

# Biology

## Notes

For Study Guide

By Class 1 Grade 10  
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# Unit 1 Biochemistry.

1. Water

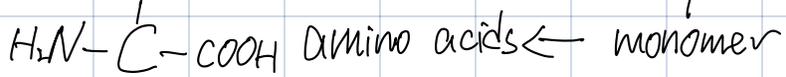
ribose 核糖  
ribosome 核糖体

2. Nucleic Acids.   
 DNA - Deoxyribo nucleic acids  
 RNA - Ribonucleic acids

polymer 聚合物

monomer 单分子 → nucleotide 核苷酸

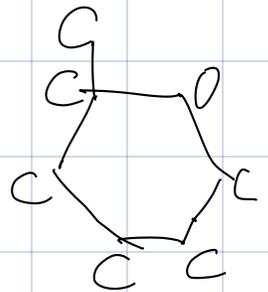
3. Proteins. (antibody 抗体, telomerase 端粒酶) polymer



官能团 ← any groups ← R

4. Lipids 脂肪 (monomer)   
 fats  
 oil  
 sterical 类固醇 (激素等)

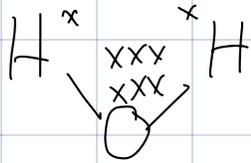
5. carbohydrates. → glucose (monomer)  
 (CH<sub>2</sub>O)<sub>n</sub> ↓ starch (polymer)



\*: polymer  $\not\Rightarrow$  macro molecules.

	Nucleic Acid	Protein	Carbohydrates	Lipids 脂肪*
monomer	nucleotide	amino acid	monosaccharide	脂
bond	sugar-phosphate covalent bond	peptide bond	glycosidic bond	ester bond
elements	C, O, H, P, N	C, H, O, N, S	C, H, O	C, H, O
functions	* store genetic information * transport * phospholipids	* enzyme * immune * transport * structure *	* provide energy * store energy * raw materials * structure	* energy storage * cushion organs * insulates body * Fat * phospholipids * steroid

# 1 Water



ionic bond 离子键

covalent bond 共价键

非极性

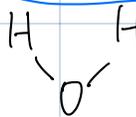
nonpolar

eg:



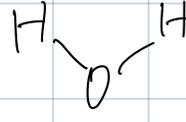
polar

极性



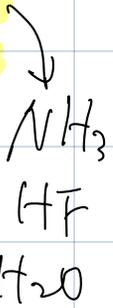
(H 显正电性, O 显负电性)

电子分布不均



Hydrogen bond

氢键



相似相溶

## Elixir of Life

灵丹妙药

### Special properties of water

1. cohesion & adhesion 内聚力 附着力

- surface tension, capillary action

2. good solvent

- many molecules dissolve in H<sub>2</sub>O

亲水性

hydrophilic vs. hydrophobic

疏水性

3. lower density as a solid

- ice floats!

4. high specific heat 比热容

- water stores heat

5. high heat of vaporization

- heats & cools slowly



Ice! I could use more ice!



