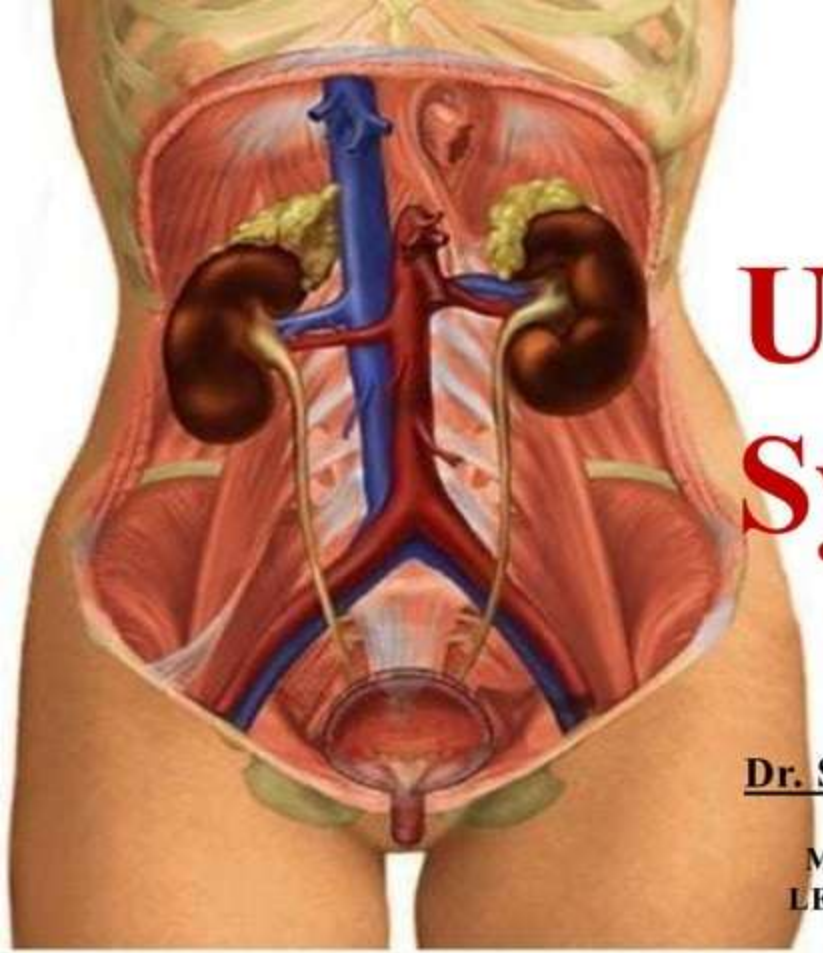

Urinary System

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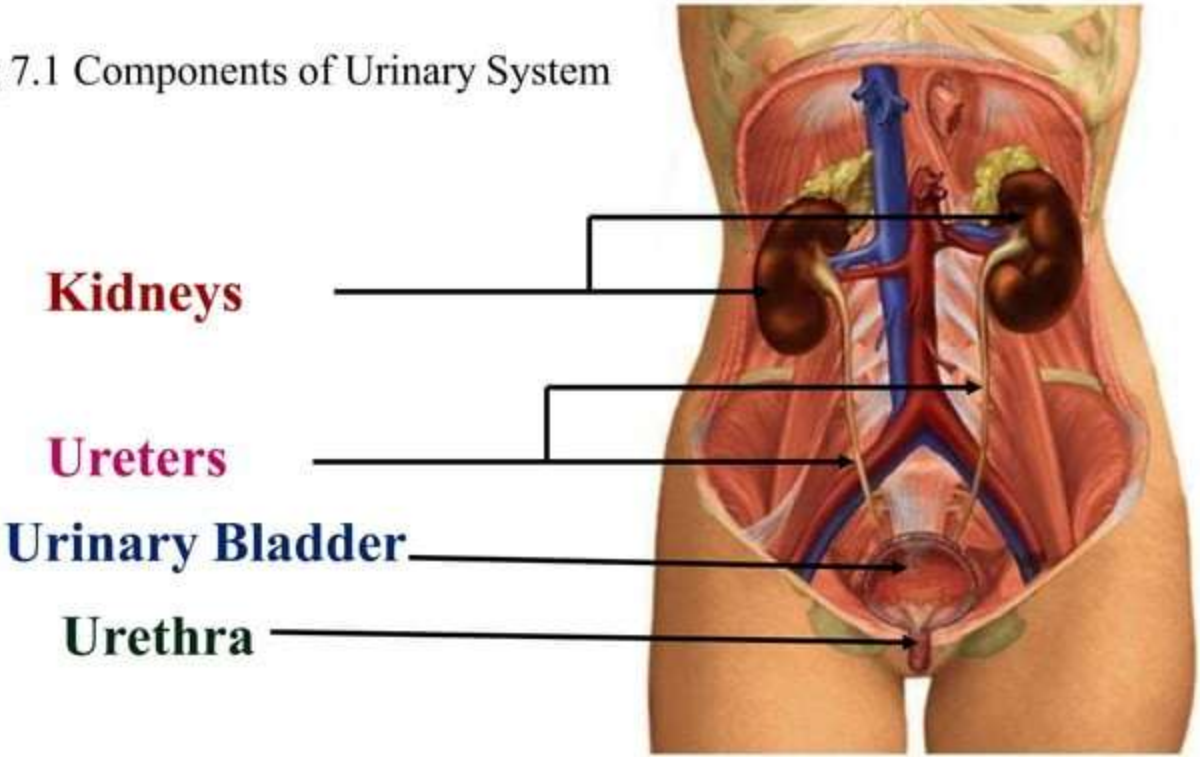
LECTURER [LIHS][LCPS]

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.

