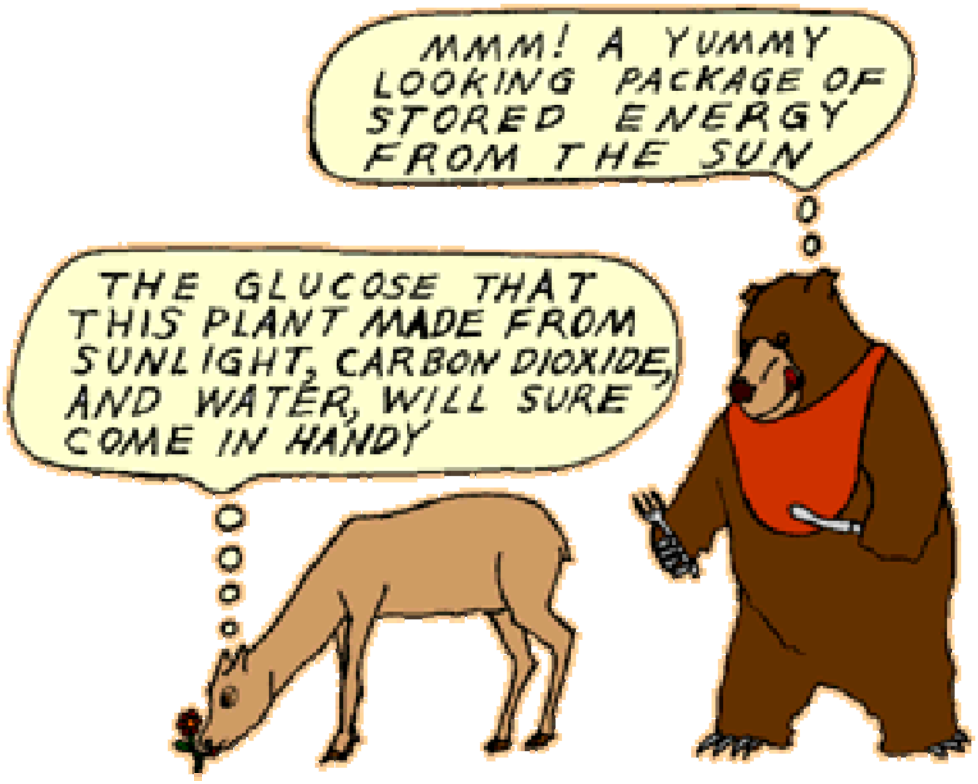
Energy for Life!



Our bodies require a source of energy for various life-sustaining functions

The energy expended by the body in sustaining life must be balanced by the energy obtained in the food that is eaten

The unit of energy is the joule (J). The old unit for measuring energy was the calorie.

- METABOLISM
  - Is the total of the chemical reactions occurring in a living thing

- BASAL METABOLISM
  - In humans, is the sum of chemical reactions required to maintain essential body processes and to maintain body temperature

- BASAL METABOLIC RATE (BMR)
  - Is the rate of energy use in an inactive, unfed person in warm conditions.
  - BMR depends on age, sex, body composition and the size of the person.