# 1. cohesion & adhesion

eg: Transpiration 蒸騰作用

xylem 导管 — 水

phloem 筛管 — 营养物质

# 2. solvent 溶剂

solvent 溶质      solution 溶液

## Ionization of water & pH

### Water ionizes

◆  $H^+$  splits off from  $H_2O$ , leaving  $OH^-$

• if  $[H^+] = [OH^-]$ , water is neutral

• if  $[H^+] > [OH^-]$ , water is acidic

• if  $[H^+] < [OH^-]$ , water is basic

### pH scale

◆ how acid or basic solution is

◆  $1 \rightarrow 7 \rightarrow 14$

$pH = 1$   
 $H^+ 10^{-1}$

$pH = 3$

$H^+ 10^{-3}$

$pH = 14$

$H^+ 10^{-14}$

$OH^- 10^{-13}$

$\Rightarrow$

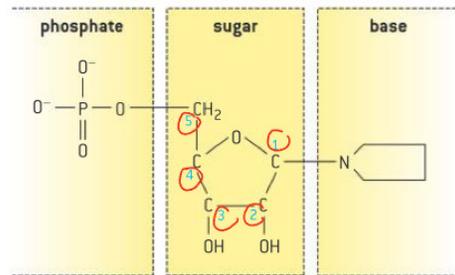
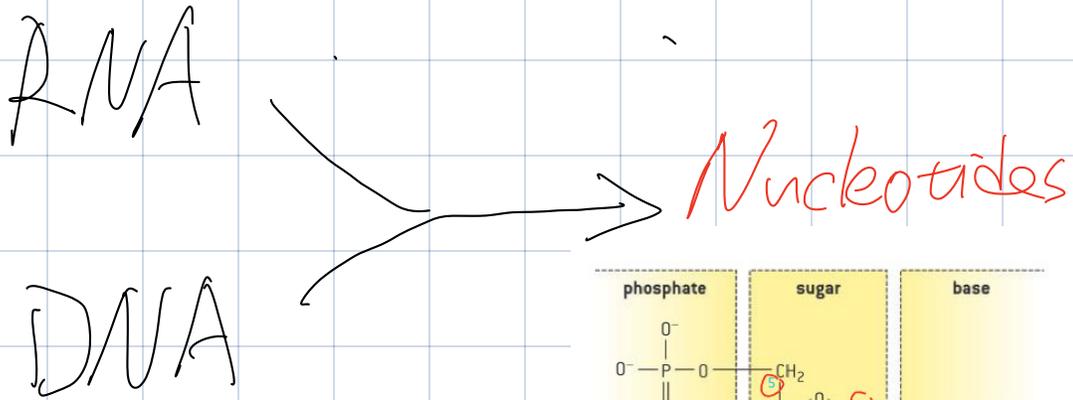
$OH^- 10^{-11}$

$\Rightarrow$

$OH^- 10^0 = 1$

# 2. Nucleic Acids

Function: 1. stores information (DNA)  
2. transfers information (mRNA, tRNA)



▲ Figure 1 The parts of a nucleotide

**Nucleotides**

- 3 parts
  - nitrogen base (C-N ring)
  - pentose sugar (5C)
    - ribose in RNA
    - deoxyribose in DNA
  - phosphate ( $PO_4$ ) group

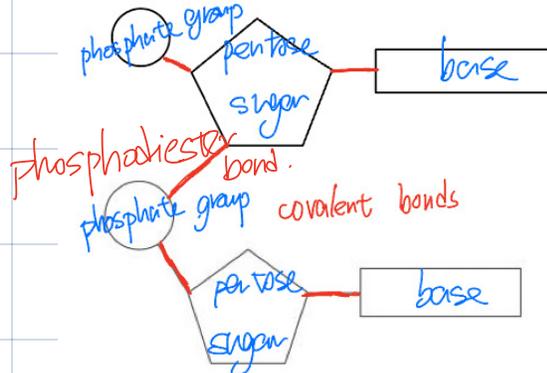
Are nucleic acids charged molecules?

Nitrogen base  
I'm the A, T, C, G or U part!