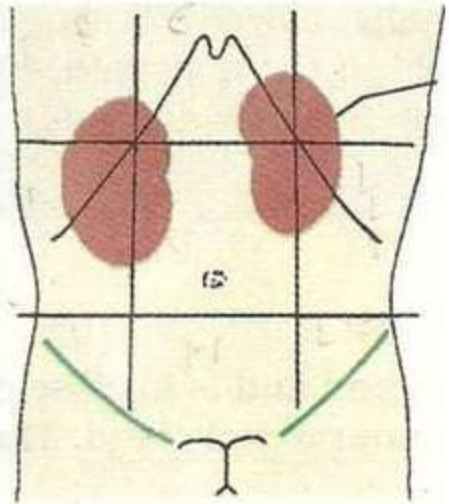
The Kidneys/Renes

- ***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.***

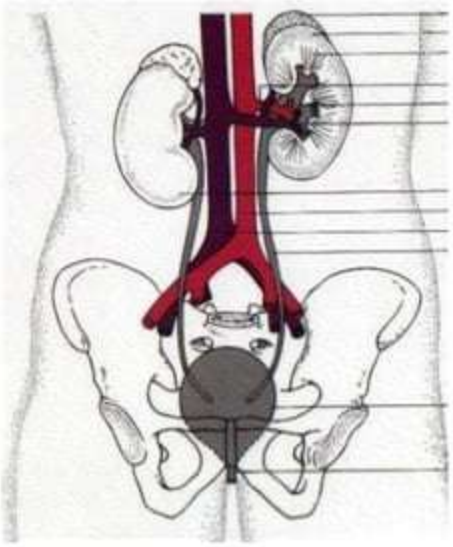
Location

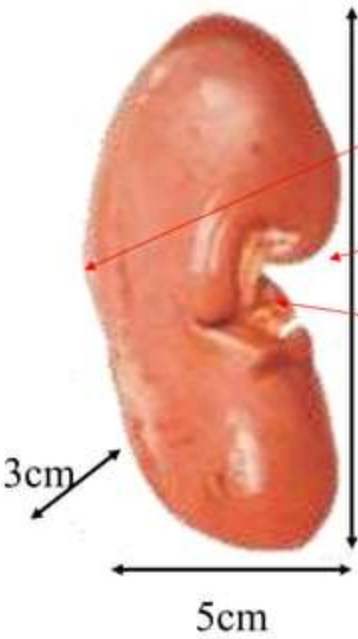
- The kidneys occupies the epigastric , hypochondriac, lumbar & umbilical regions.
- Vertically they extends from upper border of twelfth thoracic vertebra to the center of the body of third lumbar vertebra.
- The right kidney is slightly lower than the left, & the left kidney is little nearer to the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





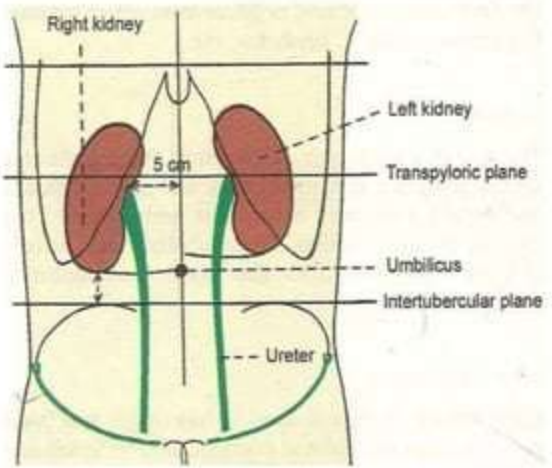
- The lateral border is convex.
- The medial border is concave.
- The middle part of the medial border is depressed and is known as hilum (hilus)

Measurements

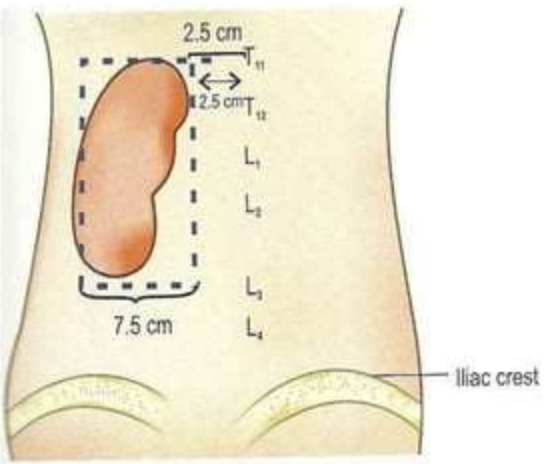
- Color : **Reddish Brown**
- Length : About 11 cm long(the left kidney is little longer & narrower than right)
- Width : 6cm broad
- Thickness : 3cm thick
- Weight
  - Males : 150gm
  - Females : 135gm

