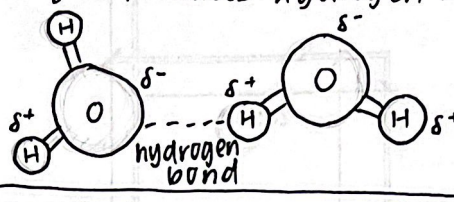
water

Polarity of water

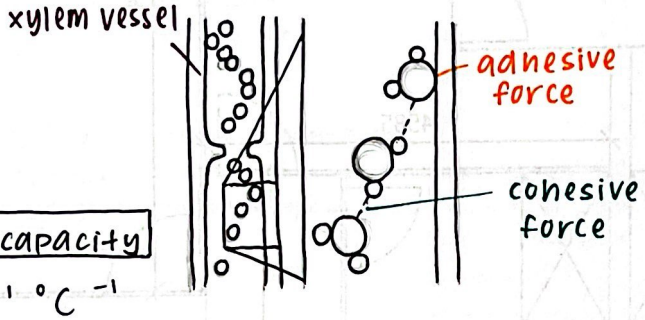
- water → an inorganic compound consisting of the hydrogen (H) + oxygen (O) elements
  - → polar molecules bcuz shared electron btw oxygen + hydrogen will be attracted towards oxygen which is more electronegative (δ^-)
  - δ^+ → produces hydrogen bonds + allows water to act as a universal solvent
    - allow solutes : glucose + electrolytes to be transported thru the plasma membranes in/2 cells for biochemical reactions



Cohesive force + adhesive force of water

- cohesive force → force allowed water molecules to attach to each other
- adhesive force → force that allows water molecules to attach to other surfaces

} produce capillary action which allows water to enter + move along narrow spaces : xylem tube



specific heat capacity

- $4.2\ kJ\ kg^{-1}\ °C^{-1}$
  - → 4.2 kJ heat energy is needed to raise the temperature of 1kg of water by 1 °C
- water absorbs a lot of heat energy w/ a small rise in temp.
  - → maintain the temperature of organisms

protein

- complex compound composed of carbon, hydrogen, oxygen + nitrogen
  - → most proteins also contain sulphur + phosphorus
- composed of one / more polymers known as polypeptides
- dipeptides → 2 amino acid molecules linked together by a peptide bond thru condensation
  - → further condensation can link more amino acids to form a polypeptide chain

made up of monomers/ small units known as amino acids
- → 50 - thousands in a polypeptide
- → linked thru condensation

importance

1. build new cells
2. repair damaged tissues
3. for the synthesis of enzymes, hormones, antibodies + haemoglobin
4. form building blocks : keratin in the skin, collagen in bones, myosin in muscle tissue

amino acid + amino acid $\xrightarrow{\text{condensation}}$ Dipeptide + water

Dipeptide + water $\xrightarrow{\text{hydrolysis}}$ Amino acid + amino acid

Food rich in protein

1. fish
2. meat
3. milk
4. beans
5. eggs

4.2 carbohydrates

- organic compounds consist of carbon, hydrogen + oxygen element in the ratio 1:2:1 + w/ the chemical formula $(CH_2O)_n$

Organic compounds
- chemi. comp. contain carbon elements
- large + complex comp.
  - macromolecules
    - most are polymers comprising small molecules known as monomers

Types of carbonydrates

① monosaccharides (simple sugars)

- carb. monomers
  - simplest carb. units
- can combine to form polymers thru condensati
- taste sweet, form crystals, dissolve in water
- has reducing power / reducing sugars
  - transfer hydrogen (or electron) to other compounds
    - reducing process
  - when monosaccharide is heated in Benedict's solution,
    - monosaccharide will reduce the blue copper (II) sulphate to a brick red precipitate of copper (I) oxide
      - x soluble in water
- examples:
  - glucose → sugar found in plants: rice, wh... apes
    - most commonly found monosacchari...
    - most polysaccharides are formed from ...
  - fructose → sugar found in honey + sweet fru...
  - galactose → found in milk

Starch
- main storage of polysaccharide in plants
- found in chloroplast
- source: grains, potatoes, legumes

...ce
- ...energy: glucose
- ② food reserve: glycogen in animal cells + starch in plant cells
- ③ support structure: cellulose in the plant cell wall

Glycogen
- main storage of polysaccharide found in muscle cells + animal liver cells

Sucrose → x - reducing sugar
- x reduce copper (II) sulphate solution
- when hydrolysed in 2 monosaccharide
  - Benedict's test +ive