Phosphate group

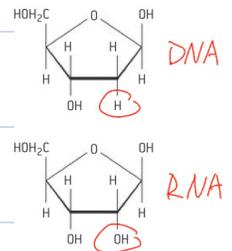
Nitrogenous base

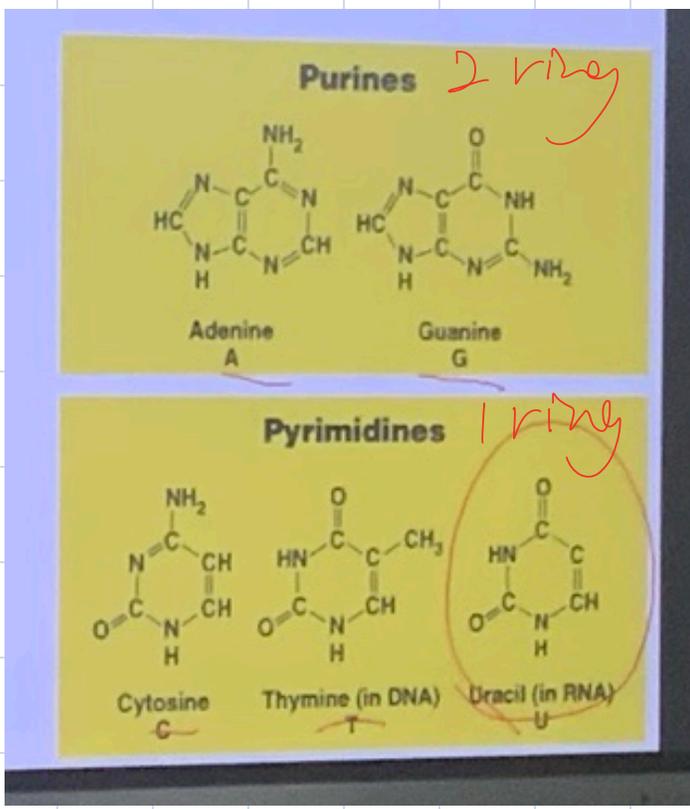
Pentose sugar



▲ Figure 2 A simpler representation of a nucleotide

nitrogen base → A, G, C, T, U  
 pentose sugar → deoxyribose in DNA  
 ribose in RNA  
 phosphate group





purine = pyrimidine

A :: T

G :: C

↓  
H bond

### 3. Proteins.

特屏码: D 9 R

## The function of proteins

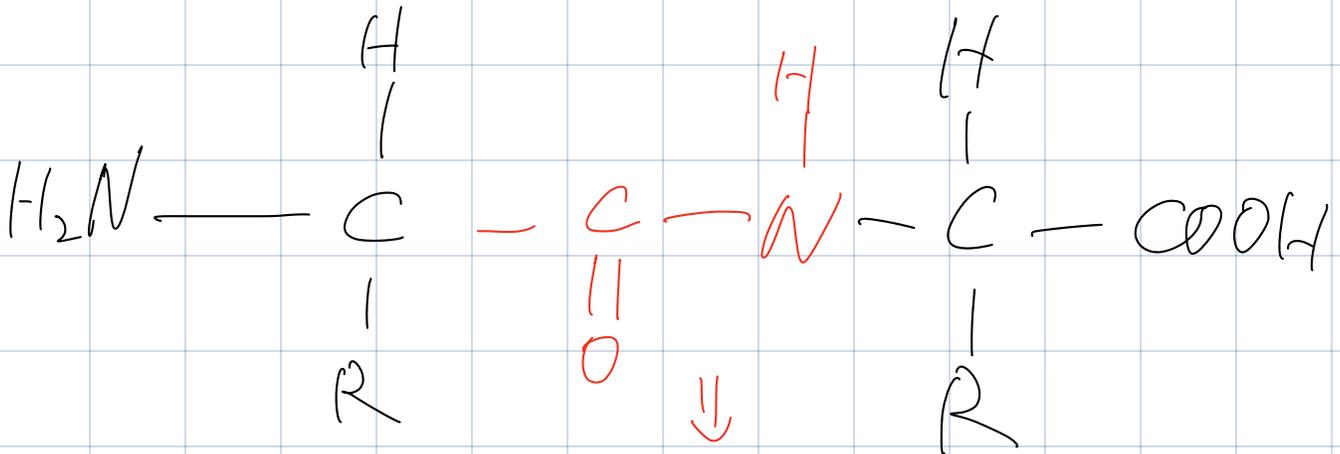
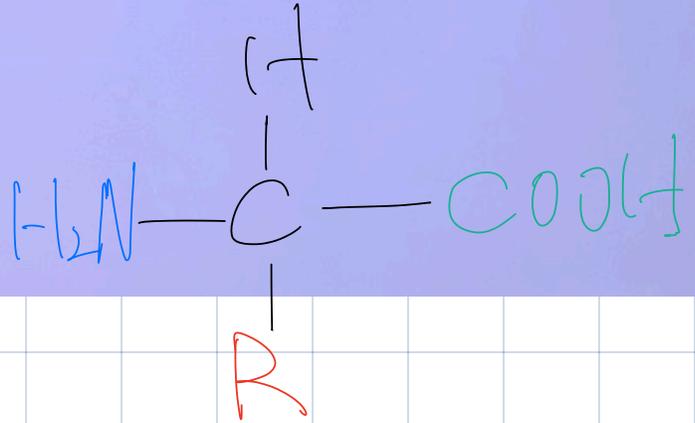
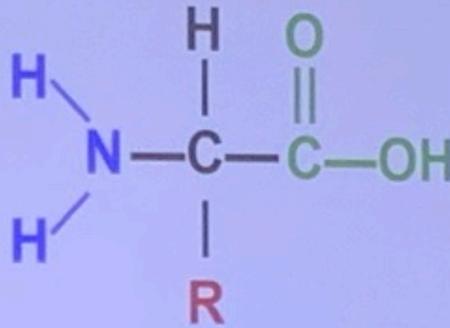
- Most structurally & functionally diverse group
- Function: involved in almost everything
  - enzymes (胃蛋白酶 pepsin, DNA 聚合酶 DNA polymerase) *catalyst 催化剂*
  - structure (角蛋白 keratin, 胶原蛋白 collagen)
  - carriers & transport (血红蛋白 hemoglobin, 水通道蛋白 aquaporin)
  - cell communication
    - signals (insulin & other hormones)
    - receptors
  - defense (antibodies)
  - movement (actin & myosin)
  - storage (bean seed proteins)

