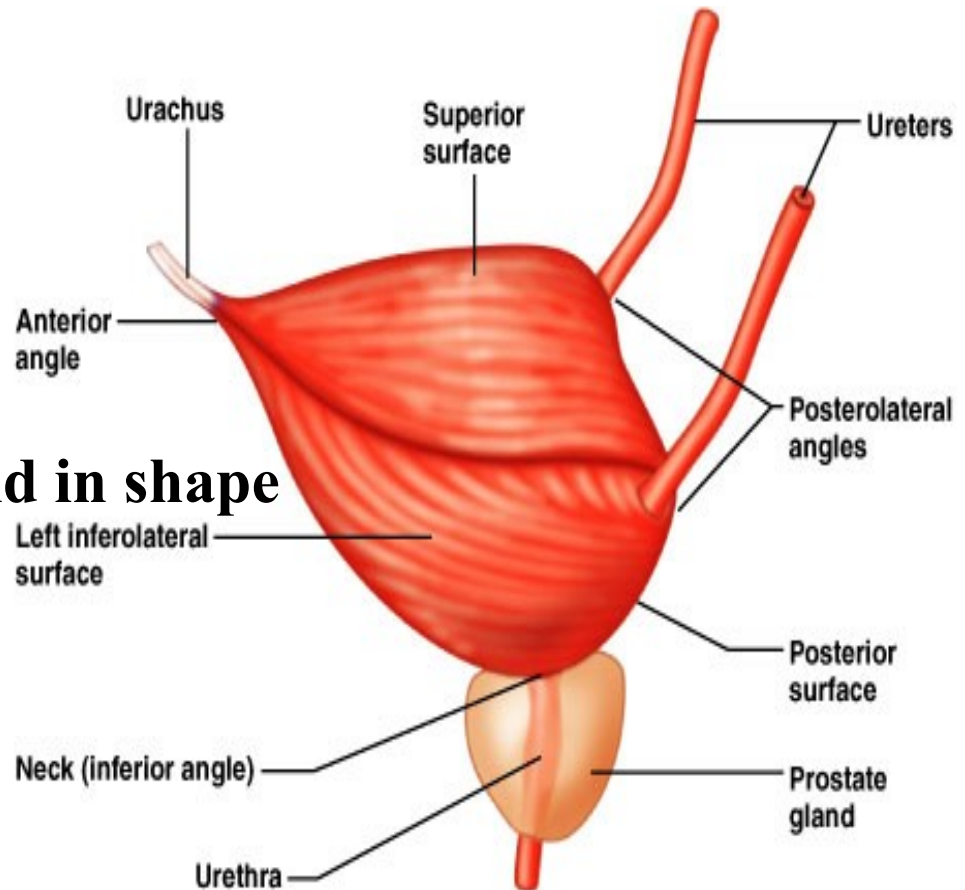
- Empty bladder , in the adult situated within the pelvis . When distended , it rises up to the abdominal cavity and becomes an abdomino-pelvic organ.
- Capacity
  - The mean capacity of the bladder is 220 ml, filling beyond 220ml causes a desire to micturate. Filling upto 500ml may be tolerated, buut it becomes painful.