② Disaccharides

- formed when 2 simple sugar molecules (monosaccharides) combine thru condensation
  - involves the removal of a water molecule

Glucose + glucose ⟶ Maltose + water

Glucose + fructose ⟶ sucrose + water

Glucose + galactose ⟶ lactose + water

- can be broken down to monosaccharides units thru hydrolysis + one water molecule

Maltose + water ⟶ Glucose + glucose

Sucrose + water ⟶ Fructose + glucose

Lactose + water ⟶ Galactose + glucose

- Example: · maltose → found in grains · lactose → milk · sucrose → sugar cane sweet fruits + sugar beet

③ Polysaccharides

- sugar polymers consisting of monosaccharides monomers
- formed thru condensation process + involves hudreds of monosaccharides to form long molecular chains
- disintegrate thru hydrolysis w/ the help of — dilute acids / boiling / enzyme action
- x taste sweet
- x crystallise

lipids

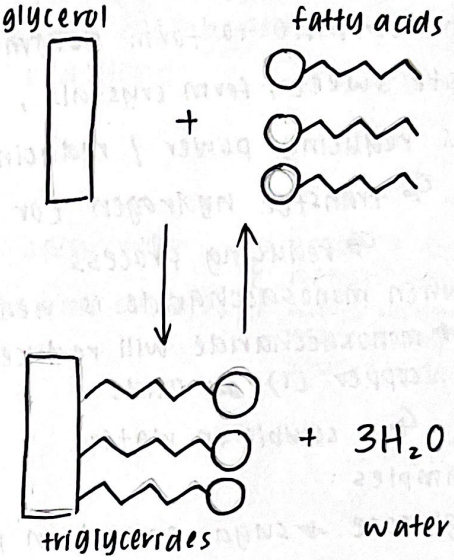
- naturally occuring hydrophobic compounds found in plant + animal tissues
- made up of carbon, hydrogen + oxygen but w/ a much higher ratio of hydrogen atoms to oxygen atoms
- water insoluble, but soluble in other organic solvents : • alcohol • ether • chloroform

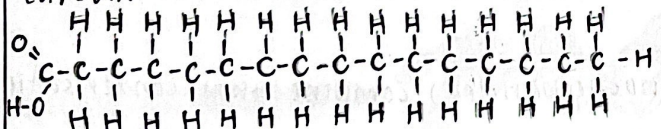
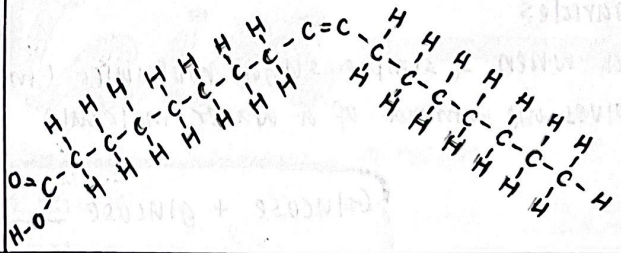
Types of lipids

① Fats

- fats + oils are triglycerides.
- triglycerides → a type of ester formed from the condensation of 1 glycerol molecule w/ 3 fatty acids molecules
  → can be hydrolysed again inz glycerol + fatty acids thru hydrolysis

  glycerol: a type of 3 carbon alcohol that contain 3 hydroxyl groups (-OH)



Saturated Fats	Unsaturated Fats
Both consist of carbon, hydrogen + oxygen elements	
Both contain glycerol + fatty acids	
Both contain nonpolar molecules	
Fatty acids only hv single bonds btw carbon. 	Fatty acids hv at least 1 double bond btw carbon 
x form chemical bonds w/ additional hydrogen atoms bcuz all bonds btw carbon atoms are saturated	double bonds can still receive 1/more additional hydrogen atoms bcuz carbon atoms are unsaturated
Exist in solid form at room temperature.	Exist in liquid form at room temperature
Source : butter + animal fat	Source : olive + fish oil

② Wax

- contains 1 molecule of alcohol that combines w/ another molecule of fatty acid
- waterproof

③ Phospholipid

- major component of plasma membrane
- made up of 1 molecule of glycerol + 2 molecules of fatty acid + 1 group of phosphate

④ Steroids

- lipids that x contain fatty acids
- Examples : • cholesterol • testosterone • estrogen • progesterone

