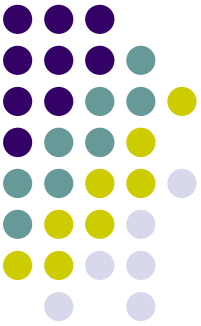
# Urinary System



# Objective

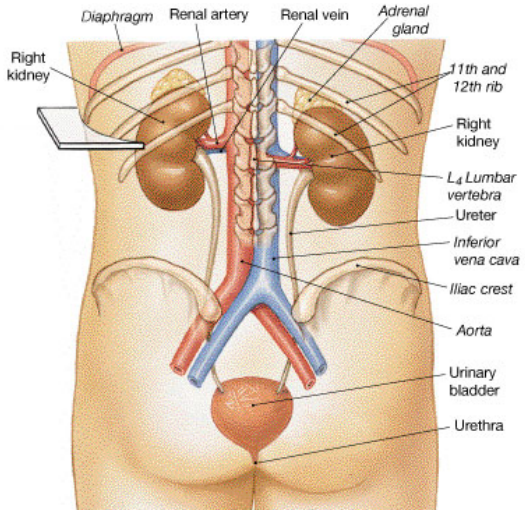
- Identify and describe the components of the urinary system and their function
- Describe the (histological) organization of the nephron
- Identify the blood vessels that supply blood to the nephrons
- Describe the blood flow through and around the nephron

# Functions of (Kidneys):

- **Regulate fluid balance (fluid volume) of the body**
- **Excrete organic waste products and conserve nutrients, etc**
- **Stabilize pH**
- **Regulate electrolyte concentrations in the blood**
- **Endocrine functions**

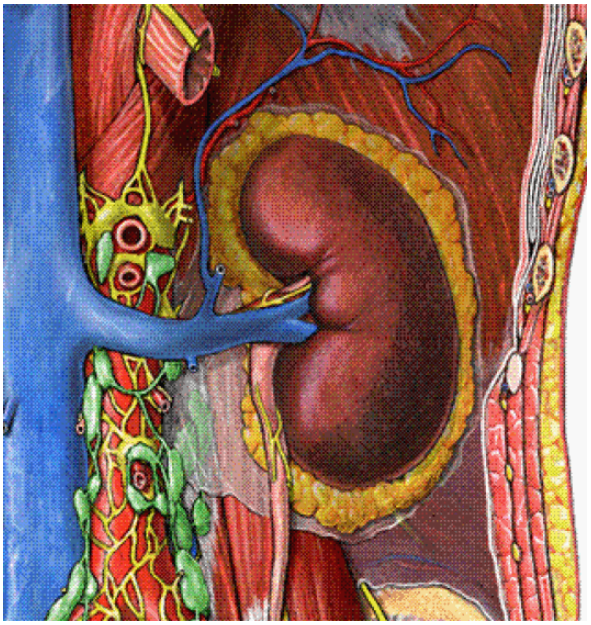
# Kidneys Location

- Lateral to vertebral column high on body wall,  under floating ribs, in retro-peritoneal position
- The right kidney is slightly inferior to the left kidney



