



**Cell &
Molecular
Biology
Notes**

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Doctor Amer Imraish

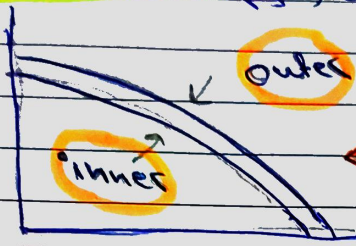
Cell Biology

2^{ed} lecture

25 Feb 2021

By Salsabeel Jaw

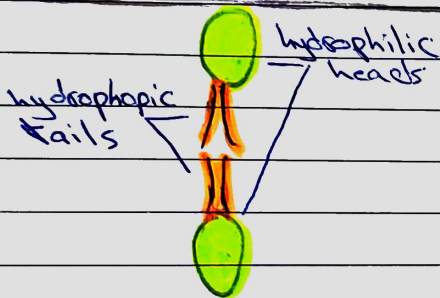
- * Plasma membrane is the outer boundary to separate the cell from the surrounding.
- * The thickness 5-10 nm
- * The membrane can not be seen by light microscopy, we use the electron microscopy



lipid bilayer (phospholipid)

phospholipid → Amphipathic
hydrophilic → interact with water
so it forms the outer and inner surfaces

hydrophobic → can't react with water (the internal structure of plasma membrane)



Membranes Functions:

- * Compartmentalization: it enclose the intracellular compartment.
(Mitochondria, Chloroplast, lysosomes) (vacuoles in plant cells)
- * Scaffold for biochemical activities: (e.g) Carbon fixation membranes consist of many enzymes for some effective interaction such as, Carbon fixation (Photosynthesis).
- * The regulation of molecules' passing, exchanging of substances between the compartments or between the cells and surrounding. Some materials cross the membrane easily while others pass difficulty.
(selective permeability)

Water can penetrate the membrane also, it has aquaporins → specific channels

* **Transporting Solutes (نقل المواد):** via Membrane proteins (**transporting proteins, carrier proteins...**) (**between compartments / cell & surrounding**)

* **The membrane have receptors** which **transduce signals** (plant, animals cells covered by receptors)
- When Hormones bind with receptors the receptors transduce the signal from the **outside the cell to the inside** to produce a **response**. (**Target molecule produces the response**)

* **Membranes ^{mediate} intermediate recognition and interaction** between adjacent cells

دفع الخلية على بعض المواد التي تقرب من خلية أخرى
في بعض الأحيان يكون لها بعض التفاعل

* **Introduce Transduce photosynthetic energy**
Convert chemical energy to ATP and store energy

Cellular respiration, ATP synthase which is located in **inner mitochondria membrane** transduce and apply the phosphorylation to **ADP to produce ATP** (Convert chemical energy from Glucose into ATP)

photosynthesis $\text{CO}_2 \xrightarrow[\text{using ATP}]{\text{By}}$ Sugar

thylakoid membrane

membran → lipid bilayer

phospholipid → Glycerol (3 Carbon Alcohol)

↓
Each carbon has
~~hydroxyl~~ hydroxyl
group

There are many kind of phospholipid according to the changing in:

1. the type of fatty acid
(Saturated, unsaturated)
(No. of carbons)
(No. of double bonds)

2 of them was fatty acid
straight → saturated
bend → unsaturated

third carbon - OH
bind with phosphate
group which has
polar molecule

But the differences between phospholipids depend on the polar molecule

The major difference

polar molecule Choline → phosphatidyl choline
H⁺ / Serine / inositol

hydrophilic (head) → phosphate group with polar molecule

hydrophobic (tail) → fatty acid

self assembly → H_2O → oil/drop → phospholipid

mainly Components of membrane: phospholipid, protein

we will take about ← another type → Integral Peripheral

later another component: Carbohydrate and protein (Glycoprotein)
lipid (Glycolipid)

another component (Cholesterol (lipid))

animal cells

plant cells have another steroid

important in: surface tension membranes is much lower than pure lipid because of the presence of proteins (Integral, peripheral)

Proteins (Individual | Complex)

Complex: penetrate fluid lipid bilayer extend out into aqueous environment

Integral proteins (amphipathic)

hydrophilic to interact with the out part of lipids

hydrophobic to extend through the membrane

lipid → membrane fluidity. (dynamic structure)
protein → function

The components of the membrane are mobile. *et al.*

8.2 Concept

Membranes are ^{mainly} **lipid-proteins** assemblies held together with **non covalent bonds**.

