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B3. Biological molecules

B3.01 What are you made of?

1. Water

Cytoplasm: solution of many different substances in water

Space between cells also liquid => almost 80%

Uses

1. Metabolic reaction: only can take place if the chemicals are dissolved in water(solvent)
 - a. Metabolism: every chemical reactions in living organism
2. Water in plasma - dissolve enzyme, transport

B3.02 Carbohydrates

1. Sugars

- simplest kinds of carbohydrates

- **Glucose** -simple sugar($C_6H_{12}O_6$)
- They are small, dissolved in water
- **disaccharide** - complex of two sugar
 - Sucrose
 - Maltose

2. Polysaccharides(다당류)

Many sugars join together - become **polysaccharide**

- Cell wall, starch, glycogen in animal cells
- Insoluble, do not taste sweet

3. Functions of carbohydrates

- Needed for energy(1g= 17 kj) - released by respiration of glucose
 - Glucose: dissolved in the plasma, transported to the cell

Plants

provide them with energy(without transport)

Store carbohydrates as starch

- Easy and quick to change glucose into starch, vice versa

Animals

Store carbohydrates in the form of polysaccharide glycogen

- Only stored in liver and muscle, small quantity

4. Testing for Carbohydrates

Reducing sugar(maltose, glucose) => Add **benedict's solution** to a food and heat it

- No reducing sugar - remain blue
- Containing reducing sugar - brick red

Starch => **iodine solution**

- Containing starch - blue black

B3.03 Fats

Fats- lipids

- Fat molecule - made of four smaller molecules
 - 1 **Glycerol**
 - 3 **fatty acids**
- insoluble , liquid(oil) in r.t.p



1. Functions of fats

- Needed for energy(1g= 39kj)
- After carbohydrates used, Fats used for energy
- Extra energy that fats contain - make them very useful for storing energy
- Underneath the skin - filled with large drop of fats or oils
 - Keep heat inside the body
- Plants: store oils in their seeds

1. Testing for fats and oils

- Chop the food, shake with **ethanol**
- Pour ethanol into water
- Emulsion made - oil + ethanol - **looks white**

B3.04 Proteins

- Carbon + oxygen + nitrogen + hydrogen
- Amino acid: smaller molecules of proteins

1. Functions of proteins

Soluble in water - haemoglobin

Others are insoluble

Not normally used to provide energy - to make new cells

2. Testing for proteins

Biuret test - mix food in water, and add dilute copper sulfate + potassium hydroxide

- **Purple** colour - protein present
- No protein - mixture stays **blue**

	carbohydrates	Fats	Proteins
elements	C,H,O	C,H,O	C,H,O,N
Smaller molecules	Simple sugar	Fatty acid + glycerol	Amino acid
solubility	Sugar-soluble Polysaccharide-insoluble	insoluble	Depends on
What needs them	Available energy	Storage of energy Insulation Make cell membrane	Making cell, enzyme Haemoglobin Used for energy

B3.05 Enzymes

Catalyst: substance that increases the rate of chemical reaction and is not changed by reaction

Enzymes: proteins that function as biological catalysts

- control every metabolic reaction
- Made up of protein

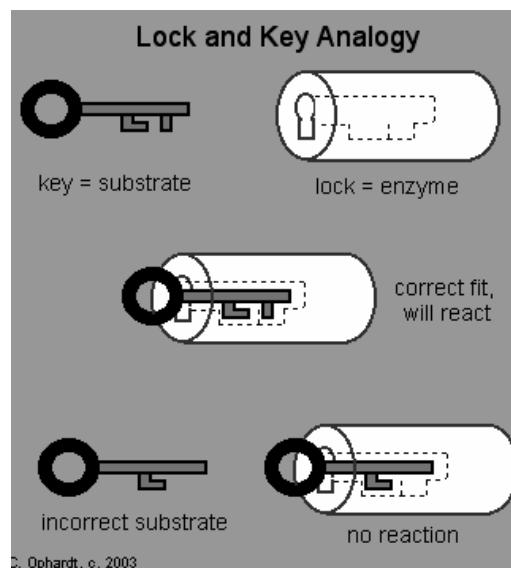
Examples

- Amylase, protease
- Catalase: work inside the cell, breakdown the substance
- Others to make large molecules from small molecules

1. How enzyme works

Substrate: the beginning of the reaction the present substance

Product: substance made by the reaction



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ex) Starch $\xrightarrow{\text{amylase}}$ maltose

- Each enzyme have **active site** - can only act on a particular substrate

2. Properties of enzymes

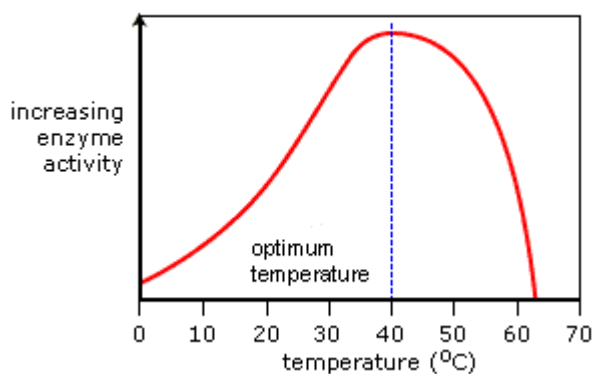
1. All enzymes are proteins
2. Enzymes are made inactive by high temperature
3. Enzymes work best at a particular temperature
4. Enzymes work best at particular pH
5. Enzymes are catalysts
6. Enzymes are specific

3. Temperature and enzyme activity

Molecule - more kinetic energy - move faster - bump frequently

Reaction more likely to take place

- In to high temperature - start to lose their shape - no longer fit with the substrate
- $\Rightarrow$ **denatured**



4. pH and enzyme activity

Most enzymes - work best in 7, otherwise denatured

Pepsin - exception