(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



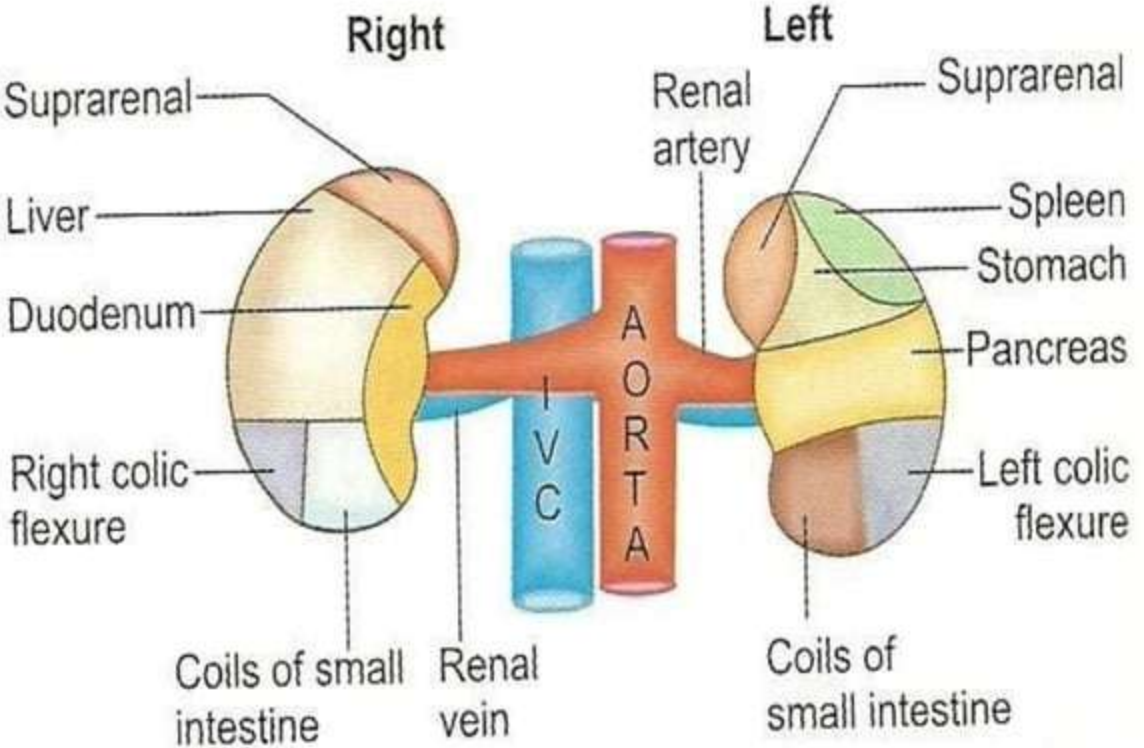
Posterior aspect

Coverings

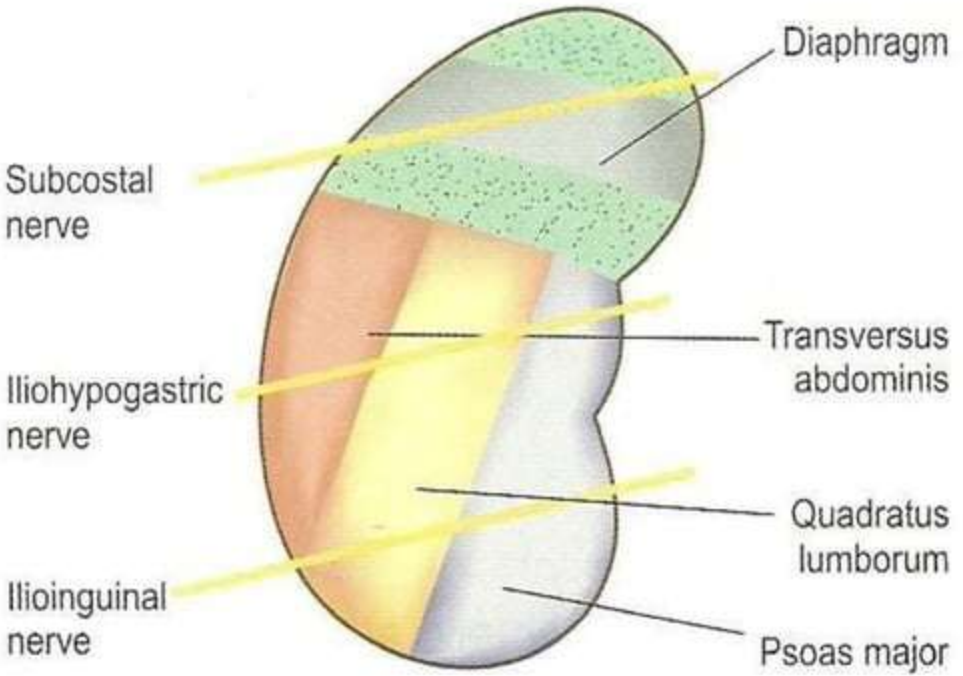
- It has 3 coverings
  1. Innermost fibrous capsule or true capsule
  2. Middle fatty capsule / perinephric fat-it is a collection of fatty tissue. (It acts as a shock absorber & helps to maintain the kidney in its position)
  3. The false capsule – made of renal fascia .It has two layers-***Anterior*** & ***Posterior.***

     (Superiorly the two layers enclose the supra renal gland & then merge with diaphragmatic fascia, that is why the kidneys move with respiration)