Importance

- Fats :
  ① reserved energy for animals
  ② liner to protect internal organs, s
  ③ heat insulator for animals
- waxes :
  ① important components in cuticles that covers epidermis of leaves
  sebum secreted by our skin
- glycolipid (in plasma membrane)
  ① stabilise plasma membrane
  ② cell identification
- steroids : cholesterol : steroid hormone synthesis

nucleic acid

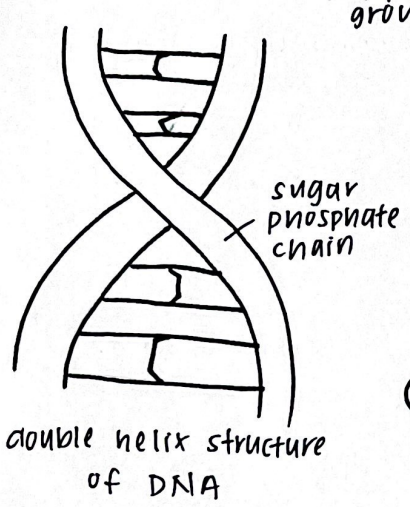
- formed from the elements of carbon, hydrogen, oxygen, nitrogen + phosphorus
- consists of:
  1. pentose sugar — ribose / deoxyribose
  2. phosphate group
  3. nitrogenous base — adenine (A), guanine (G), cytosine (C), uracil (U), thymine (T)

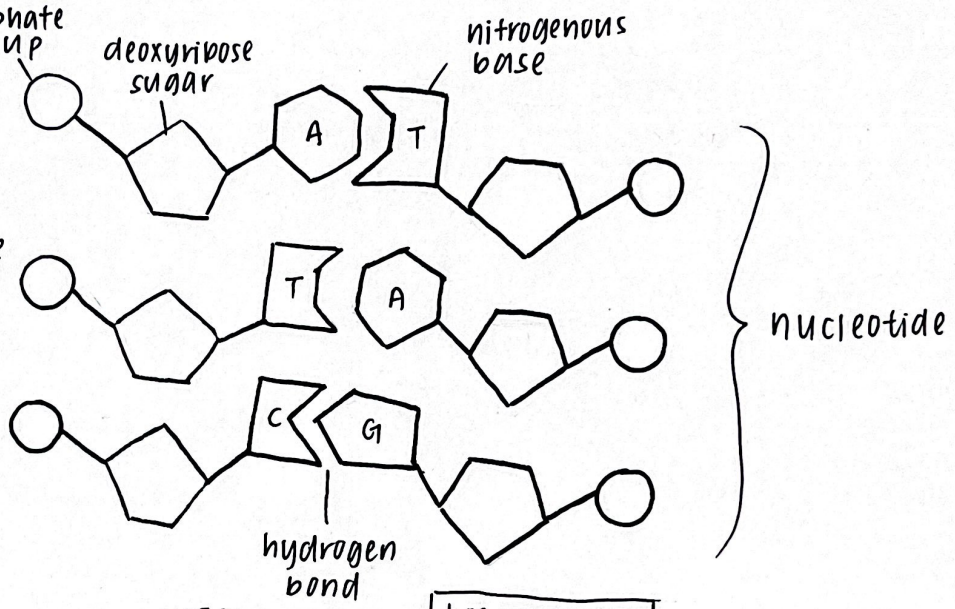
one unit → nucleotide

Nucleic acid → long chain of polymer comprising of nucleotide monomers

Types of nucleic acids

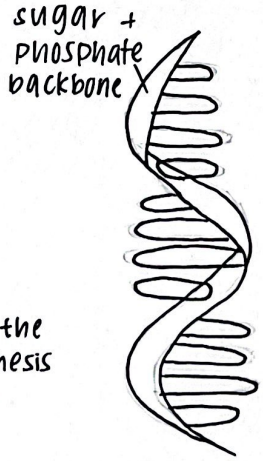
1. Deoxyribonucleic acid (DNA) → contains deoxyribose sugar
   - consists of 2 polynucleotide chains that are intertwined in opposite directions + form the double helix
   - nitrogenous base groups on both polynucleotide chains are matched + bound together by hydrogen bonds





2. Ribonucleic acid (RNA)
   - single polynucleotide chain which is shorter than DNA
   - nitrogenous base: adenine, guanine, cytosine, uracil
     - replaced thymine
   - 3 main types:
     - messenger RNA (mRNA)
     - ribosomal RNA (rRNA)
     - transfer RNA (tRNA)

     } involved in the protein synthesis process



Importance

- DNA carries hereditary info by nitrogenous bases for the synthesis of polypeptides which form proteins
  - carries genetic code
    - written as a series of 3 bases that