# Surface Anatomy

- Size of bar of soap
- Bean shaped
- Hilus – indentation

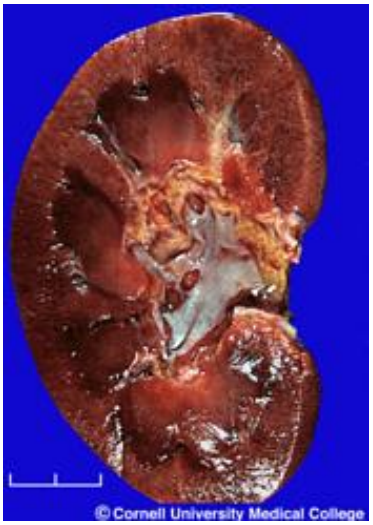


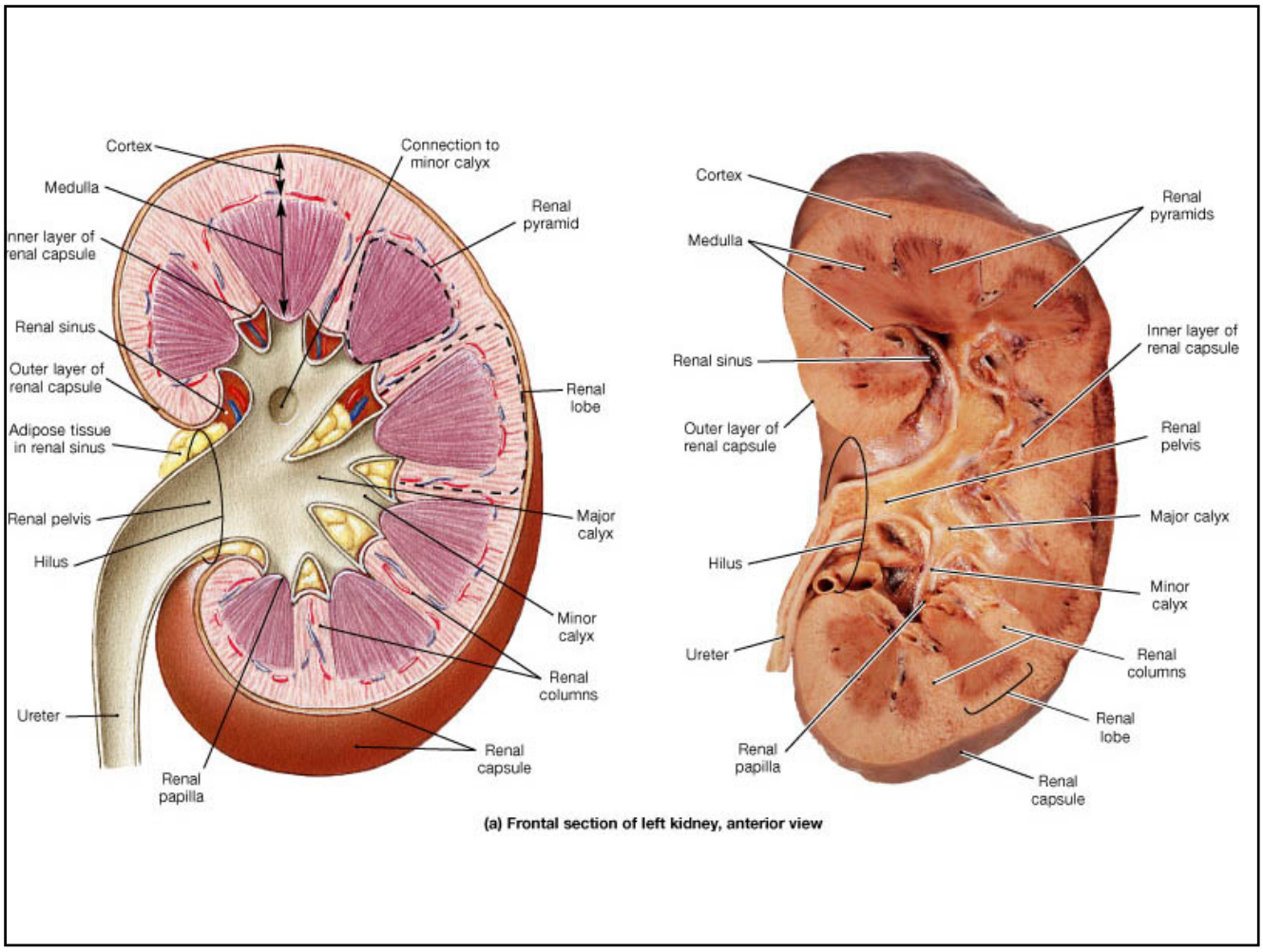
*Three layers*

- Renal fascia – fibrous tunic
- Adipose capsule – protects kidney
- Renal capsule – anchors kidney to body wall, continuous with peritoneum

# Sectional Anatomy

- **Cortex:** outer layer, light reddish brow, granular appearance (due to many capillaries)
- **Medulla:** darker striped appearance (due to tubules) Subdivided into distinct renal pyramids, terminating with a papilla. Separated by renal columns from the cortex.