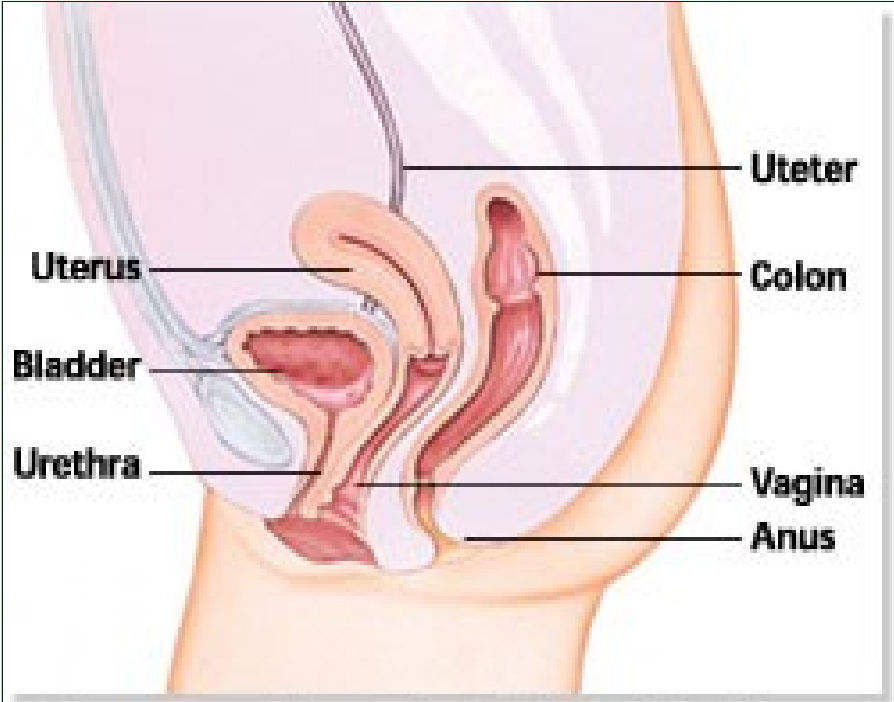
# Shape

- An empty bladder is 4 sided pyramid in shape and has
  - 4 angles -an apex, neck & 2 lateral angles
  - 4 surfaces
    - Base (posterior surface)
    - 2 inferiolateral surfaces
    - Superior surface

