Topics in Human Pathophysiology
Fall 2011
Student Learning Objectives

- Explain the chemical and cellular basis of life.
- Define homeostasis and describe how body systems maintain homeostasis and what happens when this homeostasis fails.
- Explain what happens when homeostasis fails.
- Develop an appreciation for clinical issues related to selected diseases and their therapies.
Homeostasis

(a) An increase in the controlled variable causes events that lower the controlled variable toward its set point again.
Constriction of blood vessels in skin (saves heat)

Shivering (generates heat)

Core temperature

Sensors

Temperature Falls

Set point

Control center (hypothalamus)

Nerve activity to blood vessels

Nerve activity to skeletal muscle
Levels of Body Organization

- Atoms
- Molecules
- Cells
- Tissues
- Organs
- Organ Systems
- Organism
Figure 1.1

1. Chemical level
   - Atoms combine to form molecules.

2. Cellular level
   - Cells are made up of molecules.

3. Tissue level
   - Tissues consist of similar types of cells.

4. Organ level
   - Organs are made up of different types of tissues.

5. Organ system level
   - Organ systems consist of different organs that work together closely.

6. Organismal level
   - The human organism is made up of many organ systems.
Water

a polar molecule
Properties of Water

- A great solvent
- A great reactant
- Good at holding temperature
- High heat of vaporization
Diffusion
Biological Building Blocks

- Water – H₂O
- Ions/electrolytes
- Organic Macromolecules
  - Carbohydrates
  - Proteins
  - Fats
  - Nucleic acids
Ions or Electrolytes

- Sodium – Na⁺
- Potassium – K⁺
- Chloride – Cl⁻
- Calcium – Ca²⁺
- Bicarbonate ion – HCO₃⁻
- Hydrogen – H⁺
Ion concentrations affect osmosis
Carbohydrates fuel the body

**Monosaccharides**

- Glucose
- Galactose
- Fructose

**Disaccharides**

- Glucose + galactose; also called milk sugar
  - Lactose
- Glucose + glucose; maltose molecules join in food to form starch molecules
  - Maltose
- Glucose + fructose; found in sugar cane, sugar beets, and honey
  - Sucrose
Polysaccharides are complex carbs

**Amylose**
Storage form of glucose in plants; found in grains, legumes, and tubers

**Amylopectin**

**Starch**

**Glycogen**
Storage form of glucose in animals; stored in liver and muscles

**Fiber**
Forms the support structures of leaves, stems, and plants
Fats store energy & maintain cell function

Triglyceride

Acid group

Fatty acid

cerol

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Proteins are the molecules of life

- Proteins make up the structure of cells and tissues
- Proteins act as enzymes
- Proteins help maintain fluid and electrolyte balance
- Proteins help maintain a strong immune system
How enzymes work – an example of functional proteins
DNA: the code of life