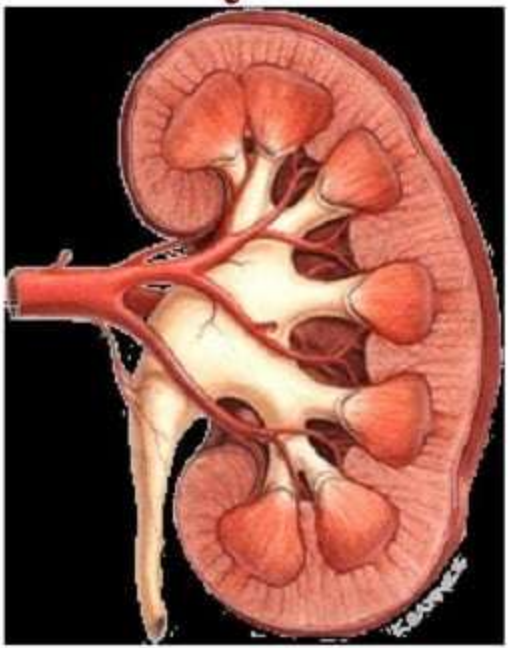
Relations - Anterior



Relations - Posterior

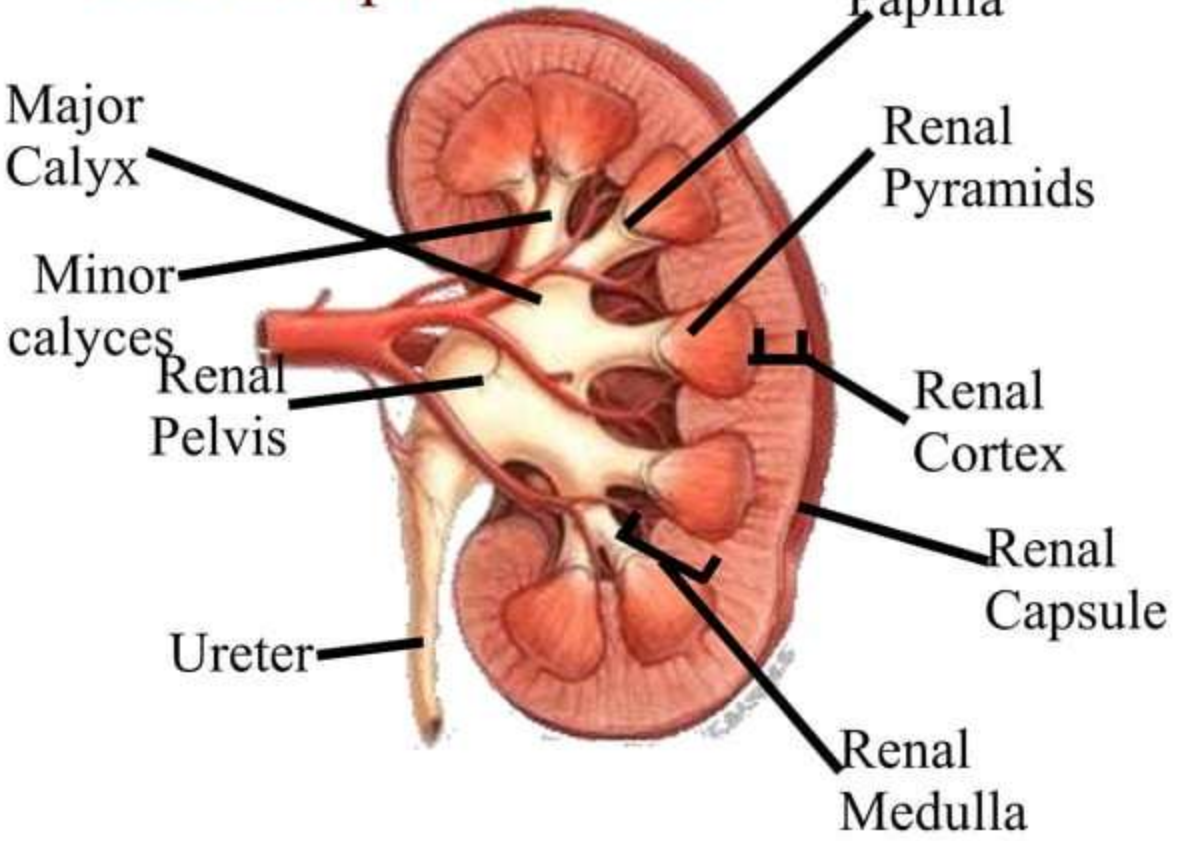


Anatomy of Kidney

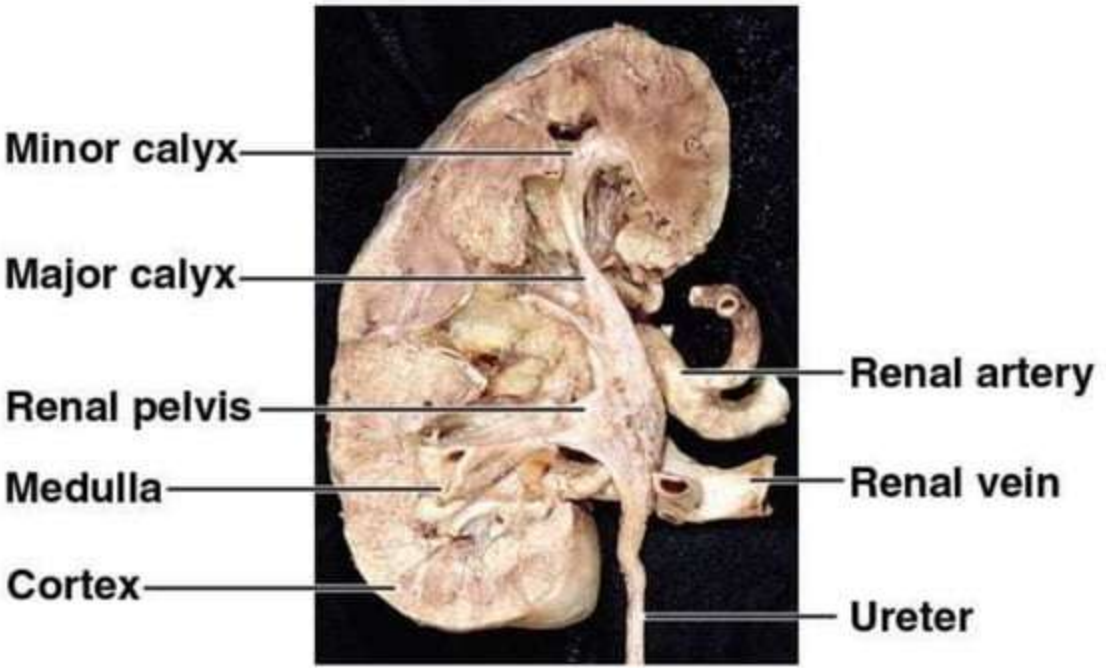


Macroscopic Structure

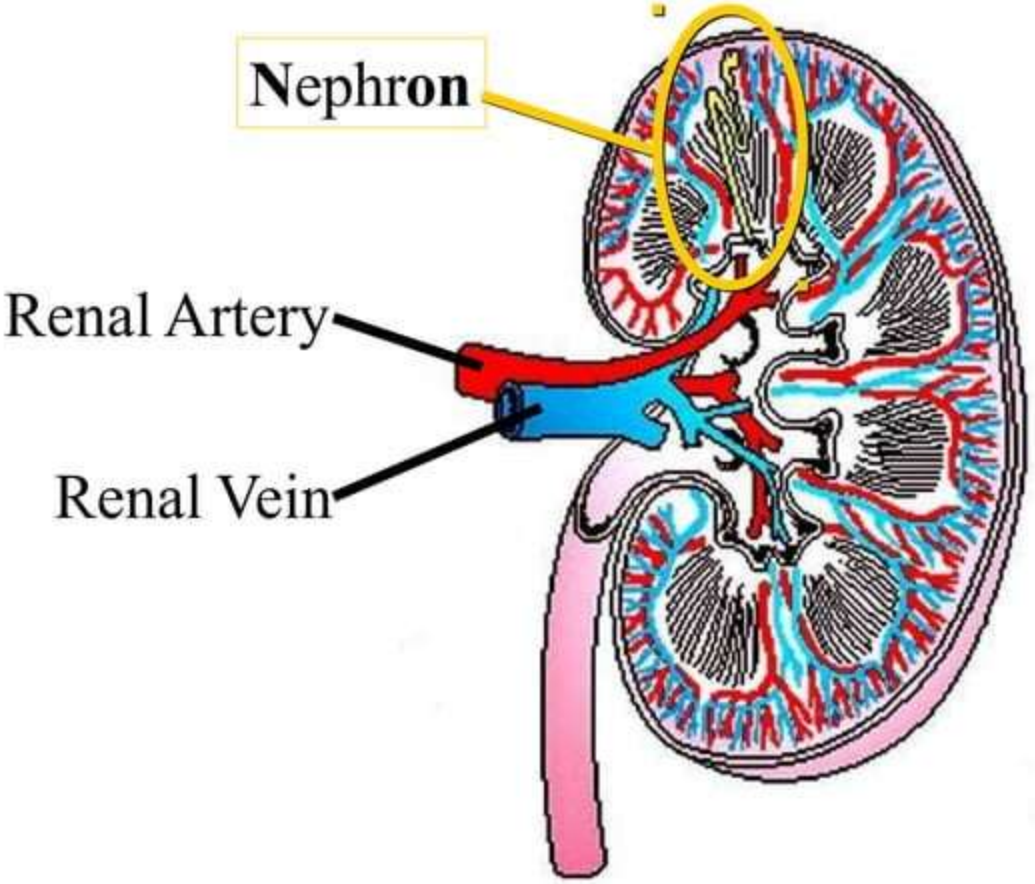
Macroscopic Structure



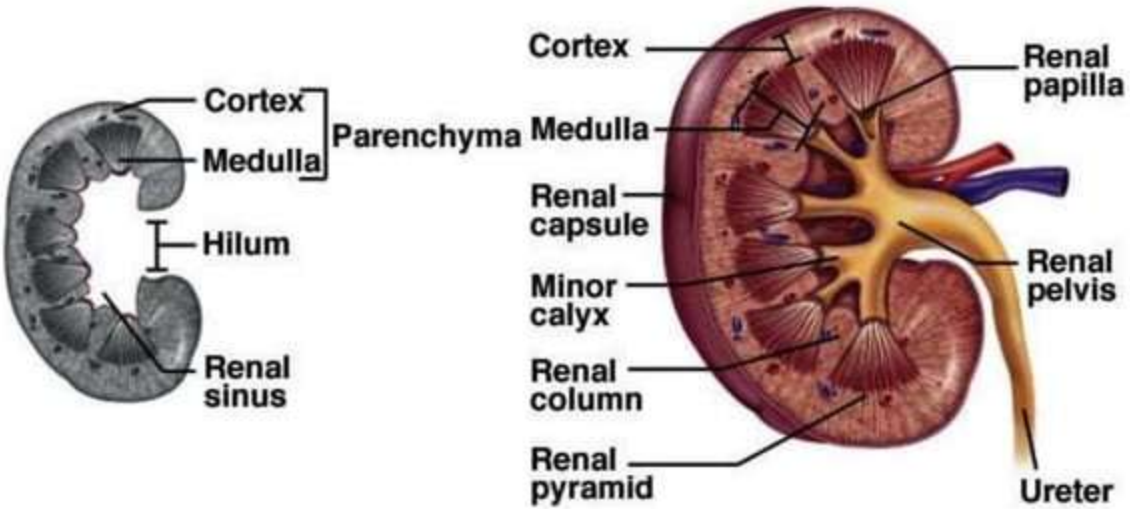