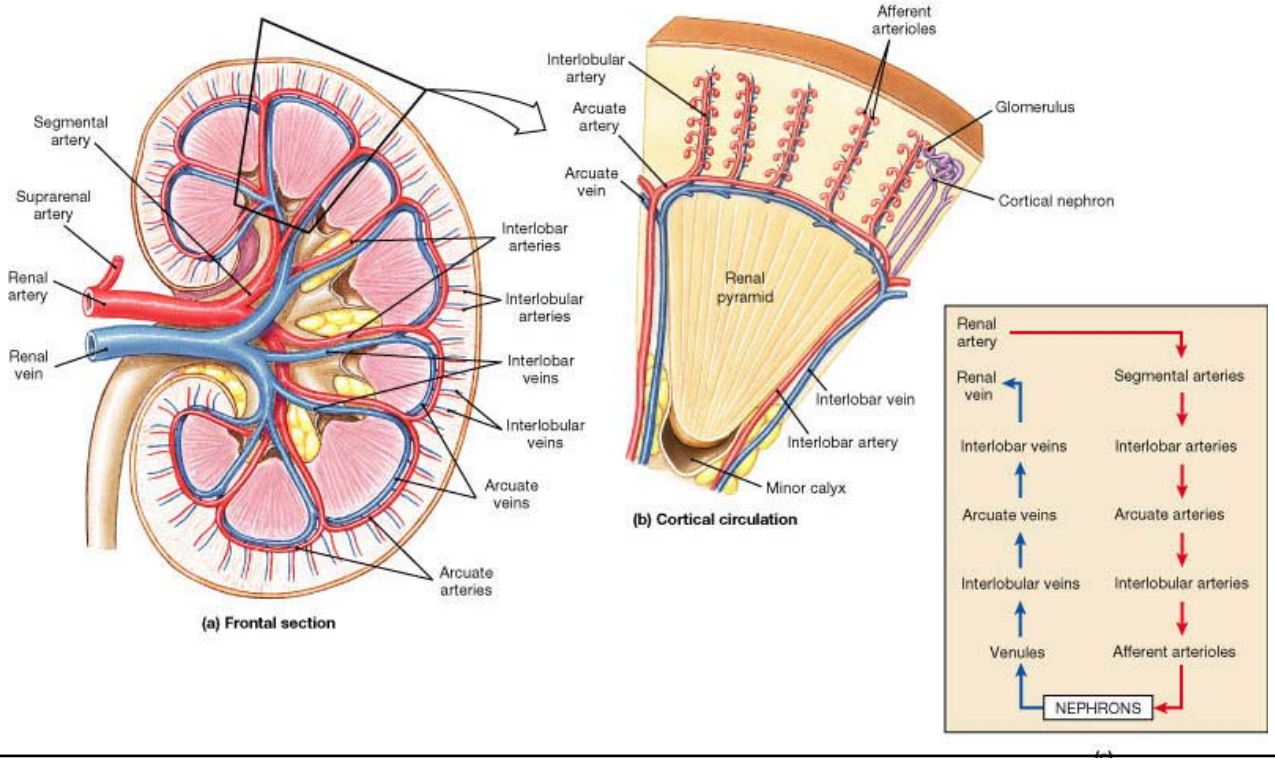




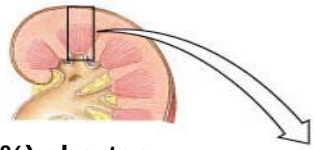

**(a) Frontal section of left kidney, anterior view**

# Renal Circulation

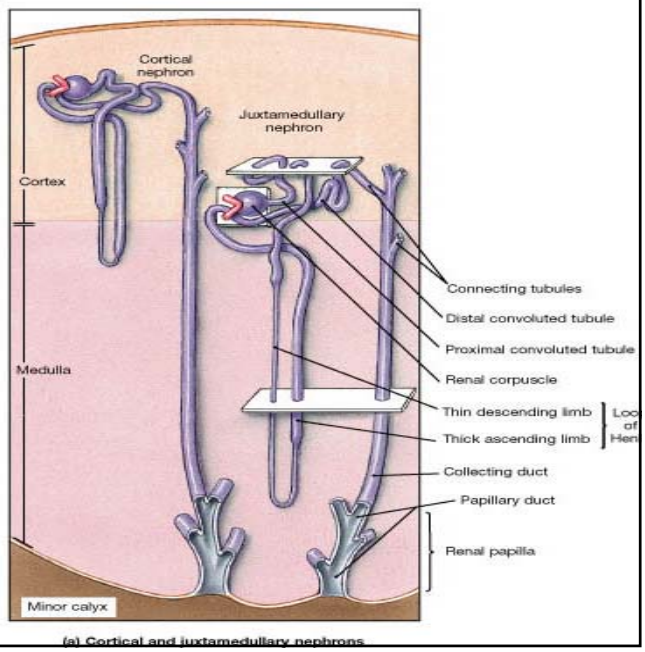
20-25% of cardiac output!!