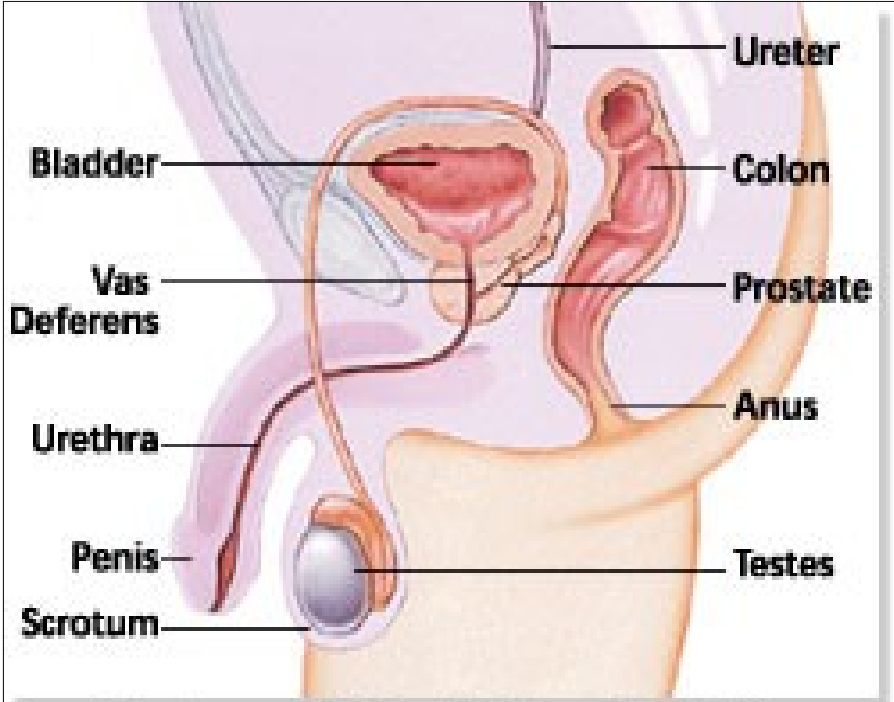
**When distended it is ovoid in shape**



# Relations

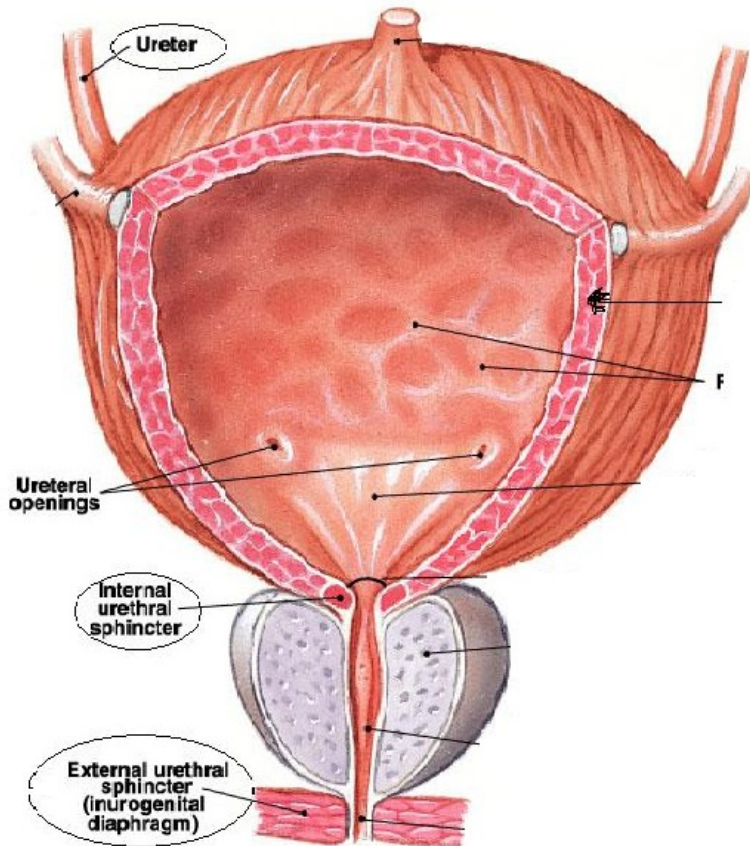


Interior of Female Pelvis - Side View



Interior of Male Pelvis - Side View

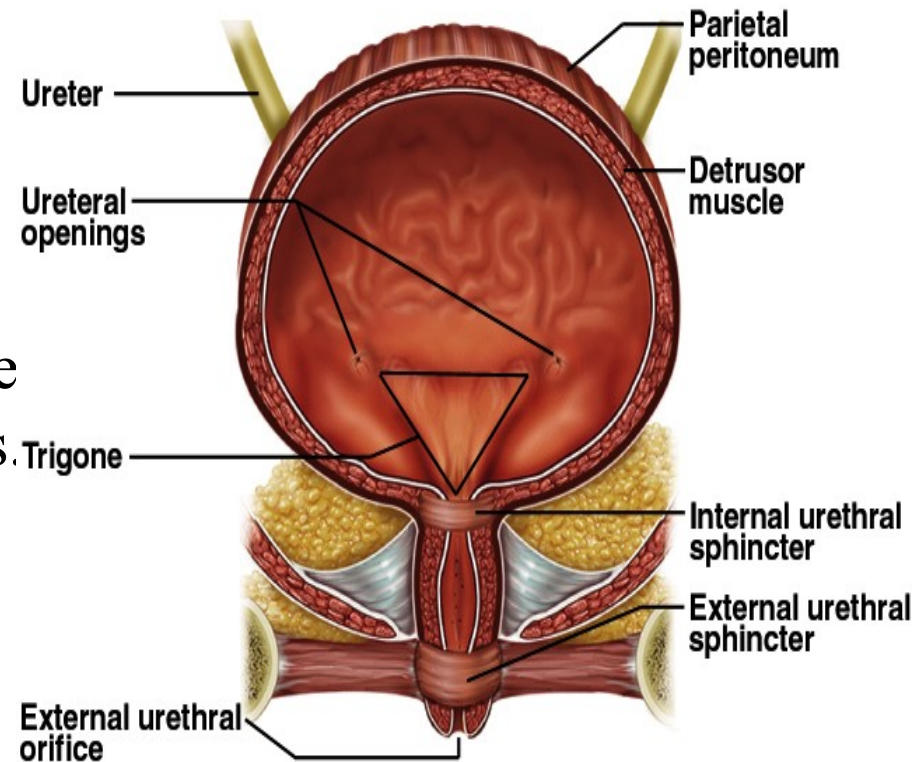
# Bladder- structure of



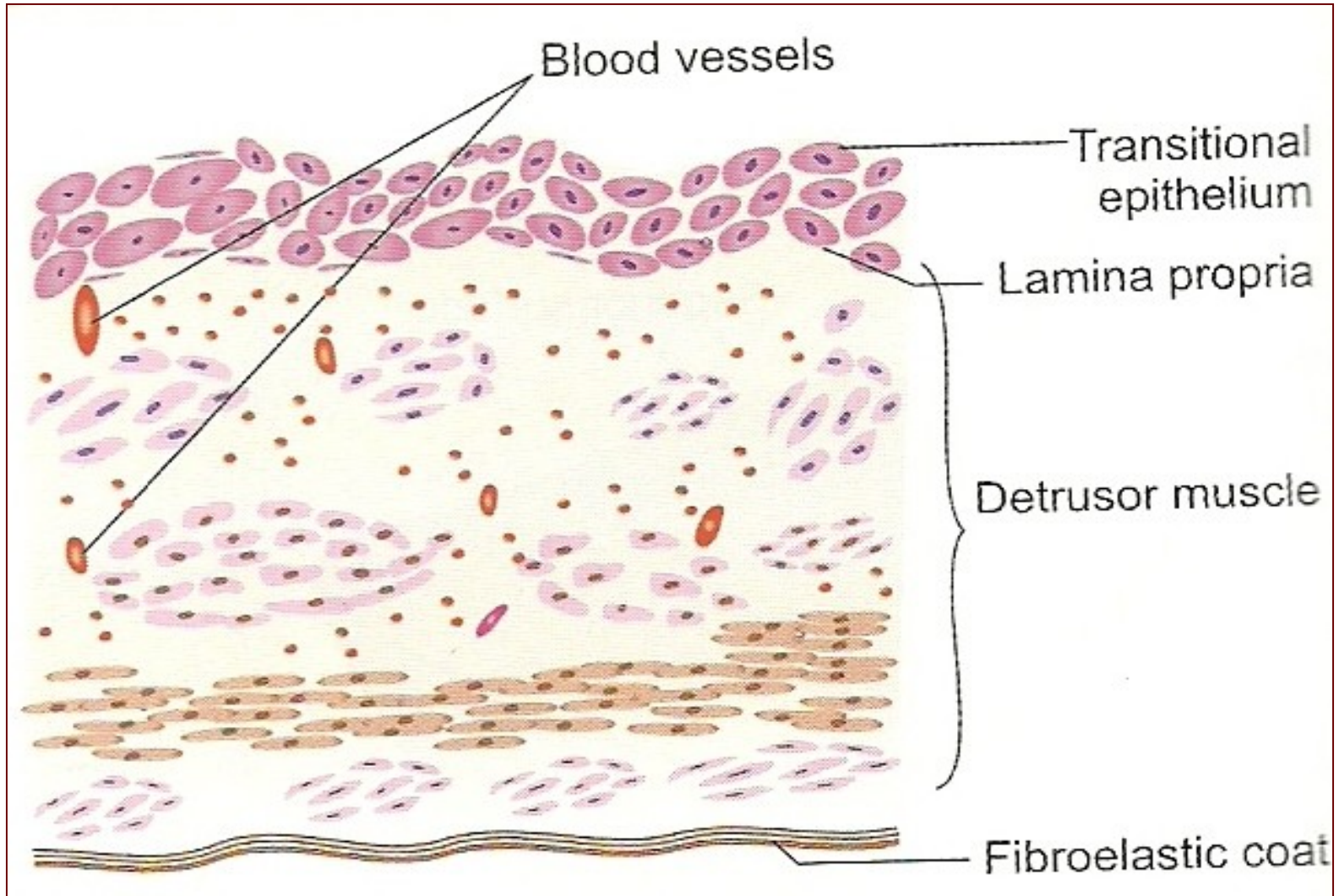
- 3 layers
  - Outer layer
    - Loose connective tissue
  - Middle layer
    - Smooth muscle and elastic fibres
  - Inner layer
    - Lined with transitional epithelium

# Interior of Bladder

- The mucous membrane is straw colored & is thrown into folds. When bladder is distended, these folds disappear.
- The posterior wall shows a smooth triangular area called *trigone*. There are no mucous folds in this region.
- At the upper lateral angles of the trigone are the ureteric openings.
- At its inferior angle is the internal urethral orifice



