

## Matter & Energy General

all life represents an efficiently organized collection of matter & energy

all events in living world begin with the organization and behavior of atoms and molecules

### Matter

= anything that occupies space and possesses mass

atoms & molecules

much of the matter (elements and molecules) in the food we eat is broken down and used as **building blocks** in constructing new molecules our cells need

### What kind of matter does your body contain?

there are about 90 different kinds of atoms (= **elements**) in the entire universe

the human body is made up of only a couple of dozen of these elements

→ they are not equally abundant:

#### **Elements of the human body:**

C	18.5%	also: Cr, Co
H	9.5%	Cu, F
O	65%	Mo, Se

N	3.2%	Si, Sn (tin)
P	1.0%	Zn, V
Ca	1.5%	

95% of living organisms is made up of only 4 different elements: CHON

these are also 4 of the most common elements in the universe; He is the most common

in humans; C,H,O,N,Ca & P make up 99% of the body mass

we must take in each element in roughly the same proportions as they exist in our bodies

→ macro and micro nutrients

### Energy

= capacity to do work

has an effect on matter; no mass or space

what kinds of energy does body use:

mechanical → muscles

electrical → nerves

chemical → all cells

energy is constantly being transformed from one type into another in the body

where does this energy come from?

**food = chemical energy**

**bonds:** break bonds → release energy  
form bonds → use (store) energy

### Chemical Bonds

chemical bonds are the energy necessary to hold two or more atoms together to form a molecule

thus a chemical bond:

**is not** an OBJECT

**is** an ENERGY RELATIONSHIP

most atoms are capable of combining to form molecules

atoms combine to form molecules by forming **chemical bonds**

three kinds of chemical bonds:

#### **1. covalent bonds**

electrons are shared between atoms

most stable kind of bond  
(bond energy = 80-110 kcal/mole)

#### **2. ionic bonds**

when an atom gives up electron to another

#### **3. hydrogen bonds**

weakest bonds but may be the most important

can be formed or broken easily

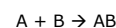
extremely important in stability of many large organic molecules

### Chemical Reactions

Chemical bonds are formed or broken in **chemical reactions:**

a chemical reaction is any process in which some chemical bonds are broken or made

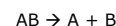
**A. synthesis** – combining to form more complex substances



eg. dehydration synthesis (condensation)  
eliminates water to synthesize larger molecules

uses energy

**B. decomposition** – break down into simpler substances



eg. hydrolysis

uses water to break down larger molecules

releases energy

cells functions by manipulating **energy** and **matter**

= **metabolism**

→ all the chemical reactions occurring in the individual cells

**Metabolism = synthesis + decomposition**

To maintain these chemical reactions requires lots of **energy**

→ some of the food we eat is used mainly to provide this energy for metabolism

### **Atoms to Molecules**

**molecules** = 2 or more atoms bound together

2 main kinds of molecules in the body

**inorganic** → small, little C

**organic** → much larger, lots of C

**Human body** (100 lbs): 100%

#### **Inorganic Molecules**

65%/lbs { 62 lbs water (59-62%)  
2.5 lb other inorganics (2.5%)

### **Organic Molecules**

35%/lbs { 18 lbs fat (14-20%)  
1.5 lbs carbos (1-2%)  
16 lbs proteins (15-18%)  
.5 lb nucleic acids (<1%)

most of the **molecules** that make up our bodies are made in our own cells out of the atoms from the food that we eat = **nutrients**

a few molecules we need but cannot be made in our bodies

→ they are **essential molecules** that we must get in our diets to survive

#### **Essential Molecules:**

O<sub>2</sub> (oxygen gas)

vitamins

8 amino acids

10 essential in children

8 essential in adults

2 fatty acids