Molecules of life

Inorganic chemicals

Simple elements or molecules

Organic chemicals

Complex carbon-based molecules

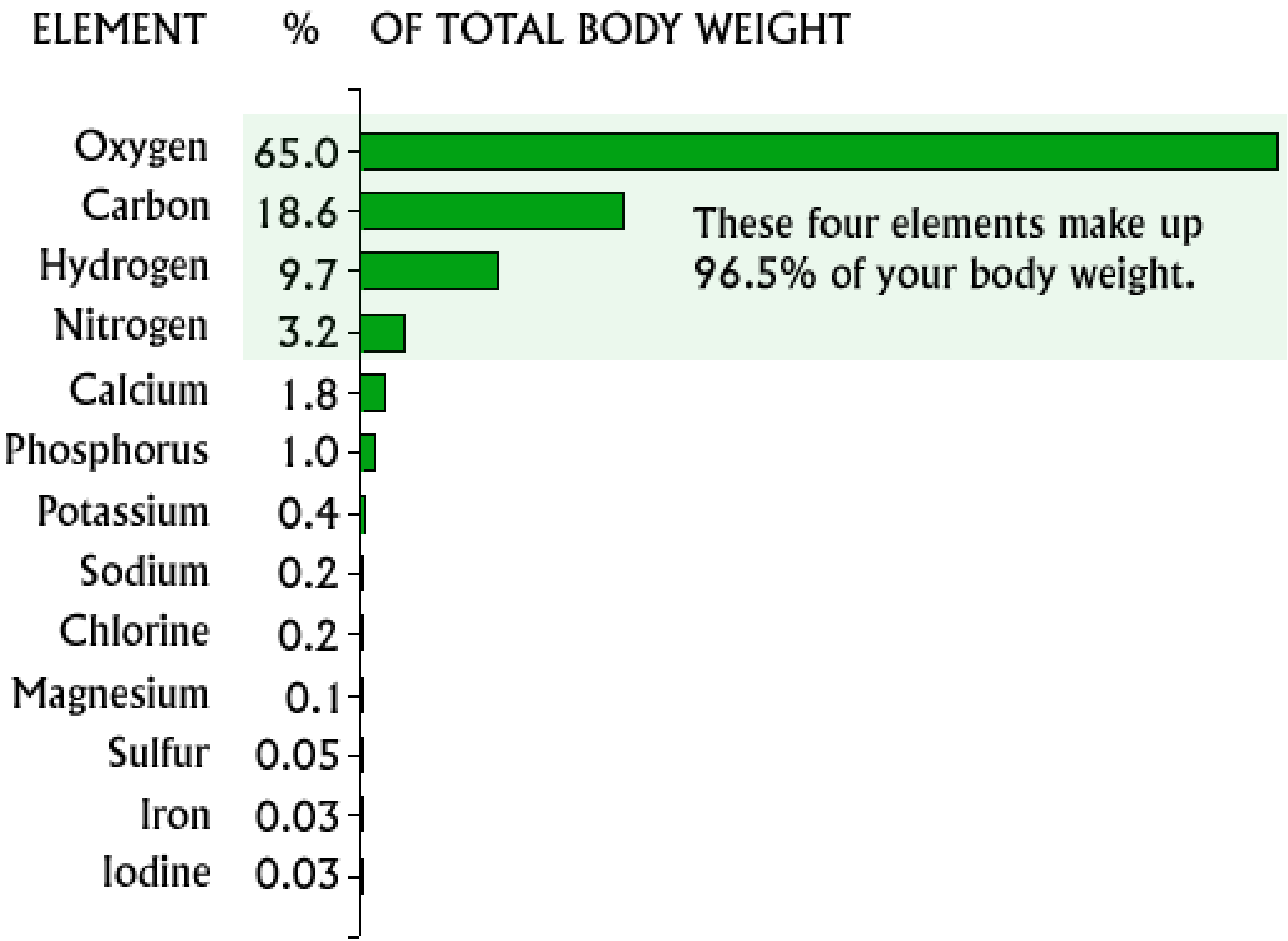
Elements Found in the Human Body

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Ti	Pb	Bi	Po	At	Rn
Fr	Ra	Ac															

Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu

Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

Common Elements Trace Elements Remaining Elements

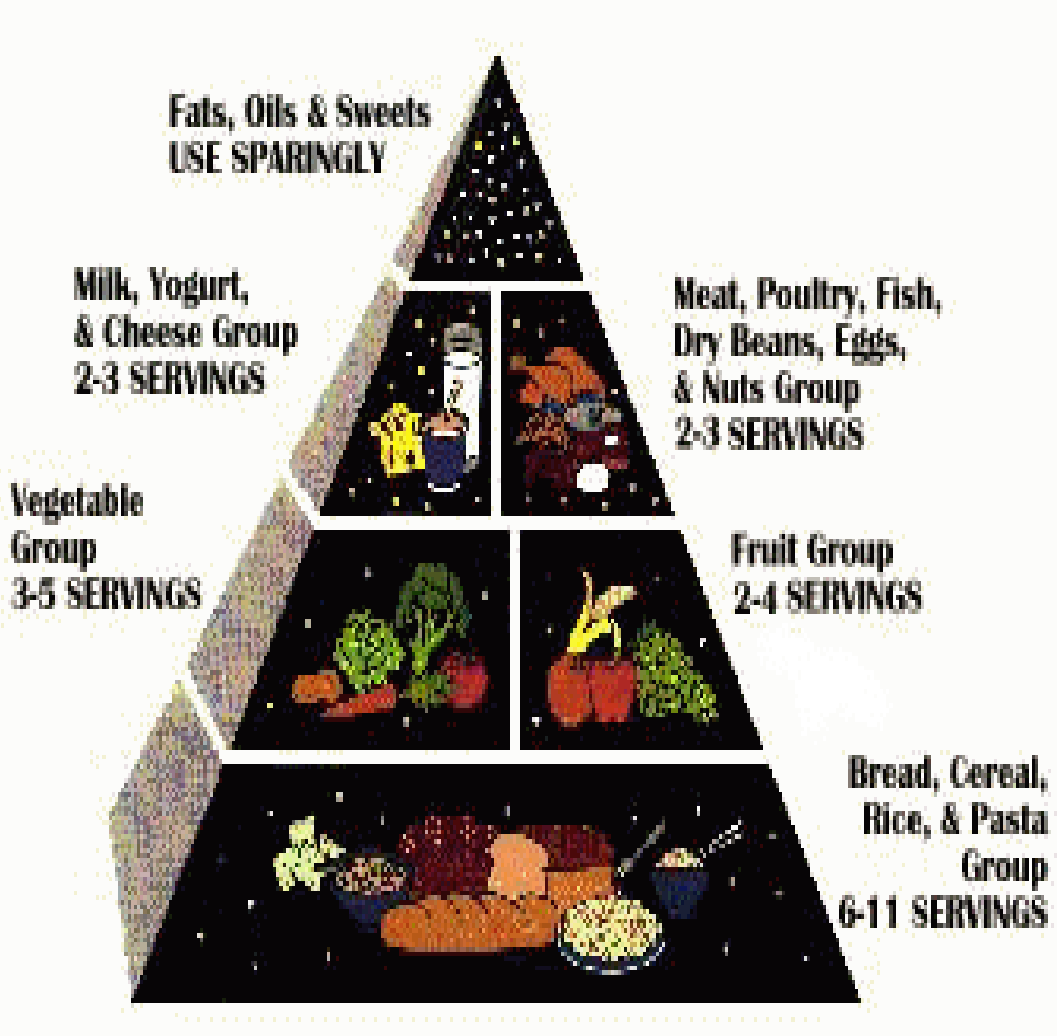

ELEMENT
%
OF TOTAL BODY WEIGHT
Oxygen
65.0
Carbon
18.6
Hydrogen
9.7
Nitrogen
3.2
Calcium
1.8
Phosphorus
1.0
Potassium
0.4
Sodium
0.2
Chlorine
0.2
Magnesium
0.1
Sulfur
0.05
Iron
0.03
Iodine
0.03
These four elements make up
96.5% of your body weight.

Elements

- H, O, N and C constitute 97 per cent of living parts of organisms
- 12 to 14 other elements of importance to living organisms
  - Ca
  - Fe
  - Na

Chemicals in Food

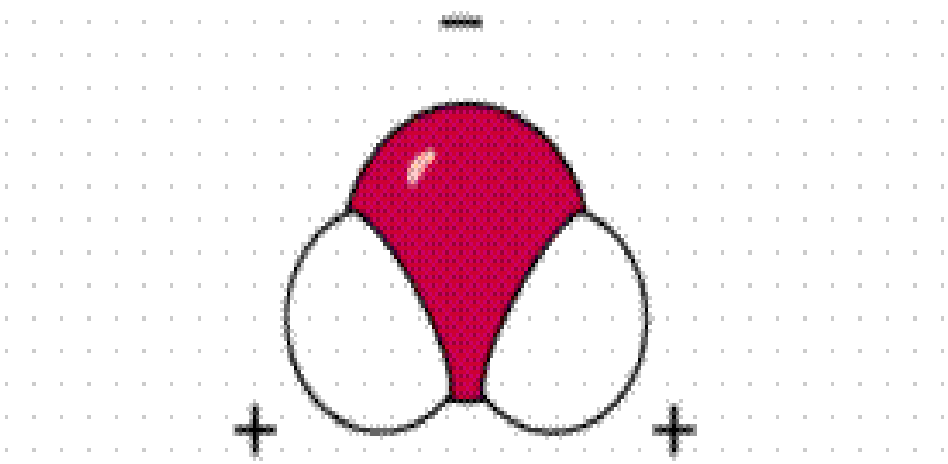
- Water
- Fat
- Carbohydrate
- Protein
- Minerals
- Vitamins
- *Additives*