# Histology



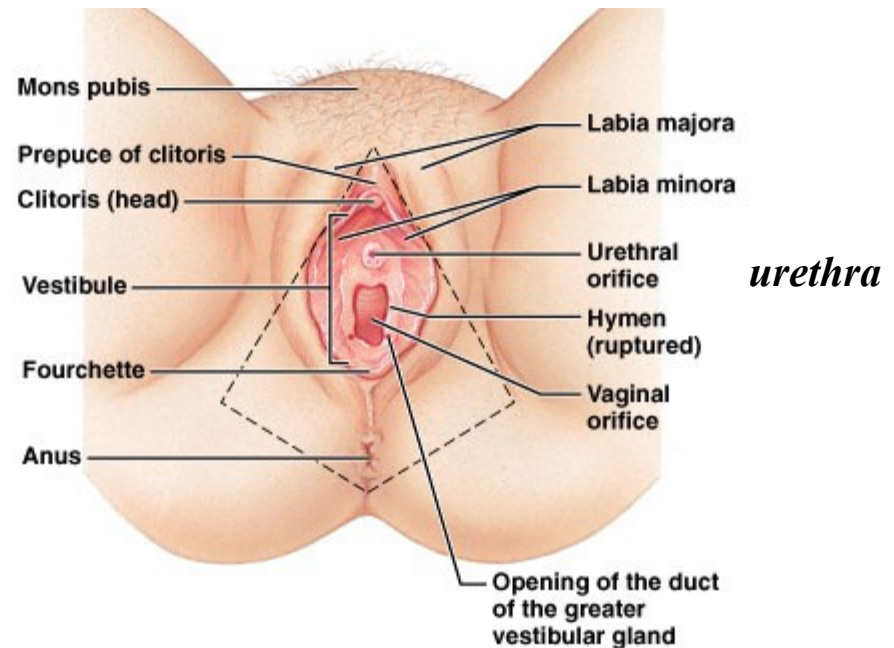
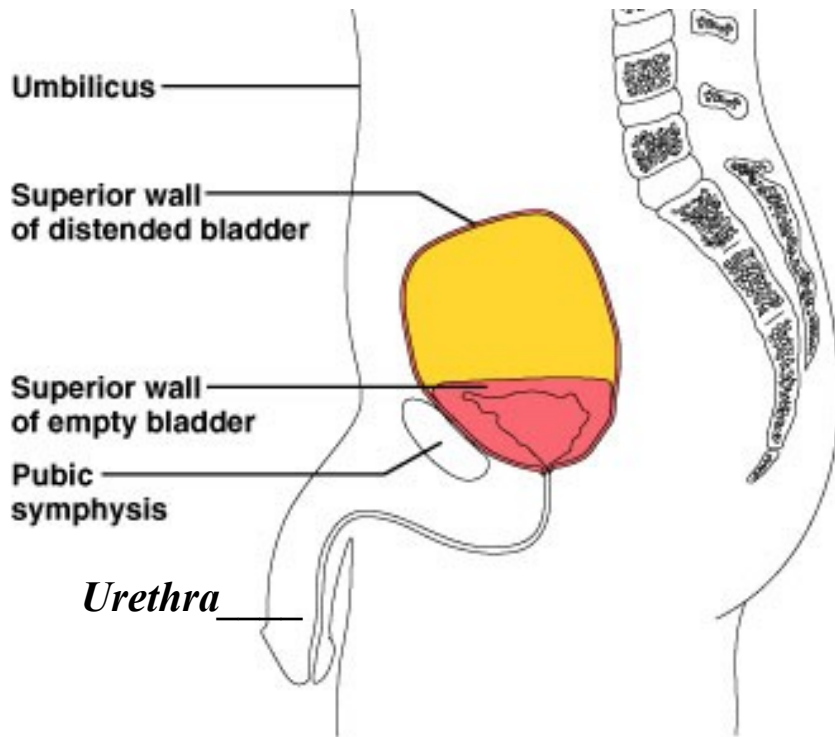
# Applied Anatomy

- Congenital Anomalies
  - Ectopia vesicae
- Infection –Cystitis
- Neurological lesions
- Rupture of bladder
- Cancer bladder
- Urinary Incontinence