# Nephrons



- **Cortical nephrons (85%) shorter, mostly in cortex of kidney, produce "standard" urine**
- **Juxtamedullary nephrons (15%), "juxta=next to" the medulla - responsive to ADH, can concentrate urine**



(a) Cortical and juxtamedullary nephrons

# Urine Collection

Ducts within each renal papilla release urine Into:

**minor calyx**

↓

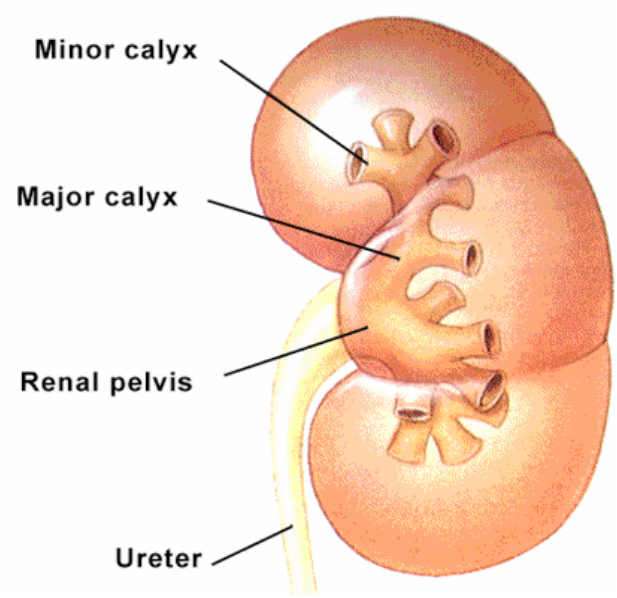
**major calyx**

↓

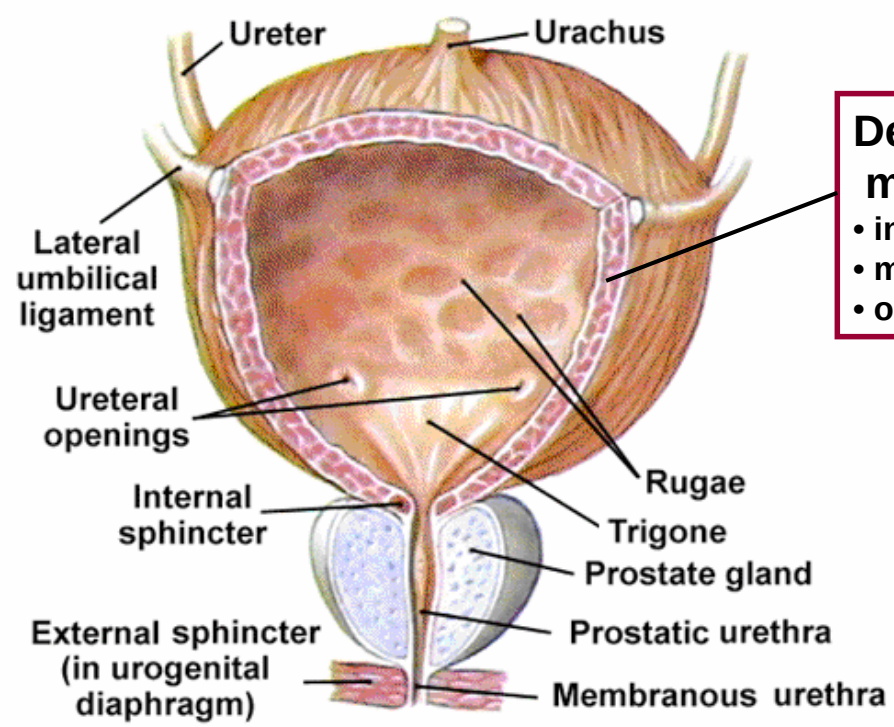
**renal pelvis**

↓

**ureter**

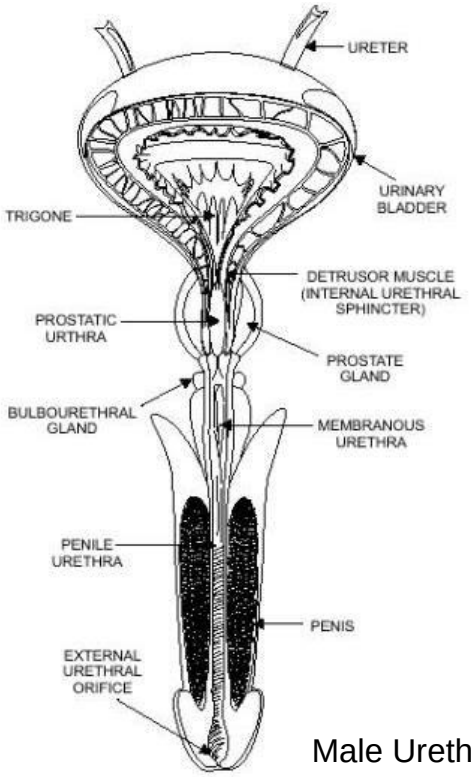


# Urinary Bladder

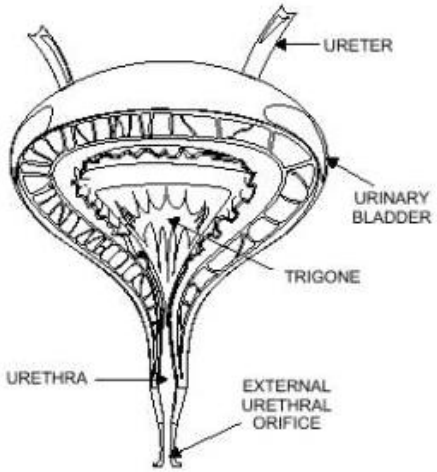



**Detrusor muscle:**
- inner longitudinal
- middle circular
- outer longitudinal

# Urethra




Male Urethra

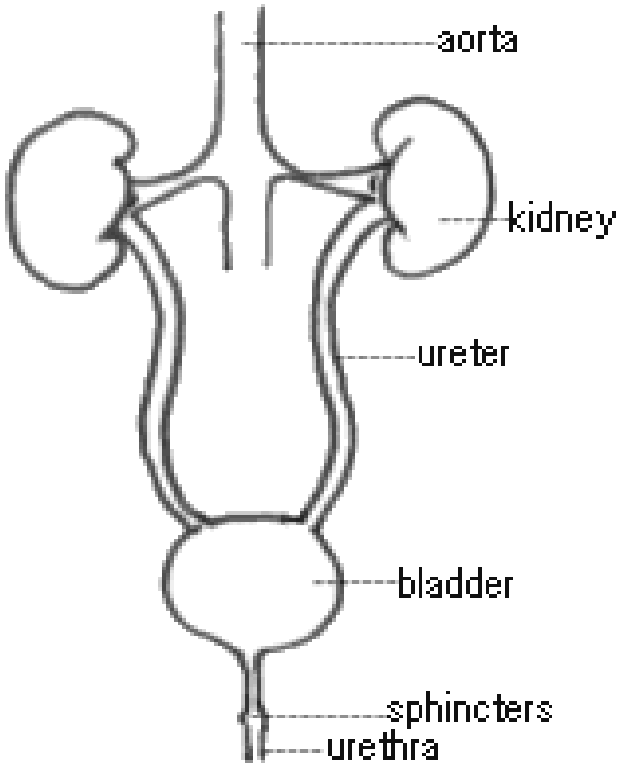



Female Urethra