Trace elements

- Ionic / charged
- _____
- Absorbed with food
- Small amounts

Water

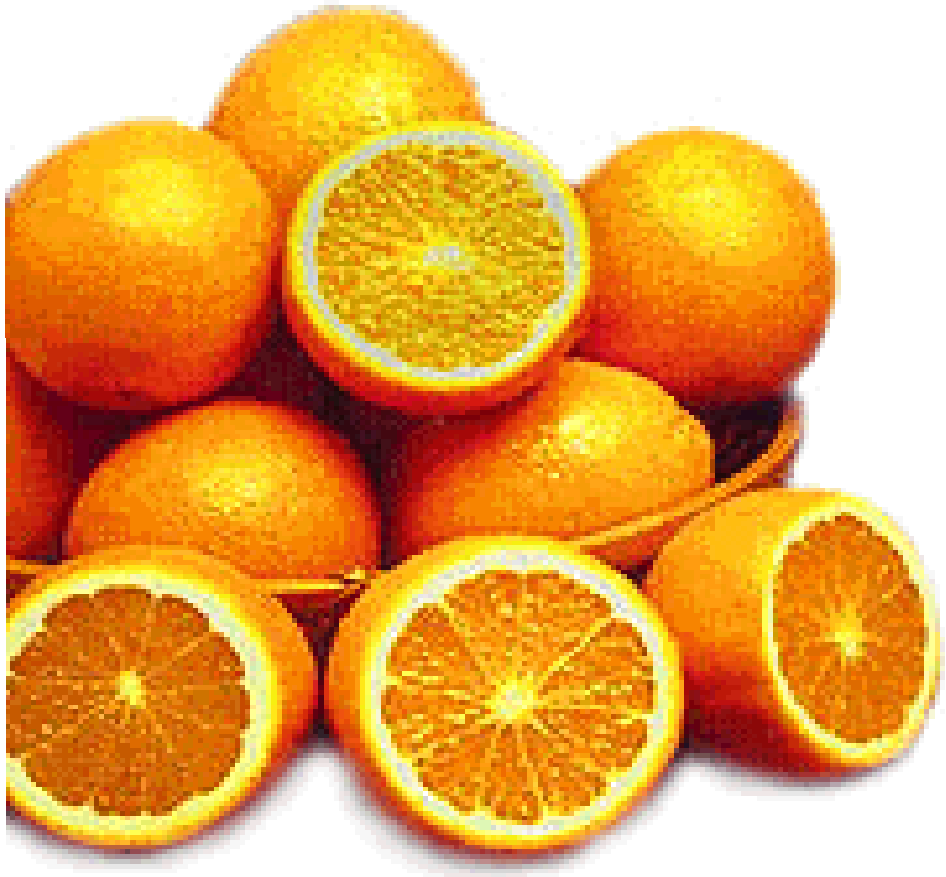


Water, a polar molecule

- Heat absorber
- _____
- Cohesive
- _____
- Major component

Vitamins and Minerals

- Examples of both
- Health
- Small amounts



Complex Organic Compounds

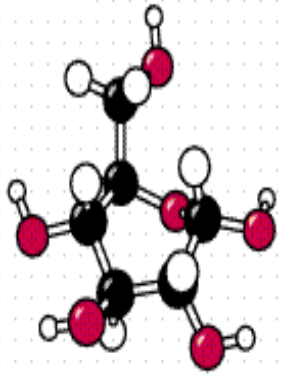
Carbohydrates

- Carbohydrates are the most abundant organic molecules in living organisms
  - chemical energy, storage of energy
- Simple sugars such as glucose and sucrose
- Complex sugars such as