proteins  $\rightarrow$  amino acids (20 kinds)  
 (poly peptide 多肽)  
 polymer  $\rightarrow$  monomer

## Amino acids

### • Structure

- central carbon
- amino group
- carboxyl group (acid)
- R group (side chain)
  - variable group



肽键 peptide

# 4. Carbohydrates $(CH_2O)_x$

$(CH_2O)_x \rightarrow C_6H_{12}O_6$  gluc

Function:

- energy
- raw materials
- energy storage
- structural materials

## Monosaccharides

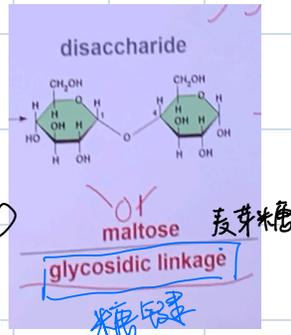
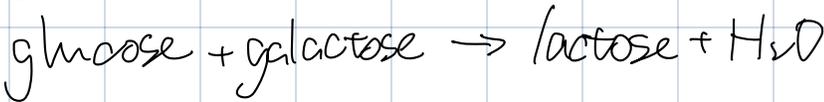
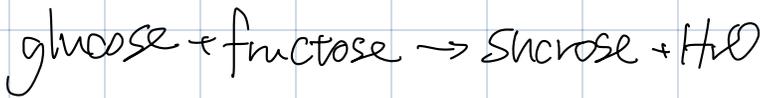
{ glucose   
 { ribose   
 { glyceraldehyde

⇒ 6C hexose   
 ⇒ 5C pentose   
 ⇒ 3C triose

} 不反应

↓ dehydration synthesis

## Disaccharides



## Polysaccharides

glycosidic bond

Polysaccharides

- Polymers of sugars
  - costs little energy to build
  - easily reversible = release energy
- Function:
  - energy storage
    - starch (plants)
    - glycogen (animals)
      - in liver & muscles
  - structure
    - cellulose (plants)
    - chitin (arthropods & fungi)
      - 壳丁原  $\rightarrow$  节肢动物





# 5. Lipid, 脂类

composed of C, H, O

fats 脂肪

phospholipids 磷脂

steroids 固醇

⇒ big monomer  
x polymer.