Kidney: Frontal Section



- Minor calyx: cup over papilla collects urine


Nephron
Renal Artery
Renal Vein

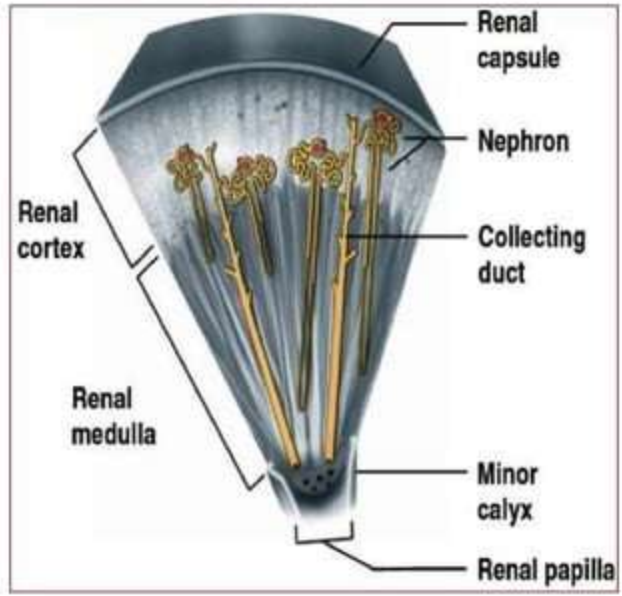
Anatomy of Kidney



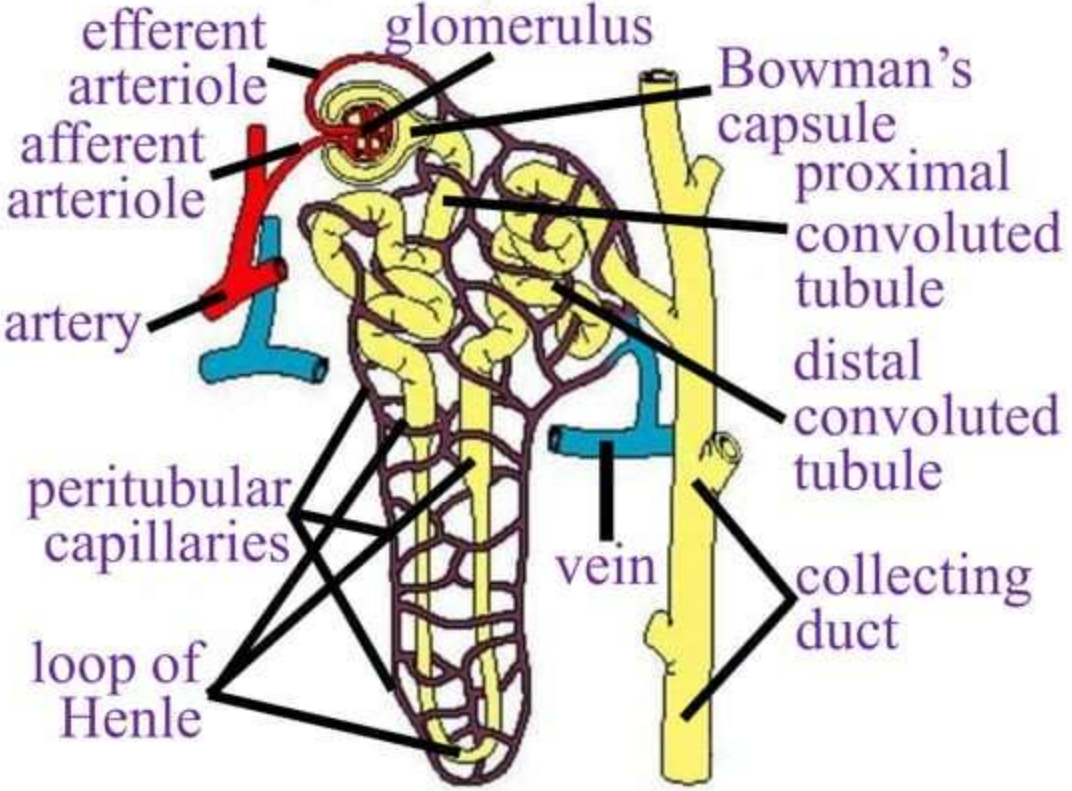
- Renal cortex: outer 1 cm
- Renal medulla: renal columns, pyramids - papilla
- Lobe of kidney: pyramid and it's overlying cortex

