



# Membrane Structure & Function

- WALT: Outline the roles of membranes.
- Describe the fluid mosaic model of membrane structure.
- Describe the structure & function of the components of membranes.
- Outline the effects of temperature on membrane structure & permeability.
- Explain cell signalling & the role of membrane-bound receptors.



Name as many membrane-bound structures as possible in 30 seconds.

**GO**

All living  
fungal cells

All living  
protocist cells

All living  
animal cells

Vesicles

Mitochondria

Endoplasmic  
Reticulum

Nucleus

All living  
bacterial cells

Golgi  
Apparatus

Chloroplasts

Lysosomes

All living  
plant cells



# Roles of Membranes

- Separating cell contents from the outside of cells.
- Separating cell components from cytoplasm.
- Cell recognition & signalling.
- Holding the components of some metabolic pathways in place.
- Regulating the transport of material into or out of the cell.

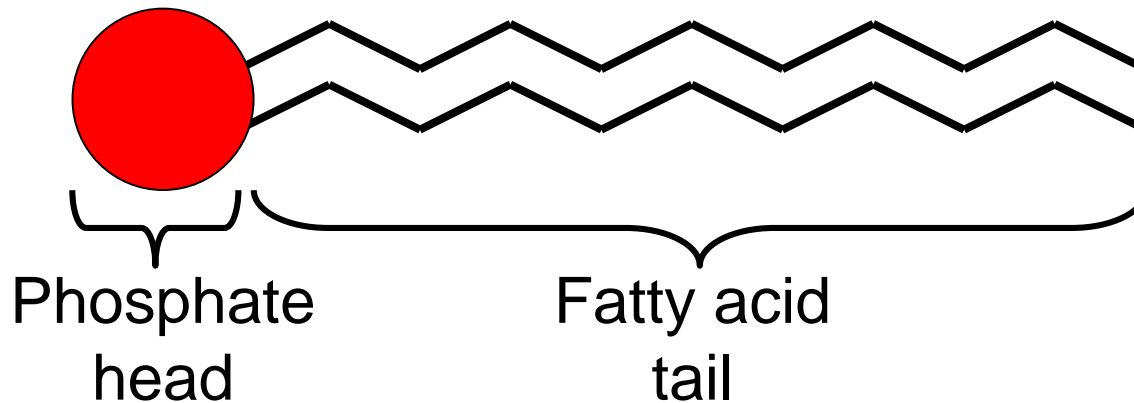


# Structure of Membranes

- All biological membranes have the same basic structure.
- Composed of phospholipids.



# What the flip is a phospholipid?



- Phosphate head is charged.
  - This makes it **hydrophilic** (water loving)
- Fatty acid tails are uncharged.
  - This makes them **hydrophobic** (water hating)



How do phospholipids make a membrane?



# 1924 – Gorter & Grendel

Published this set of results.