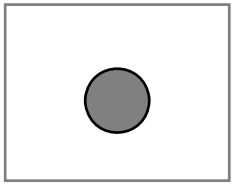
1. _____
2. _____
3. _____
4. _____

Carbohydrate

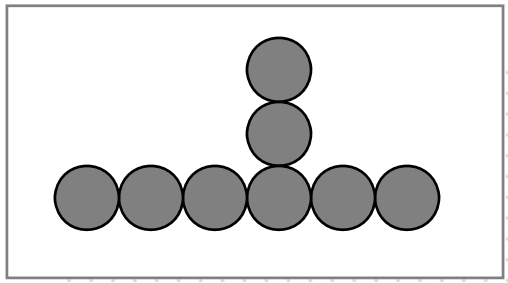
Glucose

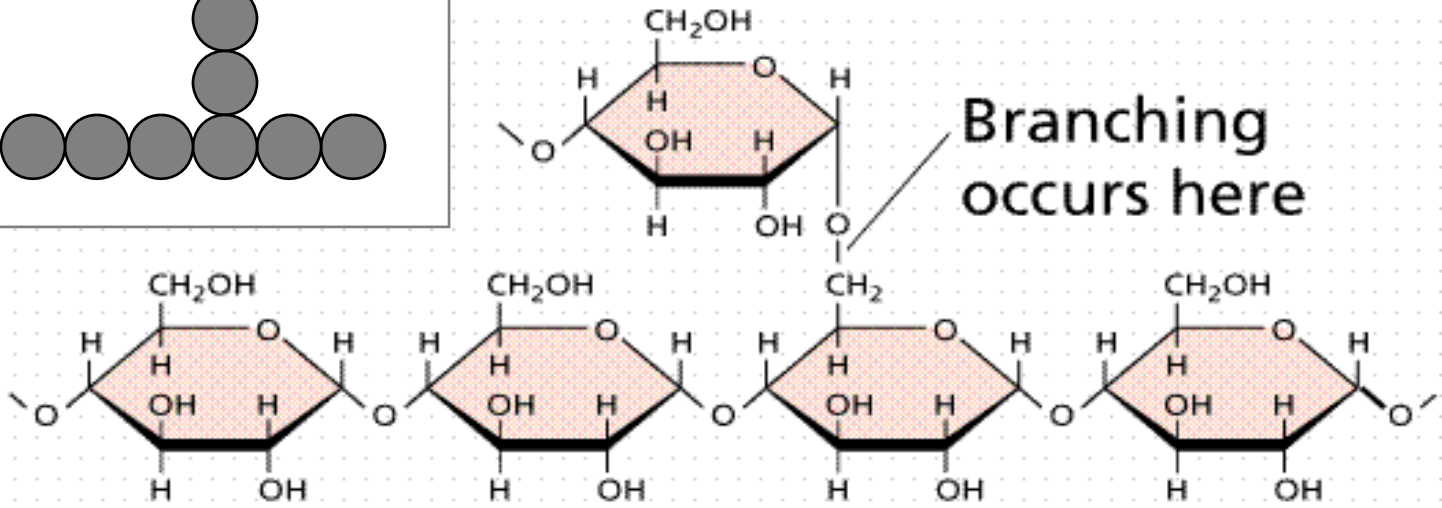


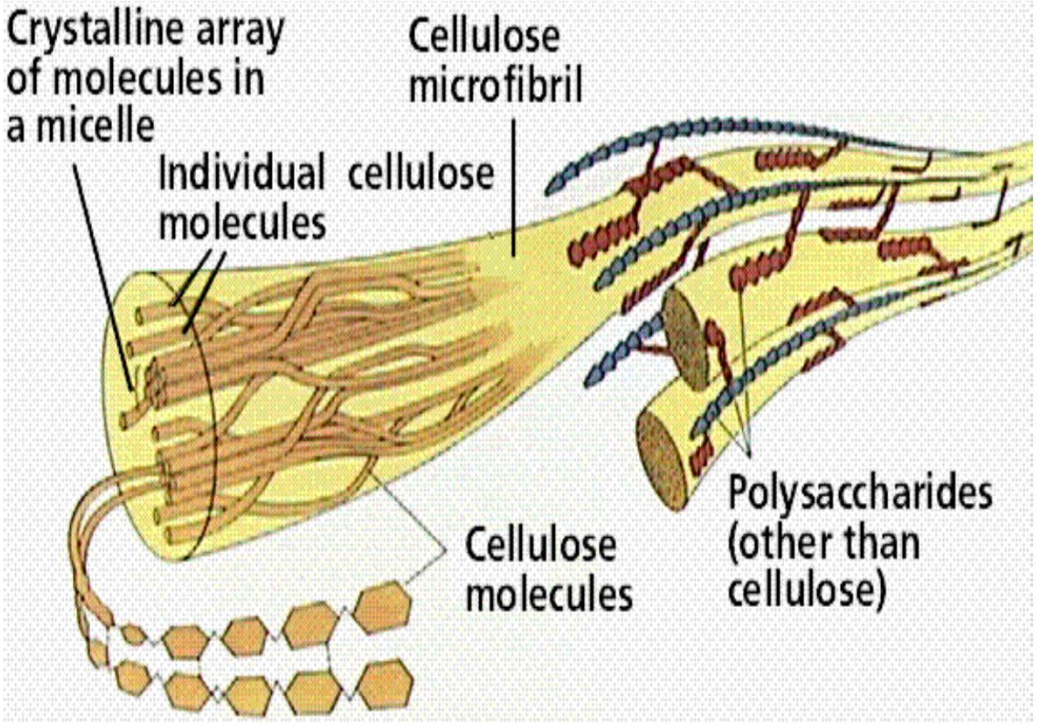
GLUCOSE

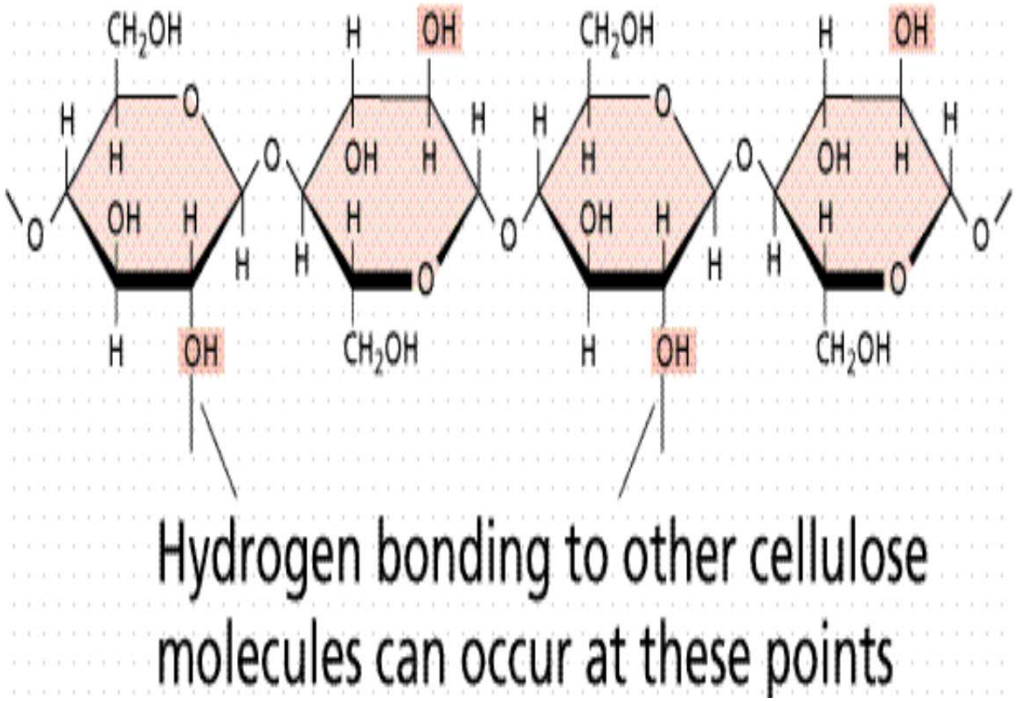


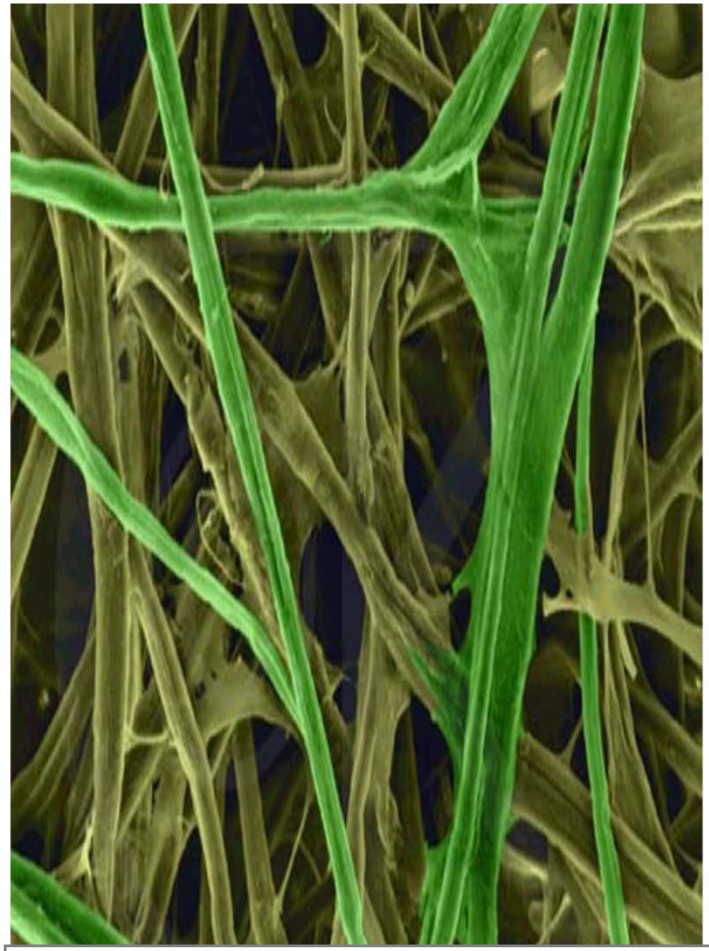
STARCH
GLYCOGEN

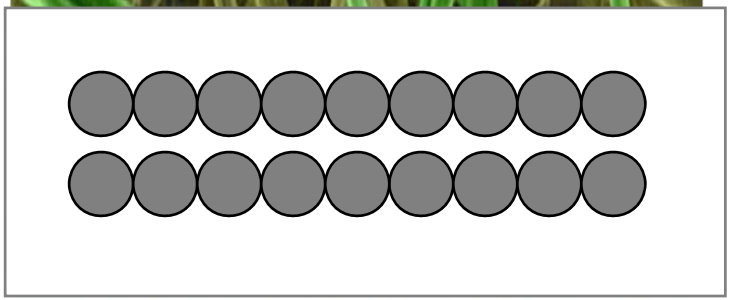





Crystalline array of molecules in a micelle
Cellulose microfibril
Individual cellulose molecules
Cellulose molecules
Polysaccharides (other than cellulose)


Hydrogen bonding to other cellulose molecules can occur at these points





CELLULOSE

Dietary Fibre

- Dietary fibre refers to a mixture of different compounds, generally complex carbohydrates.
- Fibre is found naturally in foods of plant origin and is derived from plant cell walls.
