Chapter 30: Urinary System

Maintains homeostatic conditions within body fluids

**Urinary System:**
- Maintains homeostatic conditions within body fluids

**Human Urinary System:**
- 1) Maintain water balance
- 2) Regulate [ion] (Na⁺, K⁺, Ca²⁺, Cl⁻)
- 3) Maintain blood pH
- 4) Maintain blood pressure and [O₂] in blood
- 5) Eliminate cellular waste (e.g. urea)

**Urea** = Product of amino acid metabolism

**Uric Acid** = Secreted by animals in xeric (dry) conditions (birds/reptiles)

**Chapter 30: Urinary System**

Human Urinary System:

- 1) Kidneys
  - Filter blood
  - Reabsorb nutrients
- 2) Ureters
  - Transport urine away from kidney
  - Movement via peristalsis
- 3) Bladder
  - Stores urine
  - Maximum capacity = 1L
- 4) Urethra
  - Transport urine from bladder to outside body
  - Internal sphincter (invol.)
  - External sphincter (vol.)

**Gross Anatomy of the Kidney:**
- 1/4 of cardiac output delivered to kidneys (1.25 L/min)
- 1 million / kidney

**Nephron** = Functional unit of the kidney
- 1 million / kidney

**Chapter 30: Urinary System**

**Nephron Anatomy:**
- 1) Glomerulus
  - Capillary bed
- 2) Bowman’s Capsule
  - Collects fluids from blood
- 3) Tubule
  - Conducting tube
    - (a) Proximal Tubule
    - (b) Loop of Henle
    - (c) Distal Tubule
    - (d) Collecting Duct

**Nephron Physiology:**
- 1) Filtration:
  - Movement of materials
    - Glomerulus → Bowman’s capsule
    - Ions, nutrients, waste, water
    - Filtrate = Filtered fluids
- 2) Tubular Reabsorption:
  - Water / nutrients returned to blood
    - Proximal Tubule / Loop of Henle
    - Active Transport (nutrients / ions)
    - Osmosis (water)
- 3) Tubular Secretion:
  - Wastes / excess substances move from blood to filtrate (e.g. drugs, H⁺)
    - Distal Tubule
- 4) Concentration:
  - Additional water removed (collecting ducts)

(Figure 30.3, 30.4, 30.6)
Summary of Nephron Physiology:

Urine: Waste and remaining water from nephron
- 95% water / 5% solutes (ions, urea)

Homeostatic Functions of Kidney:
(1) Eliminate waste
(2) Balance ionic contents
(3) Maintain pH
(4) Regulate water balance:
   - Collecting duct permeability variable
     - Impermeable = 22.5 L urine / day
     - Permeable = 1.5 L urine / day
   - Permeability controlled via hormones
     - Antidiuretic Hormone (Pituitary)
     - Increases permeability
     - Controlled via negative feedback
(5a) Regulate blood pressure:
   - Low BP → Kidneys release renin
     - Catalyzes formation of angiotensin
     - Constricts arterioles (=↑BP)
(5b) Regulate $[O_2]$ in blood:
   - Low $[O_2]$ → Kidneys release erythropoietin (↑RBCs)