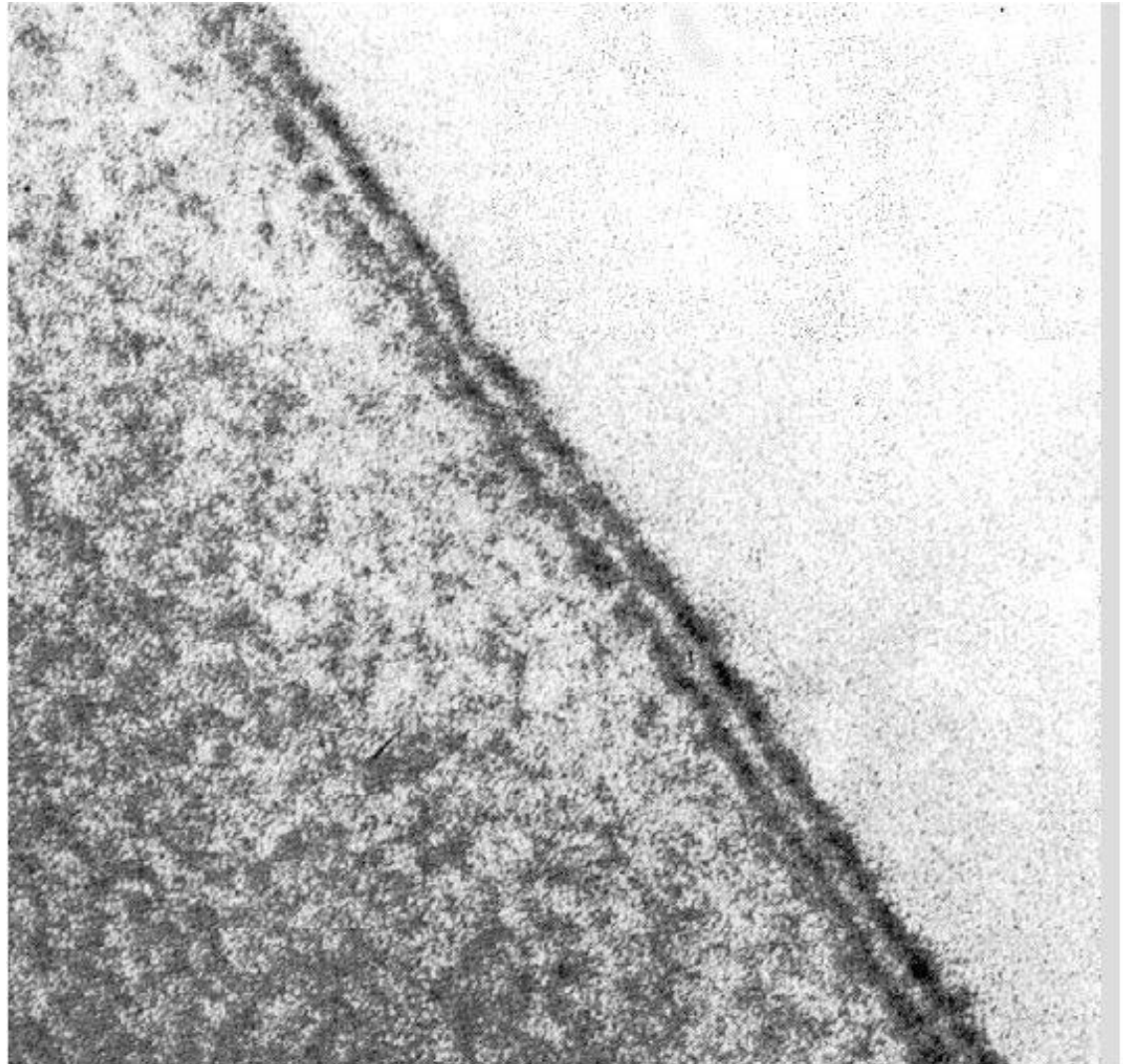
They concluded that Red Blood Cells are covered by a layer of fatty substance that is two molecules thick.

How well do the data support their conclusion?

Animal	Total surface area of the red blood cell membrane (A) Sq. $\mu$	Surface area occupied by the lipids extracted (B) Sq. $\mu$	Factor B/A
Dog	31.3	62	2
	6.2	12.2	2
Sheep	2.95	6.2	2.1
	2.65	5.8	2.2
Rabbit	5.46	9.9	1.8
	5.46	8.8	1.6
	0.27	0.54	2
	0.49	0.96	2
	4.9	9.8	2
	4.9	9.8	2
Guinea-pig	0.52	1.02	2
	0.52	0.97	1.9
Goat	0.33	0.66	2
	0.33	0.69	2.1
	3.34	6.1	1.8
	3.34	6.8	2
	0.33	0.63	1.9
Man	0.47	0.92	2
	0.47	0.89	1.9