Microscopic Structure(Histology)

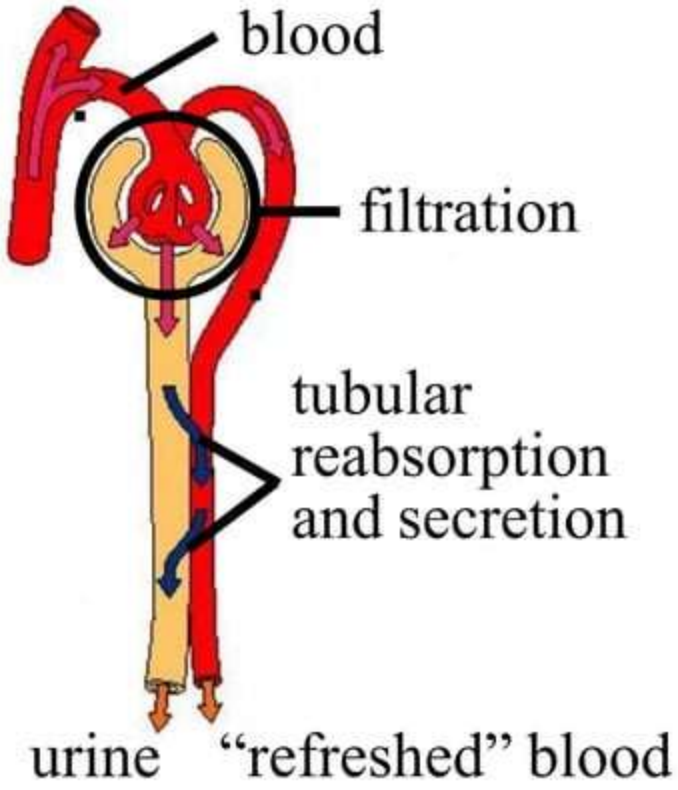
- The kidney may be regarded as a collection of millions of uriniferous tubules.
- Each uriniferous tubule consists of an excretory part called ***nephron*** and of a collecting tubule.
- Each kidney contains over 1(1-2 millions) million nephrons and thousands of collecting ducts



Structure of Nephron

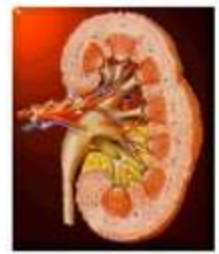

efferent arteriole
glomerulus
Bowman's capsule
afferent arteriole
proximal convoluted tubule
artery
distal convoluted tubule
peritubular capillaries
vein
collecting duct
loop of Henle

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



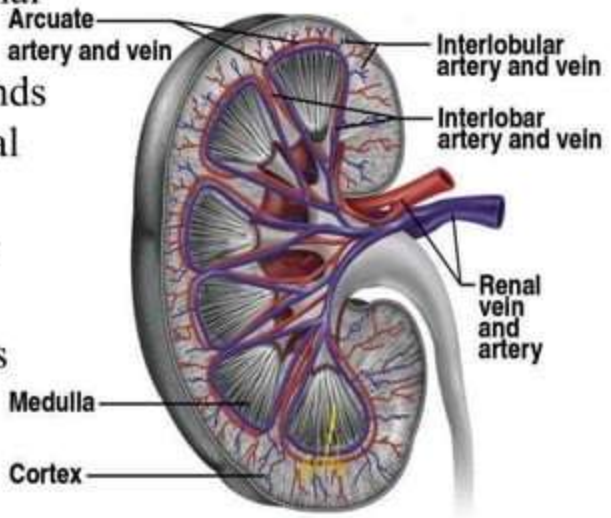
Blood Supply Diagram

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_{10},L_1 segments and parasympathetic fibers from vagus nerve.

Lymphatic drainage: into lateral aortic nodes.



THE URETERS

- Definition

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

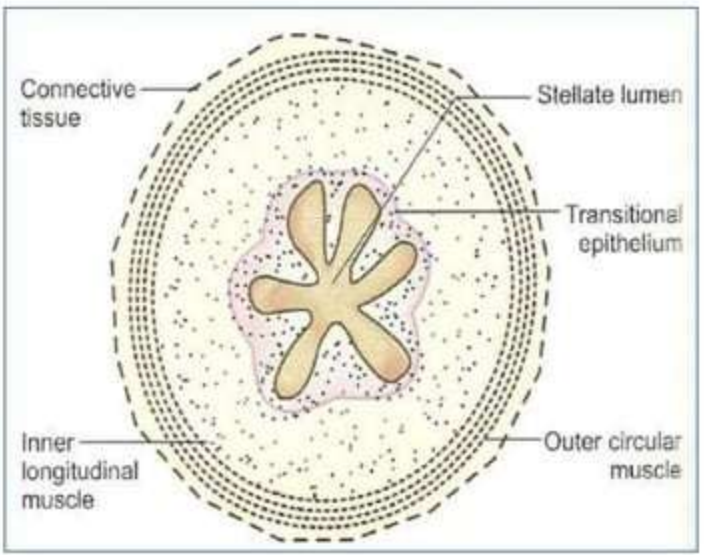
Dimensions

- 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

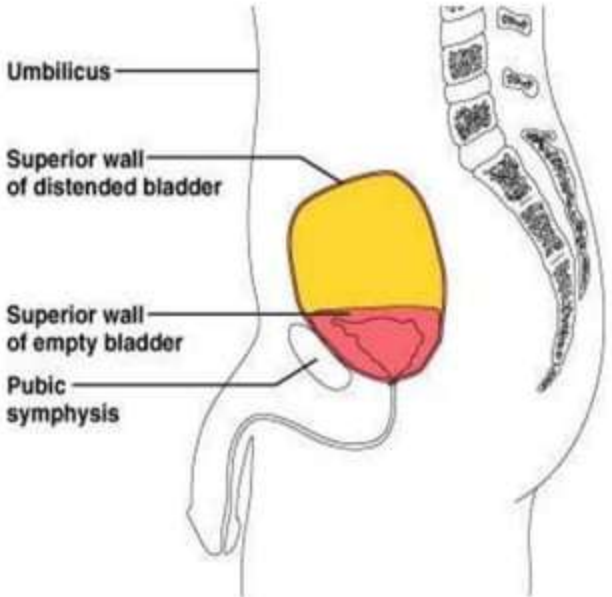


- 3 layers of tissue
  - Outer layer
    - Fibrous tissue
  - Middle layer
    - Muscle
  - Inner layer
    - Epithelium

