Chapter 2 - The Chemistry of Life

Section 1 - Matter and Organic Compounds
What are we made of?

Cells

Cells are made of?

Matter - Anything takes up space, has mass
**Elements vs Atoms**

An **atom** is the smallest amount of an element.

Gold is an **ELEMENT**

The least I could have is ONE **ATOM** of gold.
Elements vs Atoms

An **atom** is the smallest amount of an element

Gold is an ELEMENT

The least I could have is ONE ATOM of gold
Elements cannot be broken down

92 natural  Over 100 total

Element Song on iPad
**Compound vs Molecule**

- **Ionic**
- **Covalent**

Diagram showing examples of ionic and covalent compounds.
1 If I took a copper coin and kept breaking it down until I had the smallest thing that makes up the coin what would I have?

A  Atom
B  Compound
C  Ion
D  Molecule
E  Elements
2 Hydrogen likes to exist as two hydrogens bonded together. This is an example of a(n)

A Atom
B Compound
C Ion
D Molecule
E Element
**Organic Compounds**

Chemicals of living things

Contain *Carbon*

These chemicals are considered **macromolecules** because they are quite large
4 types of macromolecules

Carbohydrates

Proteins

Lipids

Nucleic Acids
Carbohydrates

Sugars

Store Energy

Fruits, Vegetables, Grains
Carbohydrates made of repeating units called **monosaccharides**

Monosaccharides (simple sugars)

- Glucose
- Galactose
- Fructose

Provide Energy Fast
**Polysaccharides**

Chains of simple sugars

Used to store energy

Starch - Plants

Glycogen - Animals
Lipids

Oil and fat

Difference?

Make up cell membranes!

Phospholipids
Saturated Fat vs Unsaturated Fat

Saturated

H H H H H H H H
H H H H H H H H
H H H H H H H H
H H H H H H H H
H H H H H H H H
H H H H H H H H
O=C - C - C - C - C - C - C - C - C - H

liquid

Unsaturated

H H H H H H H H
H H H H H H H H
H H H H H H H H
H H H H H H H H
H H H H H H H H
H H H H H H H H
O=C - C - C - C - C - C - C - C - C - C - H

solid

straight - store closely together - animals use to store energy
bent
Types of Lipids

- Triglycerides
- Phospholipids
- Steroids

Phospholipids

**Steroid Hormone Action**

1. Steroid hormone enters target cell.
2. Hormone binds to receptor, induces conformational change.
3. Hormone-receptor complex binds to DNA, induces start of transcription.
4. Many mRNA transcripts are produced, amplifying the signal.
5. Each transcript is translated many times, further amplifying the signal.
Proteins

Made of chains of amino acids

We get our amino acids to make proteins from what we eat!

Vegetarians?
Protein Structure

Primary Protein Structure
is sequence of a chain of amino acids.

Secondary Protein Structure
occurs when the sequences of amino acids are linked by hydrogen bonds.

Tertiary Protein Structure
occurs when certain attractions are present between alpha helices and pleated sheets.

Quaternary Protein Structure
is protein consisting of more than one amino acid chain.
Why are Proteins important?

Enzymes

- Reduce activation energy for reactions

Antibodies

- Recognize and neutralize pathogens

Muscle fiber

- Converts chemical energy into mechanical work

Maintains cell shape

Hormones

- Signals between cells

Hemoglobin

- Carries oxygen in red blood cells

LOTS of reasons!
Nucleic Acids

Made up of **nucleotides**

DNA (deoxyribonucleic acid)

RNA (ribonucleic acid)

Stores genetic information
Building blocks of DNA

Nucleotides (4)

Adenine
Guanine
Cytosine
Thymine

Complementary Base Pairing

A & T  C & G
"Double Helix"

Complementary Base Pairing

A & T    C & G
3 When you eat meat you are eating mostly what?

A Carbohydrates
B Proteins
C Lipids
D Nucleic Acids
4 The scientific name for fats is __________?

A  Carbohydrates
B  Proteins
C  Lipids
D  Nucleic Acids
5 When eating vegetables, fruits, and grains you are primarily eating
__________.

A Carbohydrates
B Proteins
C Lipids
D Nucleic Acids
Section 2 - Biochemical Reactions
Chemical Reactions

Reactants are CHANGED into Products

\[ \text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O} \]

\[ \text{Na} + \text{Cl} \rightarrow \text{NaCl} \]

All atoms (matter) are conserved!
**Exothermic** releases heat

**Endothermic** absorbs heat (requires heat)

Means it would **feel** colder
Exothermic = **catabolic** in organisms

break down molecules, release energy

Endothermic = **anabolic** in organisms

build up molecules from smaller ones

**Metabolism** all reactions in your body
All reactions must be **started**

This requires energy
**Enzymes** lower activation energy required
How do enzymes work?
Enzymes are affected by:

- temperature
- pH
Section 3 - Water, Acids, and Bases
Water is a very unique **inorganic** molecule

**Polar** - no overall charge, but charged "areas"
Water is an effective solvent.

The polar aspect of water pulls and hold onto ionic compounds
Water "sticks" to many surfaces

This is called **adhesion**
**Capillarity** - Water moves up small cylinders

Due to polarity water molecules stick to themselves (**cohesion**)

Called **hydrogen bonding**
Acids and Bases