Urinary System

- Major homeostatic organ of body
  - 1. Regulates the composition of extracellular fluids
  - 2. Removes or filter harmful substances including ones containing nitrogen from plasma while retaining useful products
  - 3. Secretes erythropoietin to stimulate RBC production when needed
  - 4. Helps control Blood Pressure by secreting enzyme renin.
Harmful Substances

- Nitrogenous Wastes
  - Waste products mostly from breakdown of proteins
    - Include urea, uric acid, creatinine & ammonia
  - Too much nitrogen is toxic to body

- Excess Electrolytes
- Electrolytes
  - Mineral salts in body
    - Carry an electrical charge in solution.
- Kidneys helps keep concentration fairly constant
  - For proper functioning of nerves, heart, & muscles.
- Especially Na+, K+, and Ca+2
Urinary System
Macroscopic to Microscopic

Gross Anatomy of Urinary System

- Structures are retroperitoneal
- 2 Kidneys
- 2 Ureters
- 1 Urinary bladder
- 1 Urethra
Gross Anatomy

- **Renal Hilus**
  - Indented medial region of each kidney

- **Renal Artery**
  - Enters kidney at hilus
  - Carries blood that contains waste products into kidney to be filtered
  - \( \frac{1}{3} \) of total blood flow of body delivered to kidney each minute

- **Renal Vein**
  - Exit kidney at hilus
  - Carries blood away from kidney after filtering

Renal Hilus

- **Renal Pelvis**
  - Flat, hollow, funnel shaped & basin-like chamber
  - Receives urine (fluid waste material) from inner kidney

- **Calyces**
  - Finger-like projections of Renal Pelvis
    - **Major Calyces**
      - Large or primary extensions of pelvis
    - **Minor Calyces**
      - Subdivisions of major calyces
Renal Hilus

- **Ureters**
  - Drain urine from the kidneys
  - Large amount of smooth muscle
    - Conducts urine to bladder by peristalsis

Urinary Bladder

- **Temporary storage area for urine**
  - Made of smooth muscle
    - Called detrusor muscle
    - Folds called rugae

- **Trigone**
  - Triangular region of the bladder
    - Contains openings to ureters & urethra
  - Heavy "traffic" of urine flow there so susceptible to irritation
    - Called trigonitis
Urinary Bladder

- **Urethrae**
  - Tube that discharges urine from the bladder
  - Emptying controlled by:
    - Internal & External Urethral Sphincters
- **Urinary Meatus**
  - End of urethral canal
- **External Urethral Orifice**
  - Opening to outside

Internal Anatomy of Kidney

- **Renal Cortex**
  - Outer superficial kidney region
    - Light colored
    - Contains most nephrons of kidney
- **Renal Medulla**
  - Deep to the cortex
    - Darker, reddish-brown color
Renal Medulla

- Medullary or Renal Pyramids
  - Separated into triangular regions
    - Have a striped, or striated appearance
    - Contain mostly collecting ducts
  - Papilla or Apex
    - Point to the innermost kidney region
    - Urine collects here
- Renal Columns
  - Areas of tissue like cortex
    - Dip inward between the pyramids

Microscopic Anatomy of the Kidney

- Kidney
  - Each kidney contains over a million nephrons
- Nephron is anatomical unit responsible for forming urine
- Contains 2 major structure types
  - 1. Specialized Capillaries
  - 2. Specialized Tubules
Nephron

- 1. Specialized Capillaries
  - Glomerulus
  - Peritubular Capillaries
- 2. Specialized Tubules
  - Bowman’s Capsule
  - Renal Tubule

3 Main Functions of Nephrons

- Urine Formation
- Involves 3 processes
  - 1. Filtration
  - 2. Reabsorption
  - 3. Secretion
Filtration

- Blood flowing under pressure forces water and small molecules through a specialized capillary membrane.
  - Blood cells & most proteins (especially albumin) are too large to pass
- Filtrate
  - Water & substances that pass through the membrane

Reabsorption

- Some filtered substances are transported from tubules back into blood
  - Into a specialized capillary.
    - Called peritubular capillary.
Secretion

• Opposite of reabsorption
  – Some substances are transported from capillary blood back into tubules
  – During final stages of urine formation.