- **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



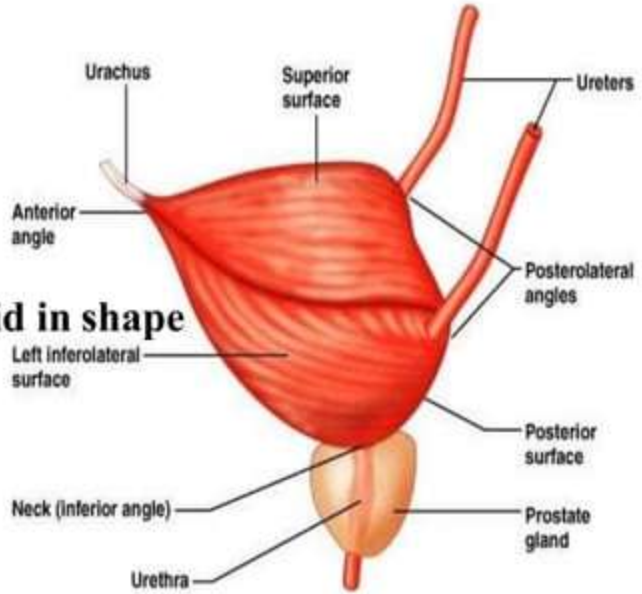
Position

- 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.

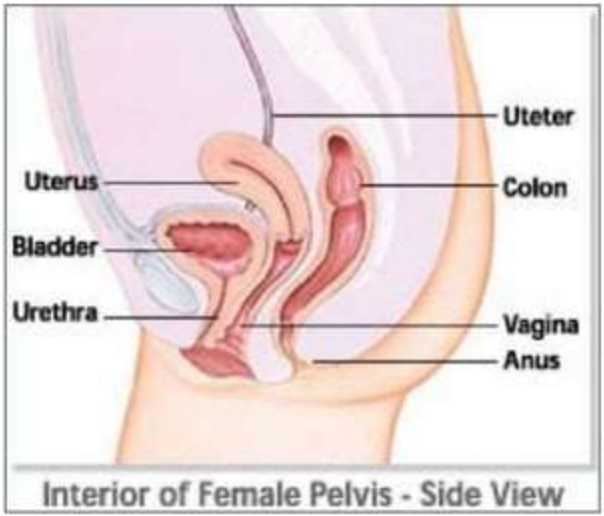
Shape

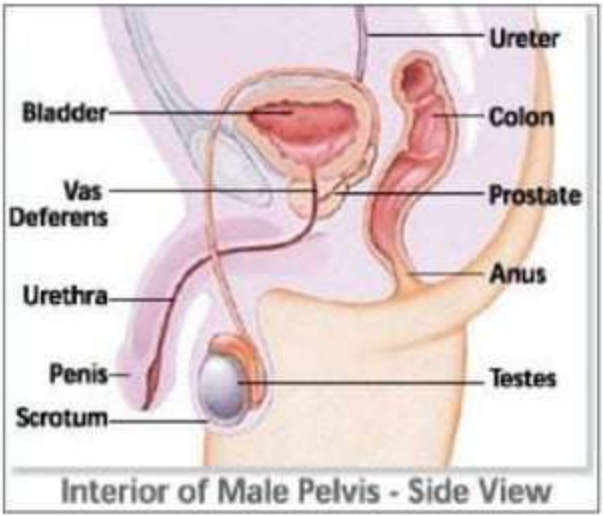
- An empty bladder is 4 sided pyramid in shape and has
  - 4 angles -an apex, neck & 2 lateral angles
  - 4 surfaces
    - Base (posterior surface)
    - 2 inferiolateral surfaces
    - Superior surface

When distended it is ovoid in shape

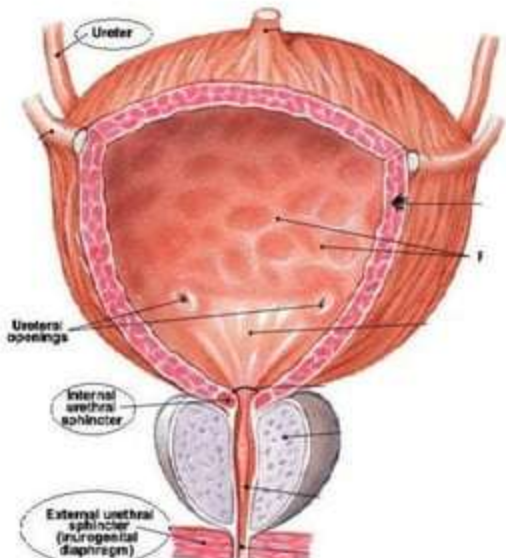


Relations


Uteter
Uterus
Colon
Bladder
Urethra
Vagina
Anus
Interior of Female Pelvis - Side View


Ureter
Bladder
Colon
Vas Deferens
Prostate
Anus
Urethra
Penis
Testes
Scrotum
Interior of Male Pelvis - Side View