## Fats: Triglycerides

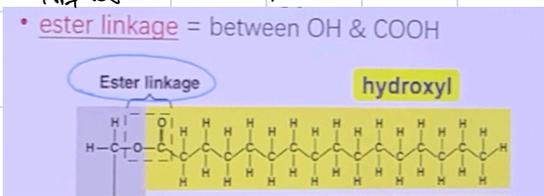
↓  
glycerol + fatty acid

(甘油, 丙三醇)

酯化

dehydration synthesis

long tail  
carboxyl group (COOH) 羧基



### Fats store energy

- Long HC chain
- polar or non-polar?
- hydrophilic or hydrophobic?
- Function:
  - energy storage
    - concentrated
    - all H-C/
  - 2x carbohydrates
  - cushion organs
  - insulates body
    - Whale blubber & polar bears!

non-polar  
hydrophobic

The diagram shows three stacked triglyceride molecules. Each molecule has a glycerol head and a long hydrocarbon tail. The tails are highlighted in yellow.

## Saturated Fats

solid at room temperature, from animal.

## Unsaturated Fats

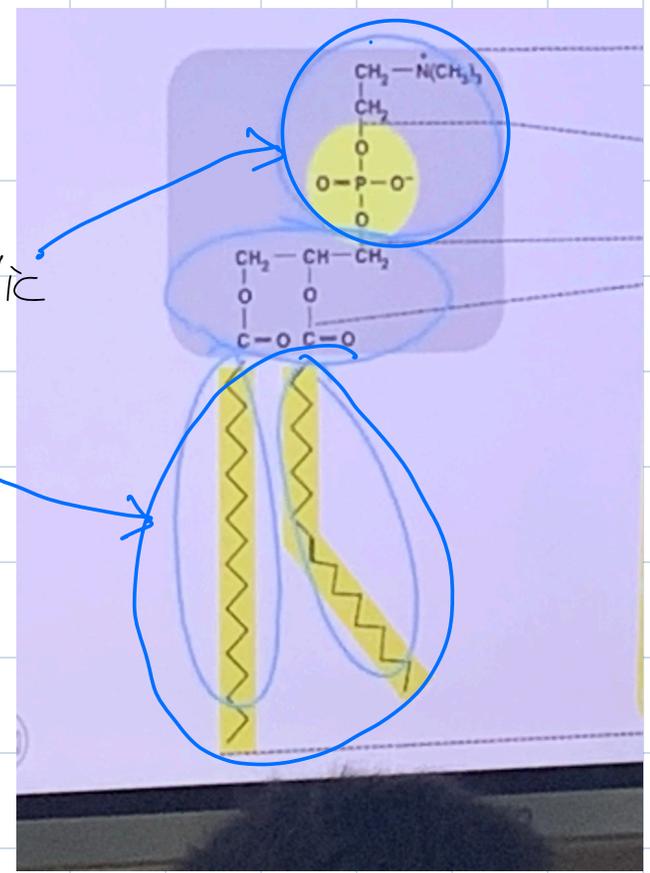
liquid at room temperature, from plant / fish

## Phospholipids

# Phospholipids

glycerol + 2 fatty acids +  $PO_4$

↓ hydrophobic      ↓ hydrophilic

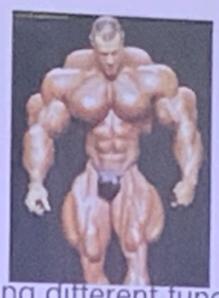


# Steroids

## Steroids

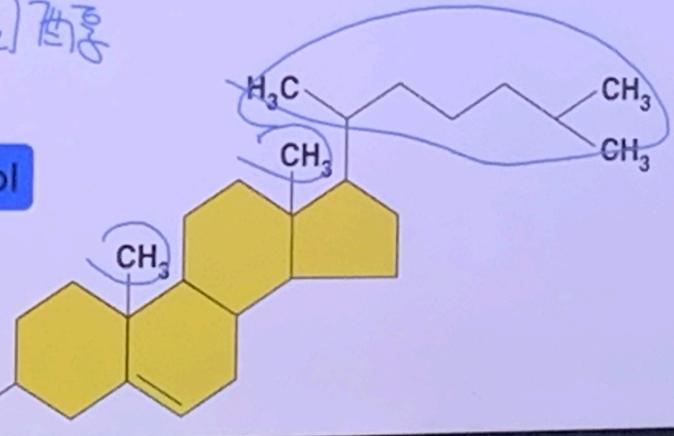
Structure:

- 4 fused C rings + ??
- different steroids created by attaching different functional groups to rings
- different structure creates different function
- examples: cholesterol, sex hormones

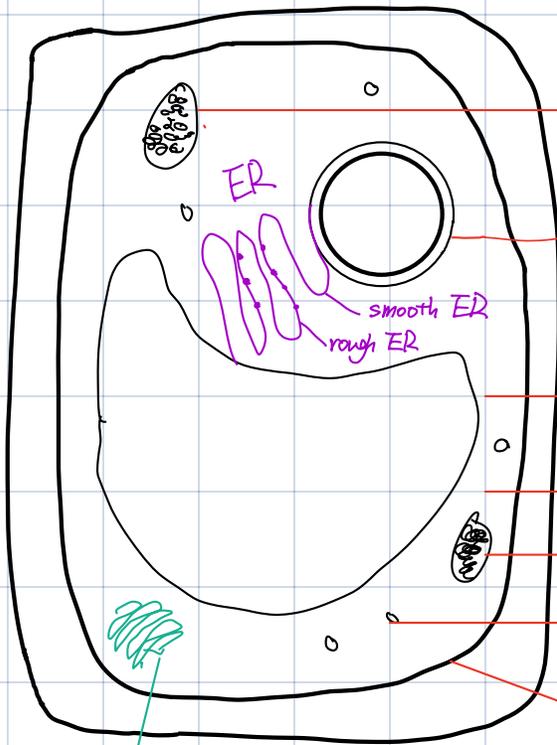


胆固醇

cholesterol



# Unit 2 Cell



chloroplast

nucleus

ER: Endoplasmic Reticulum

cell wall

large central vacuole

cytoplasm

mitochondria

Small vacuole

cell membrane

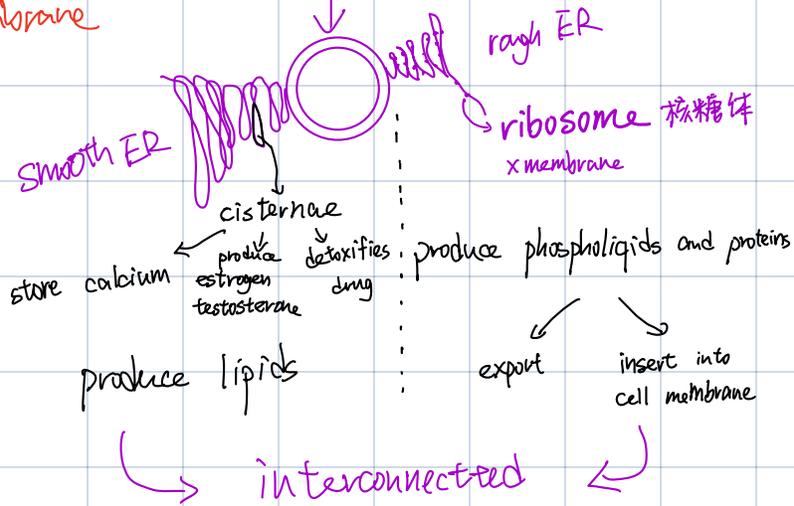
double-membrane organelle

双膜细胞器

Golgi Apparatus.

break link with nucleus

ER  
Function: intercellular highway transport



Prokaryotes 原核生物 → prokaryotic cell

nucleoid 核区



DNA



nuclear membrane



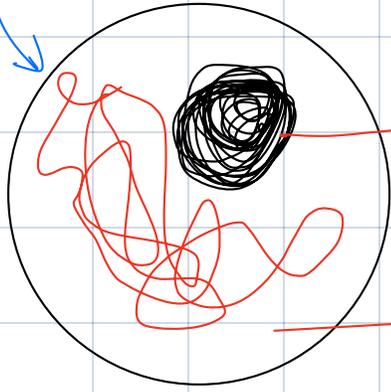
nucleus

Eukaryotes 真核生物 → eukaryotic cell

# Nucleus

controls most functions in eukaryotic cells

stores the genetic information



nucleolus

核仁

chromosome 染色体

chromatin 染色质

← DNA