- There are two types of fibre; soluble and insoluble

Type of fibre	What it does	Where its found
Insoluble	Absorbs water, bulking agent, feeling full	Wheat bran, oats, fibrous fruits and vegies
Soluble	Reduces the rate of nutrient absorption, lowers blood cholesterol	Most fruits and vegetables and many grains

Complex Organic Compounds

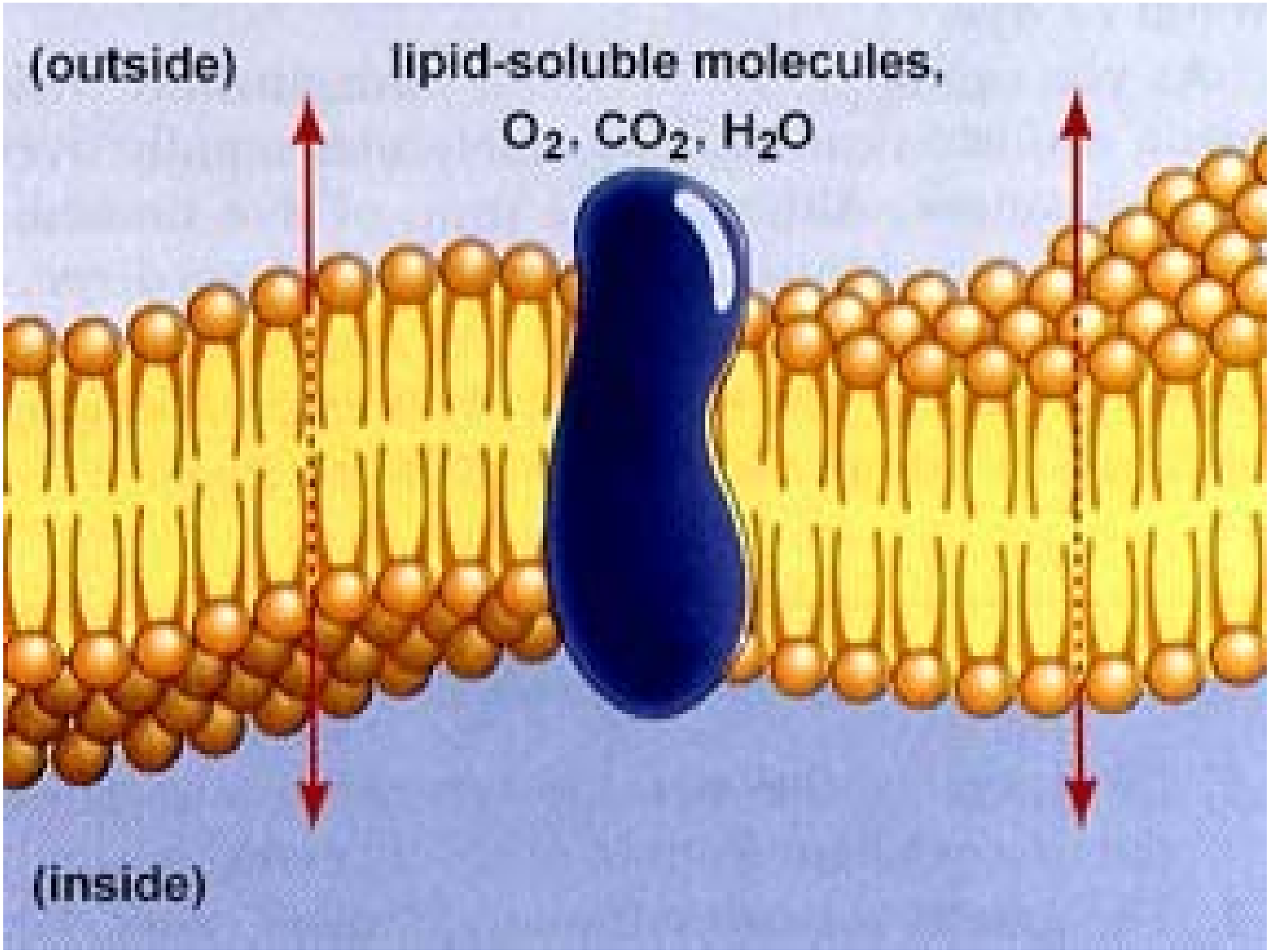
Lipids

- Composed principally of C, H and O
- Variety of functions
  - membrane structure
    - _____
  - energy storage
    - _____
  - chemical messengers
    - _____

Fats and Lipids

triglyceride

phospholipid


(outside)
lipid-soluble molecules,
O_2, CO_2, H_2O
(inside)

- Fatty acids are classified into three areas:
  1. **Saturated** – most animal fats and those found in butter. All single bonds.