lipid bilayer → to prevent **random movements**
(**structural backbone**)

prevent random material → **منع المواد العشوائية**

منع الحركة العشوائية

IT'S highly regulated

Such as **transport** across the membrane
it's completely organized.

proteins → **Specialized activities**

proteins and lipid compositions differ
from membrane to another

inner mitochondrial membranes
which apply the cellular respiration
many enzymes involved to this process
located in this membrane (Electron transport
Chain)

myelin sheath electrical isolated (protein → polar)
(lipid → non polar) **it consists of high fat**
of lipids. **غشاء عازل كهربائي**

phosphate → negative charge
phosphate group together with the **polar group**
the high **soluble** Domain (Head Group)

Summary

lipid & protein composition depends on

* Type of cellular membranes.

* Type of organisms.

* Type of cells

According to the membrane
Function.

Type Membrane lipids:-

* phospho glycerides (Glycerol based)

diacylglycerides (Three names)

has a small functional head group
linked to the glycerol by phosphate
Ester bond.

1 glycerol + 2 fatty acids + 1 phosphate group
+ 1 polar molecule.

Fatty acids chain is hydrophobic

16 - 22 carbons in length

* Classified according to the **Number of Carbons**

* Classified for ^{chain} **Saturation** - ~~unsaturated~~
maximum **BONDS** - ~~single bond~~

unsaturated

mono unsaturated one double bond

polyunsaturated more than one double bond.

Phosphoglycerides often contain one saturated and one ~~unsaturated~~ **unsaturated** ^{hydrophilic} _{hydrophobic} **hydrophilic**

hydrophilic head



polar molecule

phosphate group

glycerol

non polar fatty acids (HYDROPHOBIC)

AMPHIPHILIC

B

* Sphingolipids → attachment of sphingolipids to fatty acids → They are ceramides

* Derivative from sphingosine (amino Alcohol)

Glycerol is used to

is used to

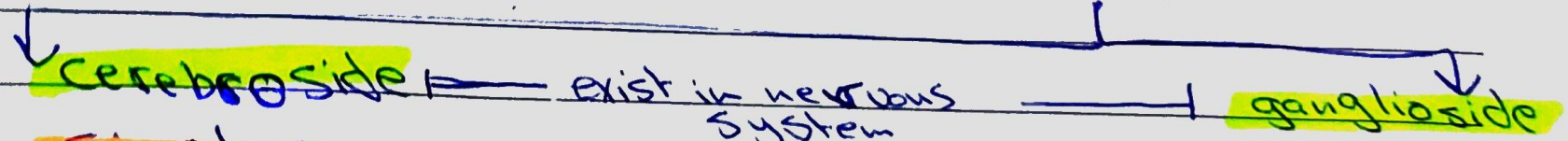
sphingosine binds with fatty acids to make ceramide.

Sphingosine → long carbon chain linked with amino group of sphingosine and they form ceramide.

!!! مركز نشيد قه

* Substitution is phosphocholine → sphingomyeline

* Substitution is carbohydrate → glycolipid



Simple sugars

(ceramide binds with)

galactose

ceramide binds

with oligosaccharide

(small cluster sugars)

include sialic acid

myelin sheaths (نمى الخلية العصبية) contain a high content of galactocerebroside (simple sugar-galactose)

The lacking of enzymes that make the glycolipids causes

- * Severe muscular tremors
- * eventual paralysis.

When the human is unable to synthesize ganglioside he suffers from

- * Severe neurological disease characterized by severe seizures and blindness.

Glycolipids play a role in infectious disease toxins can enter the target cells by binding to cell-surface gangliosides

in Fluenza virus recognize the specific glycolipids and then infect the cell

~~Membrane lipids~~ Membrane lipids:-

- * phosphoglycerides.

- * sphingolipids.

- * Cholesterol (الكوليسترول) (steroids) (الستيرويدات)

Cholesterol → smaller and less amphipathic lipid → only found in animals

4 fused rings → the last ring attached with OH group → this OH group gives the cholesterol the polarity

hydrophobic is also with less amphipathic a bit OH group

(steroid) sterol makes up to 50% of animal membrane lipids → Cholesterol

-OH group directed to the surface
polar heads polar lipid heads polar

Cholesterol → buffering the fluidity of the membrane

prevents membrane lipids from moving too fast

* High temperature → high fluidity
high movement of lipids (interfere the movement) by cholesterol

* low temperature → low fluidity
→ become solid

Cholesterol prevent the tight packing, so lipid can move