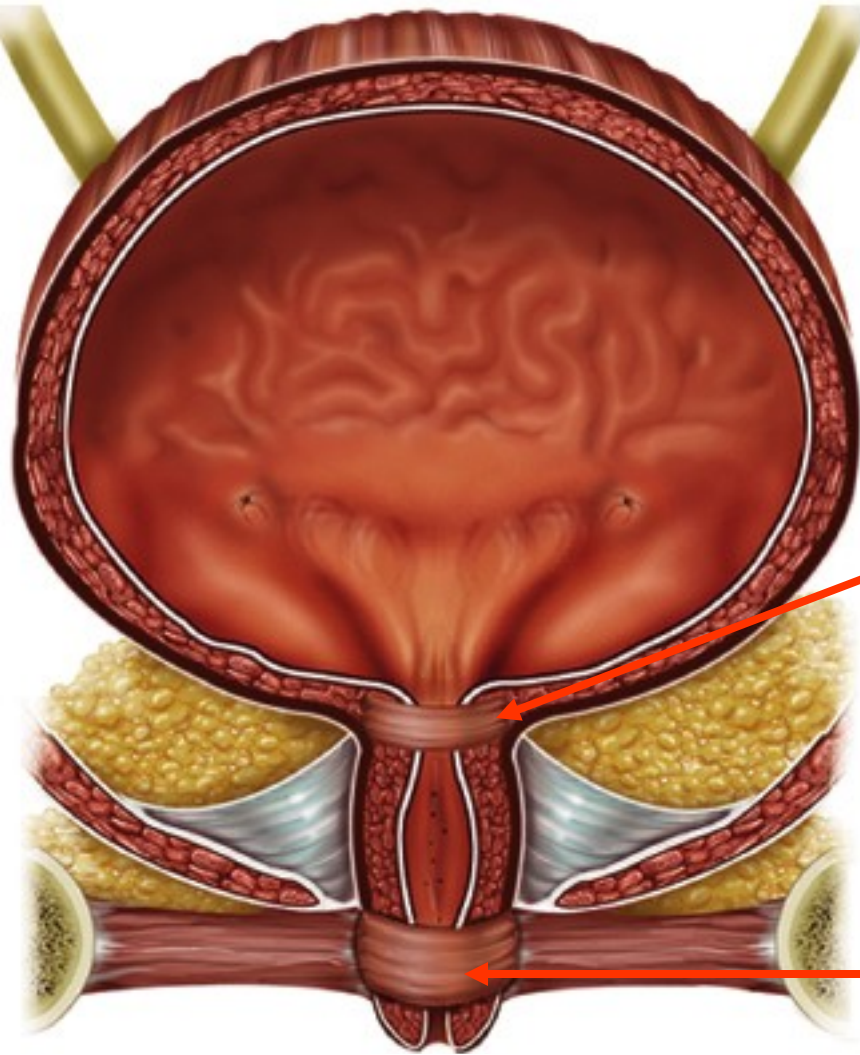


# The Urethra

- The urethra is a canal extending from the neck of the bladder to the exterior, at the external urethral orifice.
- Male: about 20 cm (8”) long
- Female: 3-4 cm (1.5”) long
  - Short length is why females have more urinary tract infections than males - ascending bacteria from stool contamination



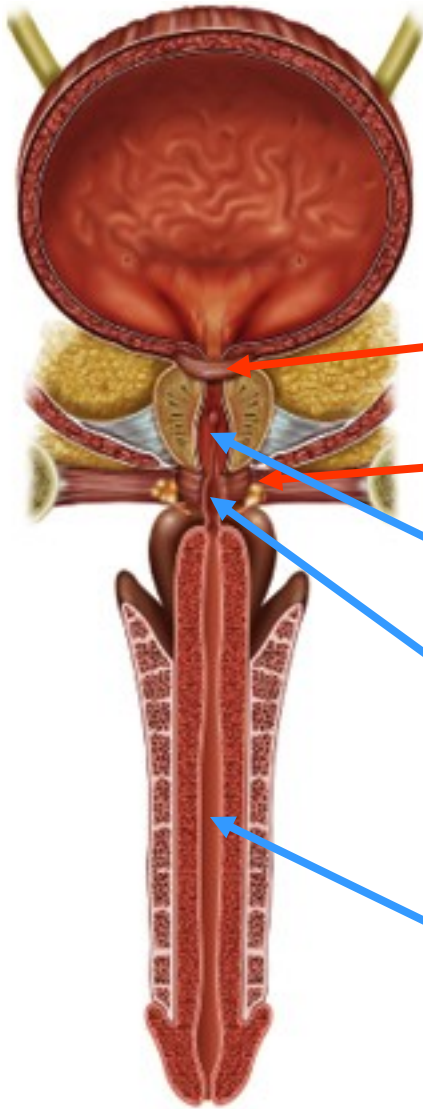
# Female Urethra



- 3 to 4 cm long
- External urethral orifice
  - between vaginal orifice and clitoris
- Internal urethral sphincter
  - detrusor muscle thickened, smooth muscle, involuntary control
- External urethral sphincter
  - skeletal muscle, voluntary control



# Male Bladder and Urethra



- 18 cm long
- Internal urethral sphincter
- External urethral sphincter
- 3 regions
  - prostatic urethra
    - during orgasm receives semen
  - membranous urethra
    - passes through pelvic cavity
  - penile urethra

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