  2. **Monounsaturated** – as in olive oil. One double bond.

  3. **Polyunsaturated** – those in margarine and vegetable or seed oil. More than one double bond.

Fish oils contain many important triglycerides that are essential in our diets. Of particular importance are the **omega-3 polyunsaturated fatty acids.**

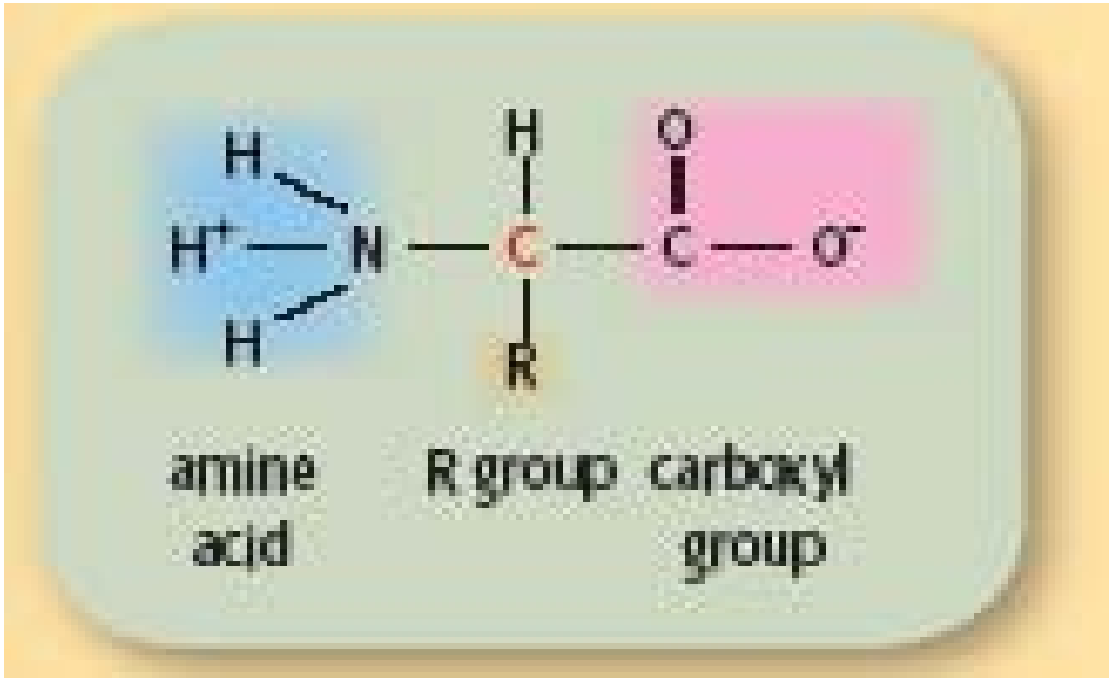
Omega-3 oils aid the development of the brain and retina. They also protect against coronary disease, high blood pressure and rheumatoid arthritis.