**Female – 3-5 cm – from base of bladder to vestibule**
**External urethral sphincters – voluntary at pelvic floor**

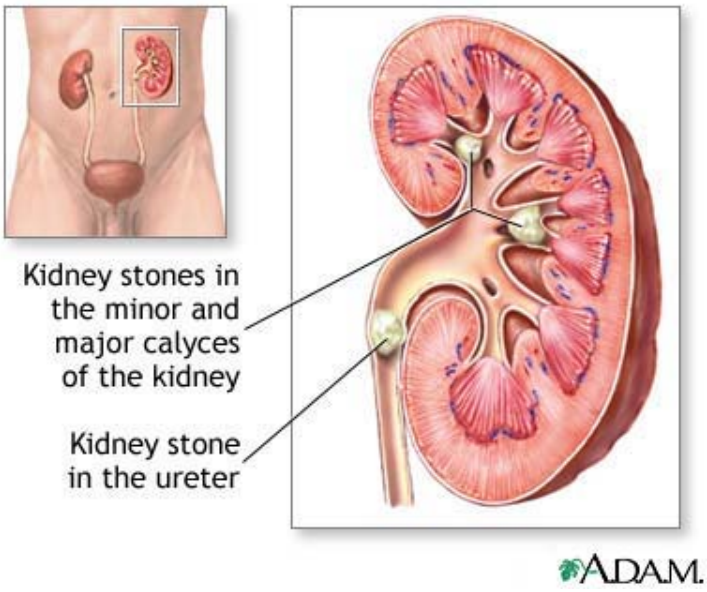
**Male – 18-20 cm**
**1. prostatic urethra – from base of bladder through prostate gland**
**2. membranous urethra – between prostate gland & base of penis**
**3. penile (spongy) urethra – traverses penis to orifice**

# Urine Transport, Storage, and Elimination



# Nephrolithiasis

- Occurs when urine becomes too concentrated and substances crystallize.
- Symptoms arise when stones begin to move down ureter causing intense pain.
- Kidney stones may form in the pelvis or calyces of the kidney or in the ureter.



# Extra Knowledge

- Kidneys may sustain 90% loss of nephrons and still not show apparent symptoms!!!
- 2-4 % of population only have 1 kidney!