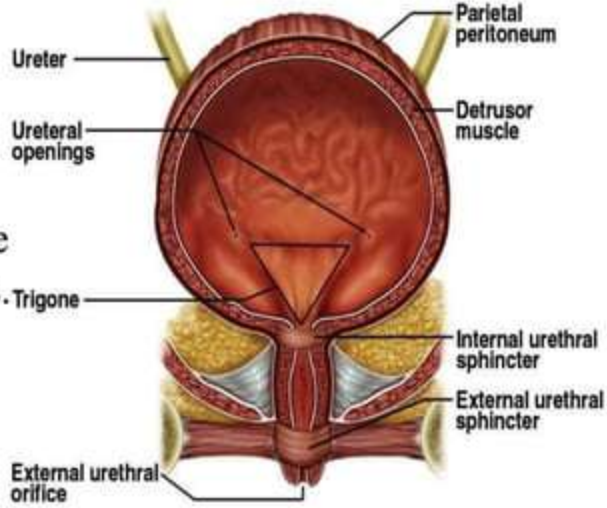
Bladder- structure of



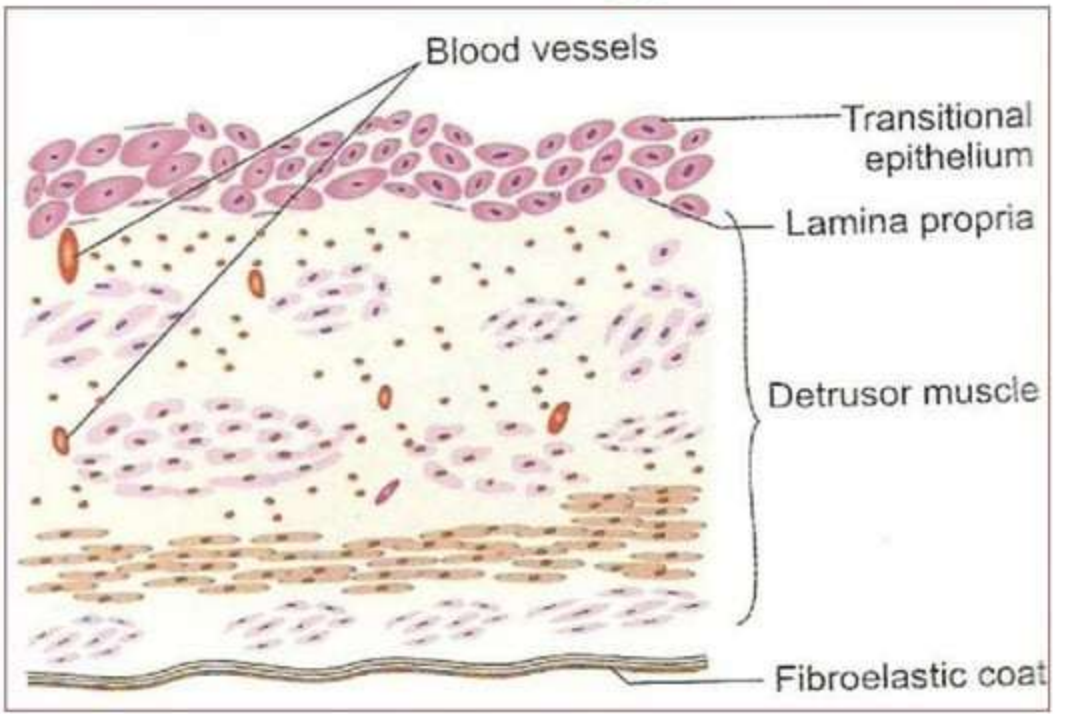
- 3 layers
  - Outer layer
    - Loose connective tissue
  - Middle layer
    - Smooth muscle and elastic fibres
  - Inner layer
    - Lined with transitional epithelium

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


Blood vessels
Transitional epithelium
Lamina propria
Detrusor muscle
Fibroelastic coat

Blood Supply

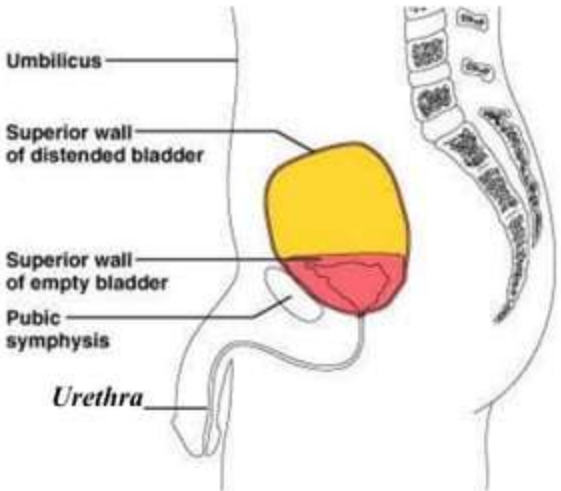
- Superior Vesicular Artery
- Inferior Vesicular artery
- Umbilical Artery

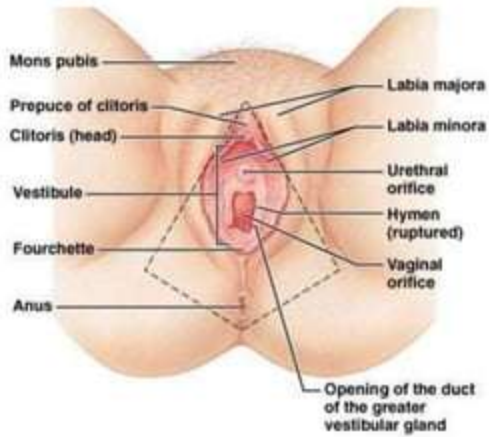
Nerve Supply

- Pelvic Nerve
- Hypogastria Nerve
- Pudendal Nerve

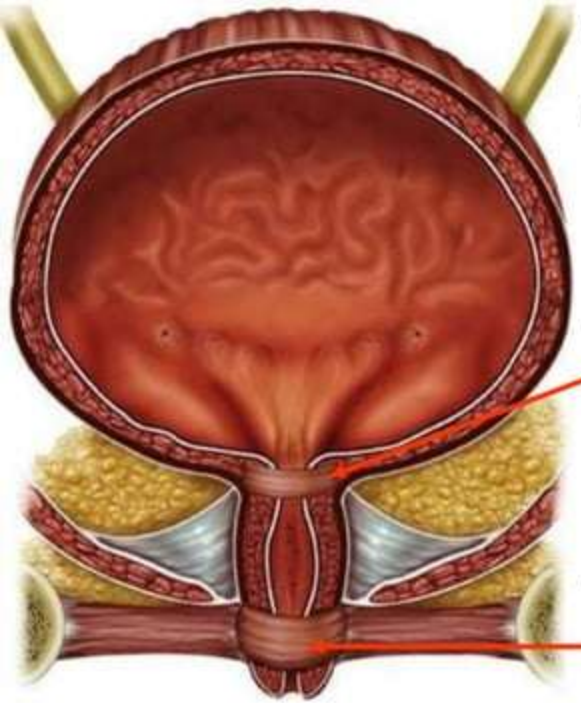
The Urethra

- 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



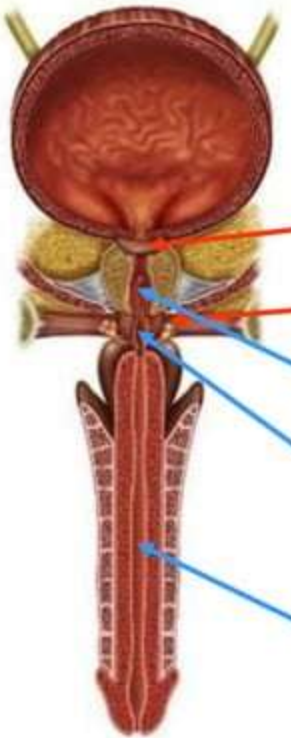


Female Urethra



- 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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