Complex Organic Compounds

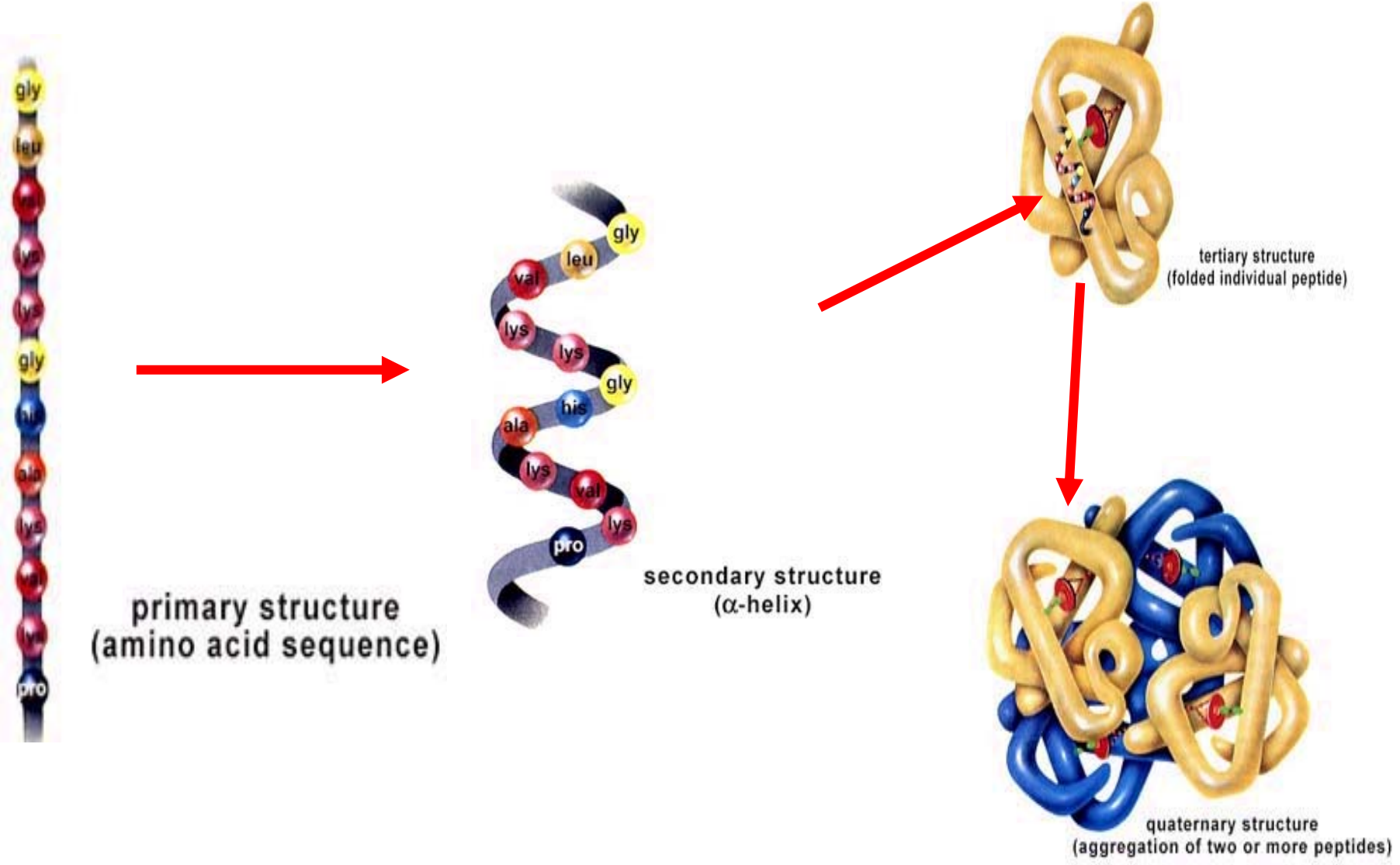
Proteins

- Proteins are the most functionally diverse biomolecules
  - enzymes……
  - structure……..
  - hormones…….
  - defence…..
  - membrane proteins….

- Proteins are chains of amino acids
  - components selected from set of twenty amino acids
  - Some are essential
  - some are non-essential

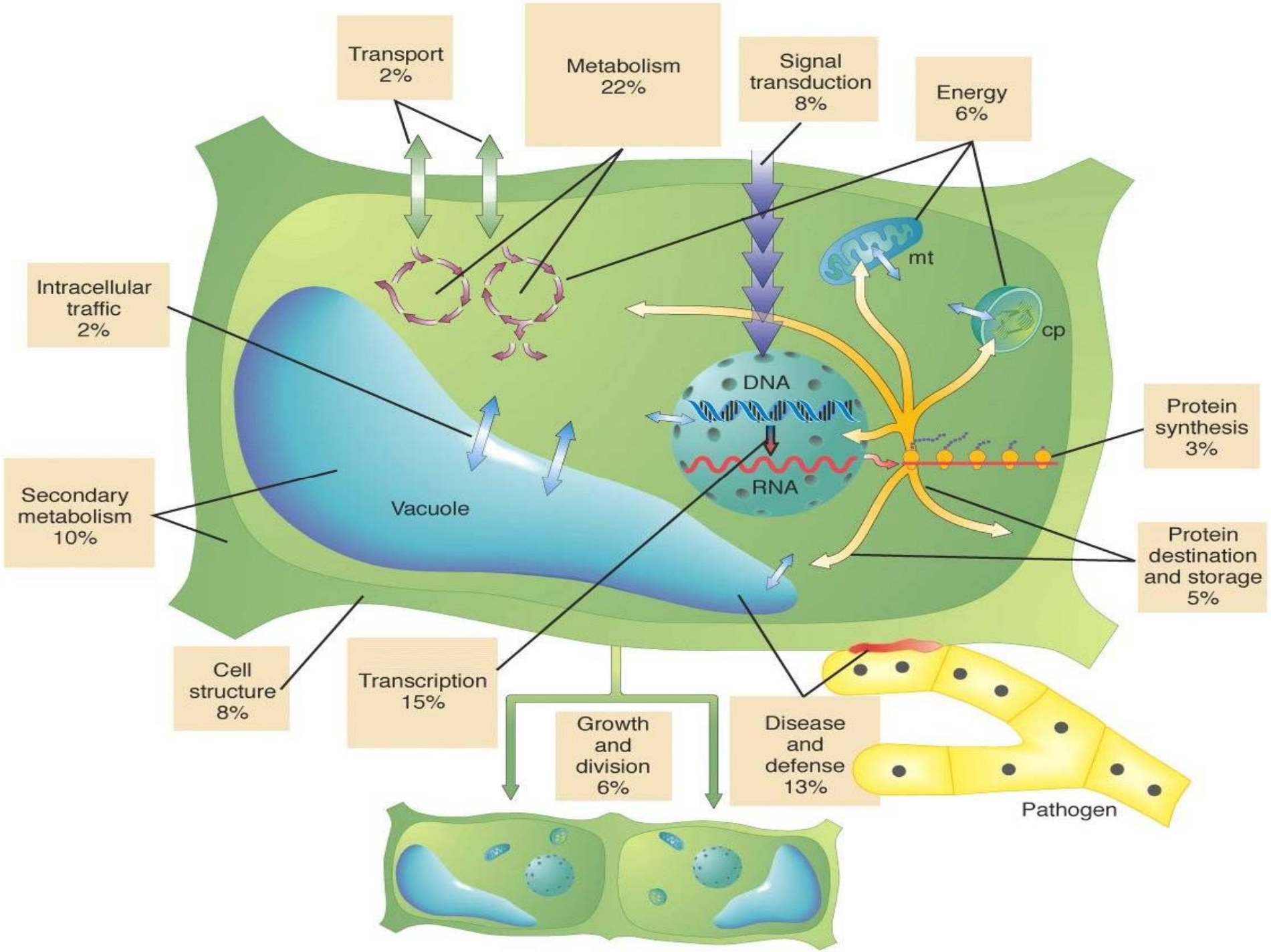


Protein Structure



Sources of dietary protein for the average Australian

Source	Percentage %
Meat and poultry	39
Milk and milk products	20
Grain products	24.5
Fruit and vegetables	6.5
Seaford and eggs	7
Other foods	3


Transport
2%
Metabolism
22%
Signal
transduction
8%
Energy
6%
Intracellular
traffic
2%
mt
cp
DNA
RNA
Protein
synthesis
3%
Secondary
metabolism
10%
Vacuole
Protein
destination
and storage
5%
Cell
structure
8%
Transcription
15%
Growth
and
division
6%
Disease
and
defense
13%
Pathogen

