

**Chapter 8**  
**Water and Electrolytes:**  
**Striking a Balance**

Hewlings/Medeiros

PowerPoint presentation created by  
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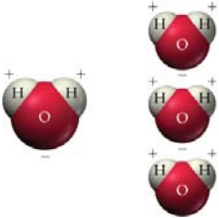
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**A Water Molecule**

- Inorganic (no carbon)



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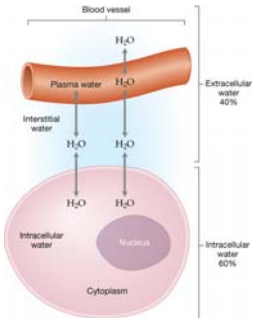
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**Distribution of Water in the Body**



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### Is Bottled Water Better?



Despite lack of scientific research, consumers believe that bottled water is better for them. It may be safer for health. But is it "safer" for the environment?

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### Water Balance

- Loss
  - Environmental temperature, age, activity level
  - Lungs, urine, feces
- Infants lose more relative to weight
- Balance ingestion with depletion
- Remember, the main function of water is to cool the body.

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### Water Input

- Sources
  - Drinking Water ~ 4 cups
  - In Foods ~ 4 cups
  - Metabolic Water ~1.5 cups

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### Water Loss

- Sweat – 1.7 cups if not active
- Urine – 3.8–5 cups
- Feces – 0.9 cup
- Lungs – less than 1 cup (increases in cold)

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### Hydration: Water Intake and Retention

- Thirst is controlled by the hypothalamus.
- Thirst not best indicator of hydration
- Antidiuretic hormone
  - Signals kidneys to hold onto water
- Aldosterone
  - Signals kidneys to hold more water and sodium

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### How Much Water Should We Drink?

- 1.5 mL/kcal or 8–12 cups per day (including beverages and water in food)
- May need more if:
  - Pregnant
  - Breast feeding
  - Exercising
    - $\frac{3}{4}$ –1.5 cups for every 15 minutes
  - On a high-protein diet

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## Staying Hydrated During Exercise

- Drink before, during, and after exercise
- Drink early, drink often
- Before:
  - 1.5–2.5 cups of fluid every 2–3 hours
- During:
  - $\frac{3}{4}$  to 1.5 cups every 15–20 min
- After:
  - 2–3 cups first 30 minutes after exercise; 4–4.5 cups every 1–2 hours until body weight is back to pre-exercise level
- Do not drink just plain water
  - Need to replace electrolytes, especially sodium

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## Dangers of Dehydration

- 1 to 2 percent can cause lack of concentration, mild fatigue, and impaired athletic performance.
- 5 percent can lead to cramping and heat exhaustion.
- 7 to 10 percent causes hallucinations and heat stroke.

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## Dehydration in Infancy

- Increased ratio of surface area to body volume = greater water loss
  - Greater requirement relative to weight
  - Greater metabolic rate
- Diarrhea and vomiting increase chances of dehydration
- Infants need 2 oz. of fluid per pound of weight
  - Easily met by breast milk or formula
- Oral rehydration solution

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### Signs of Dehydration in Infants

- Dry mouth and tongue
- No tears even when crying
- Irritability
- No wet diapers for three hours or more (five to six are normal)
- Sunken eyes and cheeks
- Inactivity or sleepiness
- Sunken soft spot on the head

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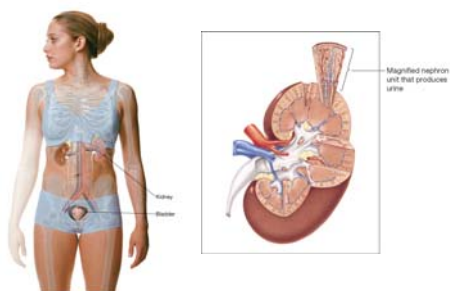
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### Role of Kidneys and Urine in Water Balance



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### Electrolytes: Sodium, Potassium, Chloride

- Electrolytes = minerals that when placed in water become charged particles
- Positively charged = cations (sodium extracellular and potassium intracellular)
- Negatively charged = anions (chloride) associated with sodium (extracellular)

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### Should someone who does not exercise be concerned about electrolytes?

- It depends on which electrolyte.
- Sodium: No
  - DRI for sodium = 1,500 mg
  - Table salt is 40 percent sodium.
  - The average American consumes eight to twelve times the estimated daily requirement.
- Potassium: Yes
  - DRI 5,700 mg; many people do not get this amount.
  - One banana = 450 mg
- Chloride: No
  - 2,300 mg/day consumed with sodium

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### Dietary Sodium

- Most sodium consumed is from processed foods, not table salt.
- 50 to 75 percent of sodium in the American diet is added to food by manufacturers.



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### Chloride in Food

- 1 g sodium chloride or table salt is 600 mg chloride (60%).
- Most Americans consume 10 to 15 g of salt.
- Easy to exceed the DRI of 2,300 mg

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## Potassium

- Good sources are fresh fruits and vegetables.
- Tomatoes, carrots, potatoes, beans, peaches, pears, squash, oranges, bananas

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## Sodium and Hypertension

- A diet high in sodium may increase risk for high blood pressure.
- 25 percent of Americans have high blood pressure.
- Essential hypertension – high blood pressure with no known cause (most cases)
- Most treatable

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## High Blood Pressure

- High blood pressure 140/90
- Systolic, top number
- Diastolic, bottom number
- To treat
  - Lose weight
  - Reduce sodium in some people
  - Consume adequate potassium



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### Sodium Labeling

- "Sodium free"
- "Very low sodium"
- "Low sodium"
- "Reduced sodium"
- "Unsalted"
- "No added salt"
- Must contain < 5 mg/serving
- Must contain < 35 mg/serving
- Must contain < 145 mg/serving
- 75% reduction in sodium
- No salt added
- No salt added

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### Absorption and Function of Electrolytes

- Sodium is absorbed by several mechanisms in the small intestine and colon along with chloride.
  - Helps absorption of amino acids, glucose, and some B vitamins
- Potassium absorption occurs along the length of the intestines, especially the colon.
  - Necessary for the movement of sodium across the intestine

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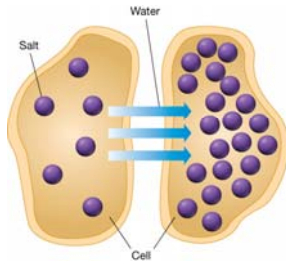
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### Physiological Functions

- Diffusion
- Osmosis



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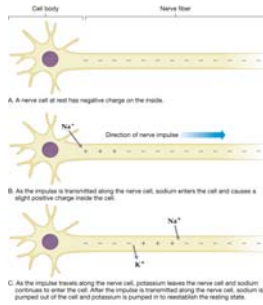
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## Sodium and Potassium and Nerve Transmission



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## Physiological Functions

- Chloride is part of stomach acid (HCl).
- Electrolytes buffer body fluids.
- Electrolytes enhance water absorption.

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## Deficiencies

- Sodium deficiency is rare.
  - Hyponatremia – occurs with dehydration or if water is replaced with no sodium
- Potassium deficiency – hypokalemia
  - Use of laxatives and diuretics
  - Excessive vomiting and/or diarrhea
  - Kidney disease
  - Extreme weight loss

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**Sports Drinks**



- Enhance water absorption and replace lost electrolytes
- Not needed in events less than one hour
- 6% glucose ideal
- 2.5 cups per pound of weight lost
- Help replace sodium and potassium

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