Chapter 25
Urinary System and Excretion

Control of Body Temperature and Water Balance

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Thermoregulation
Heat is gained or lost in four ways

- Heat exchange with the environment
  - May occur by conduction, convection, radiation, and evaporation

Figure 25.1

Animals must dispose of nitrogenous wastes

- Nitrogenous wastes are toxic breakdown products

Diagram of nitrogenous waste disposal in different organisms.
The liver performs many functions, including the production of urea. The liver produces urea, breaks down toxins, produces bile, plasma proteins, and lipoproteins and it adjusts the nutrient content of the blood.

**Organs of the Urinary System**
1. Kidneys
2. Ureters
3. Urinary Bladder
4. Urethra

**Functions of the urinary System**
1. Excretion of Metabolic Wastes
2. Maintenance of Water-Salt Balance
3. Maintenance of Acid-Base Balance
4. Secretion of Hormones

• Urine leaves the kidneys via ureters
  – Is stored in the urinary bladder, and is expelled through the urethra.
Nephrons, the functional units of the kidneys extract a filtrate from the blood and refine it to urine.

Urine Formation
- Nephrons filter about 180 liters of primary filtrate water per day
- Most of the water, nutrients and salt are reabsorbed
- Nitrogenous waste and toxins get excreted

Antidiuretic hormone (ADH) regulates the amount of water the kidneys excrete.
Aldosterone regulates Na+ reabsorption.
**Major processes of the excretory system**

- Filtration: blood pressure forces water and many small solutes into the nephron
- Reabsorption: valuable solutes are reclaimed from the filtrate
- Secretion: excess H\(^+\) and toxins are added to the filtrate
- Excretion: The finished product, urine is excreted

**Regulatory Functions of the Kidneys**

**Acid-Base Balance**

- Normal pH for most body fluids is 7.4
- Alkalosis: pH is greater than 7.4
- Acidosis: pH is less than 7.4

- Several Mechanisms Maintain a pH of \( \sim 7.4 \)
  - Acid-Base buffer system
  - Respiratory Center
  - The Kidneys

**Acid-Base Balance**

- **Acid-Base Buffer Systems**
  - Buffer – chemical or combination of chemicals
    - Can take up excess H\(^+\) or OH\(^-\)
    - Prevents large changes in pH
  - When H\(^+\) added to blood the following occurs
    \[ \text{H}^+ + \text{HCO}_3^- \rightarrow \text{H}_2\text{CO}_3 \]
  - When OH\(^-\) added to blood the following occurs
    \[ \text{OH}^- + \text{H}_2\text{CO}_3 \rightarrow \text{HCO}_3^- + \text{H}_2\text{O} \]
Disorders of the Urinary System

Disorders of the Kidneys

- Many major illnesses can cause kidney disease
  - Diabetes, hypertension, and certain autoimmune diseases, can also cause serious kidney disease
  - Pyelonephritis: Infections of the kidneys
  - Kidney Stones
  - Retention of water and salt lead to edema
    - Can lead to heart failure

Do we need to drink eight glasses of water each day?

Recently researchers have had success in growing entire human bladders in the lab, and implanting them into a limited number of patients