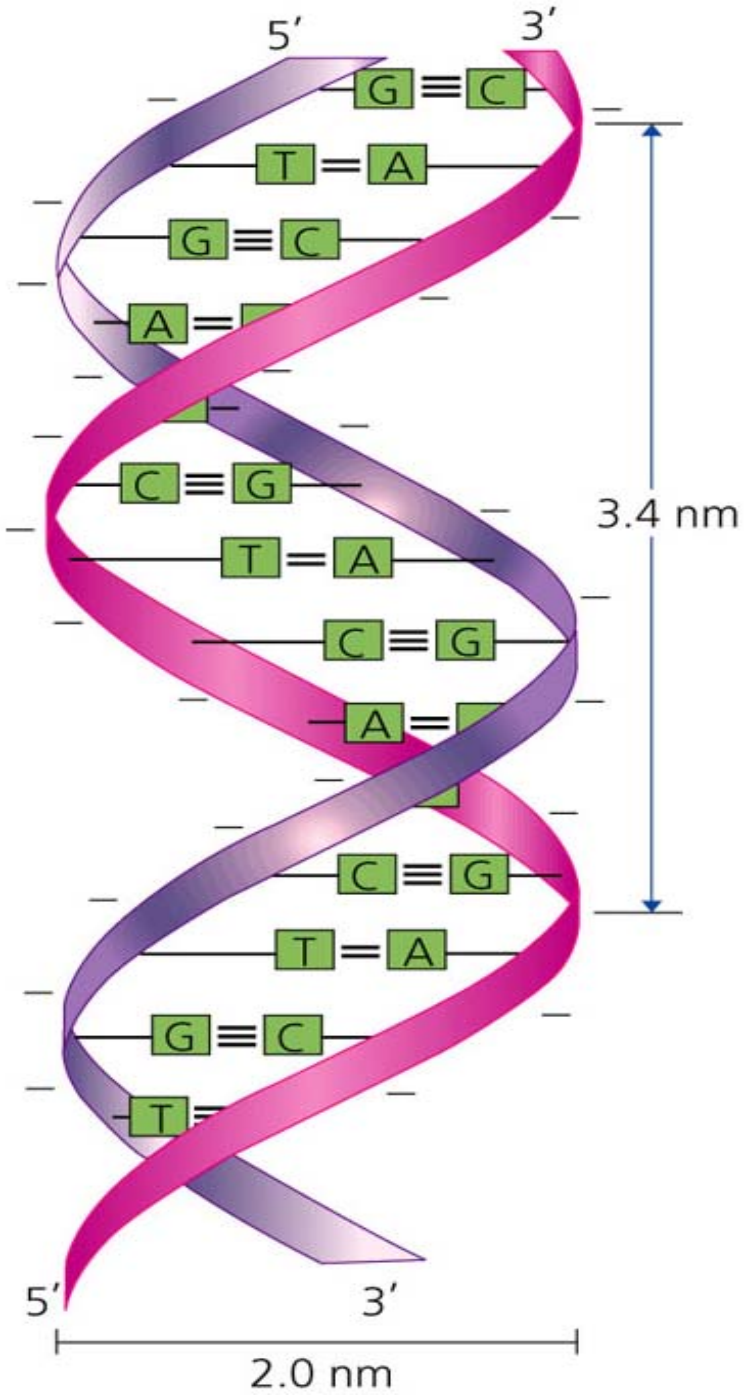
Complex Organic Compounds

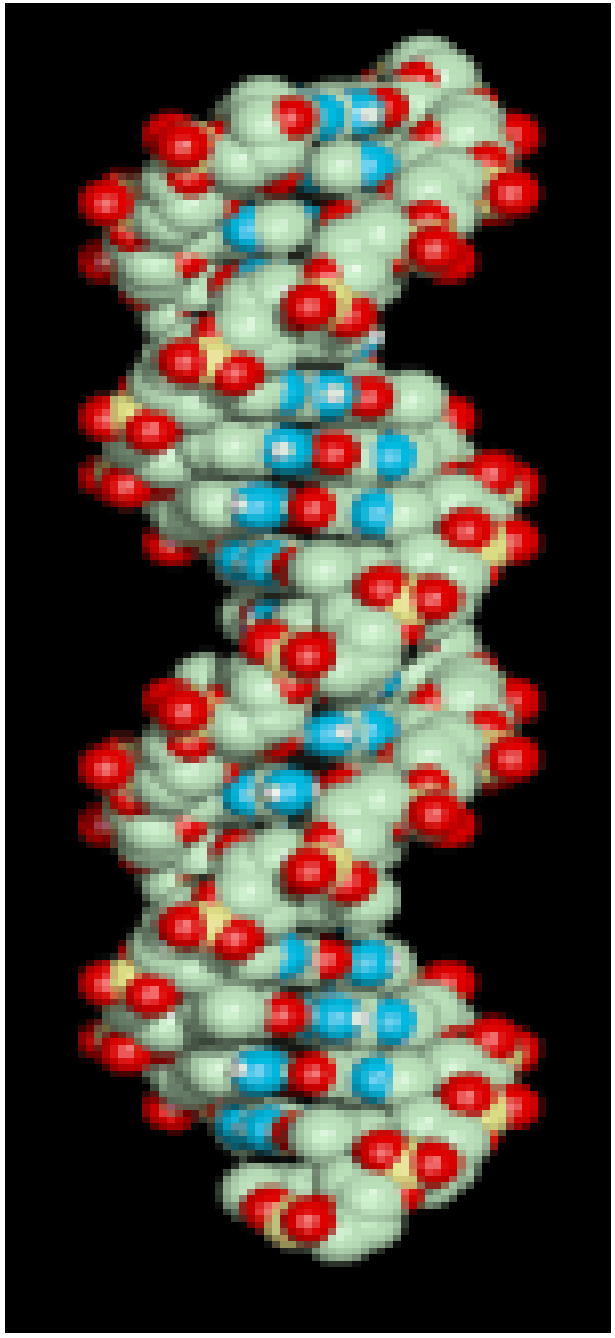
Nucleic Acids

- Nucleic acids carry genetic information in all living cells
- Composed of nucleotides
- DNA and _____
- Two strands of DNA are joined by hydrogen bonds between complementary bases

_____

_____


5′
3′
G ≡ C
T = A
G ≡ C
A =
C ≡ G
T = A
C ≡ G
A =
C ≡ G
T = A
G ≡ C
T =
3.4 nm
5′
3′
2.0 nm



In Summary

Biomolecule	Elements	Examples	Function(s)
Carbohydrate	**C, H, O**		
Lipid	**C, H, O**		
Protein	**C, H, O, N, trace**		
Nucleic acid	**C, H, O, N, P**		