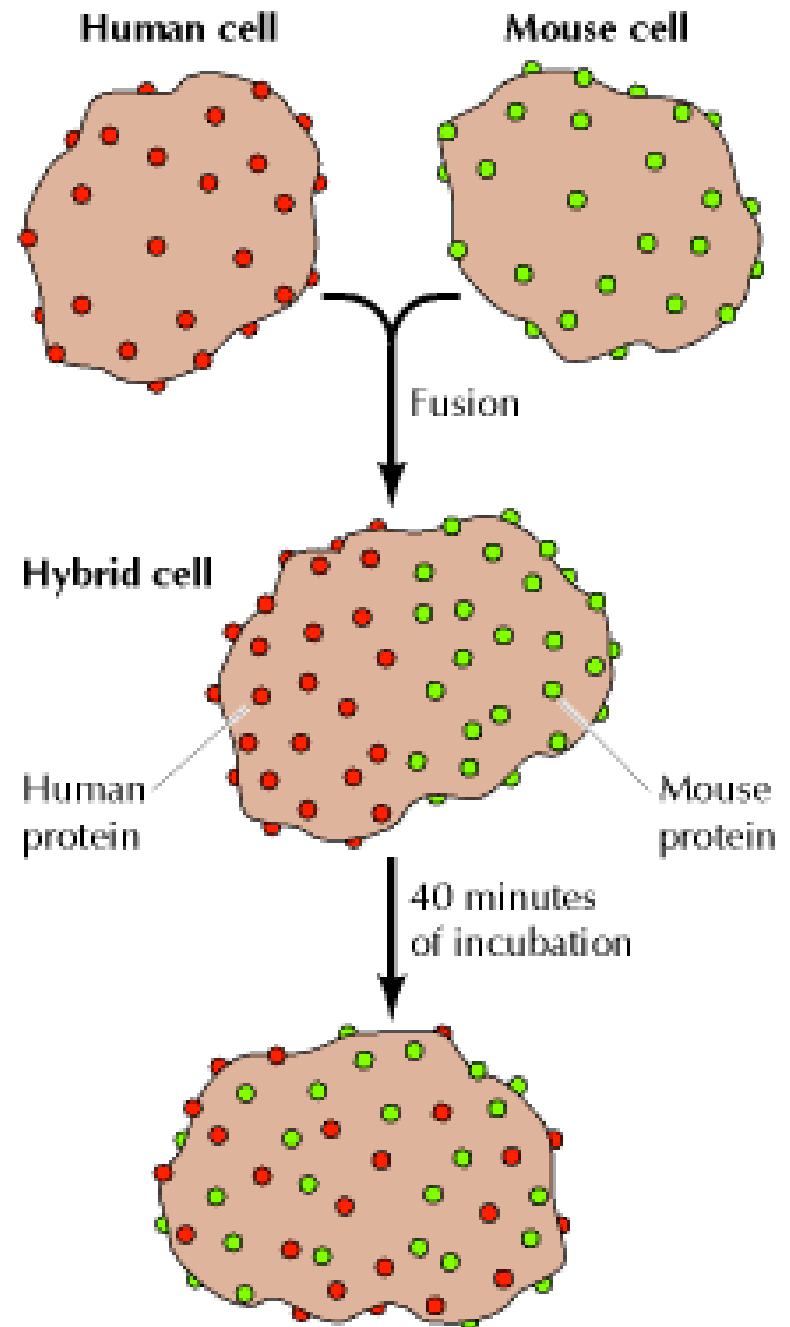
# 1940 – Electron Micrograph of the Plasma Membrane







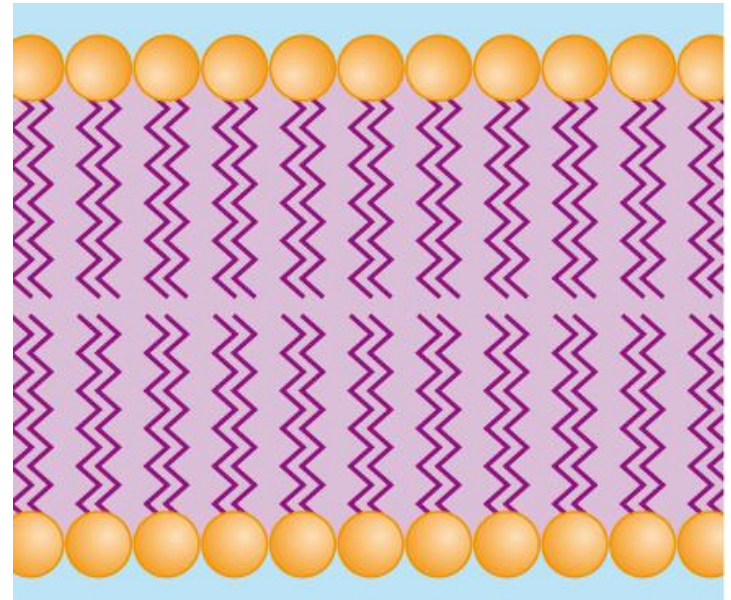
1970 - Proteins  
are shown to  
diffuse across  
the membrane





# Membranes are all basically the same.

- The phospholipid bilayer is the basic structure of all biological membranes:
  - The hydrophobic oily inner layer is a great boundary to different parts of the cell.
- Membranes are permeable to water & some solutes. We call it **partially permeable**.





# Different membranes for different jobs

- A simple phospholipid bilayer would be rubbish as a membrane.
- Other components are needed according to the function of the membrane.
  - Muscle membranes contain glucose channels to allow rapid uptake of glucose for respiration.
  - WBC membranes contain proteins that allow the cell to detect foreign particles.
  - The specialisation of membranes is part of differentiation.

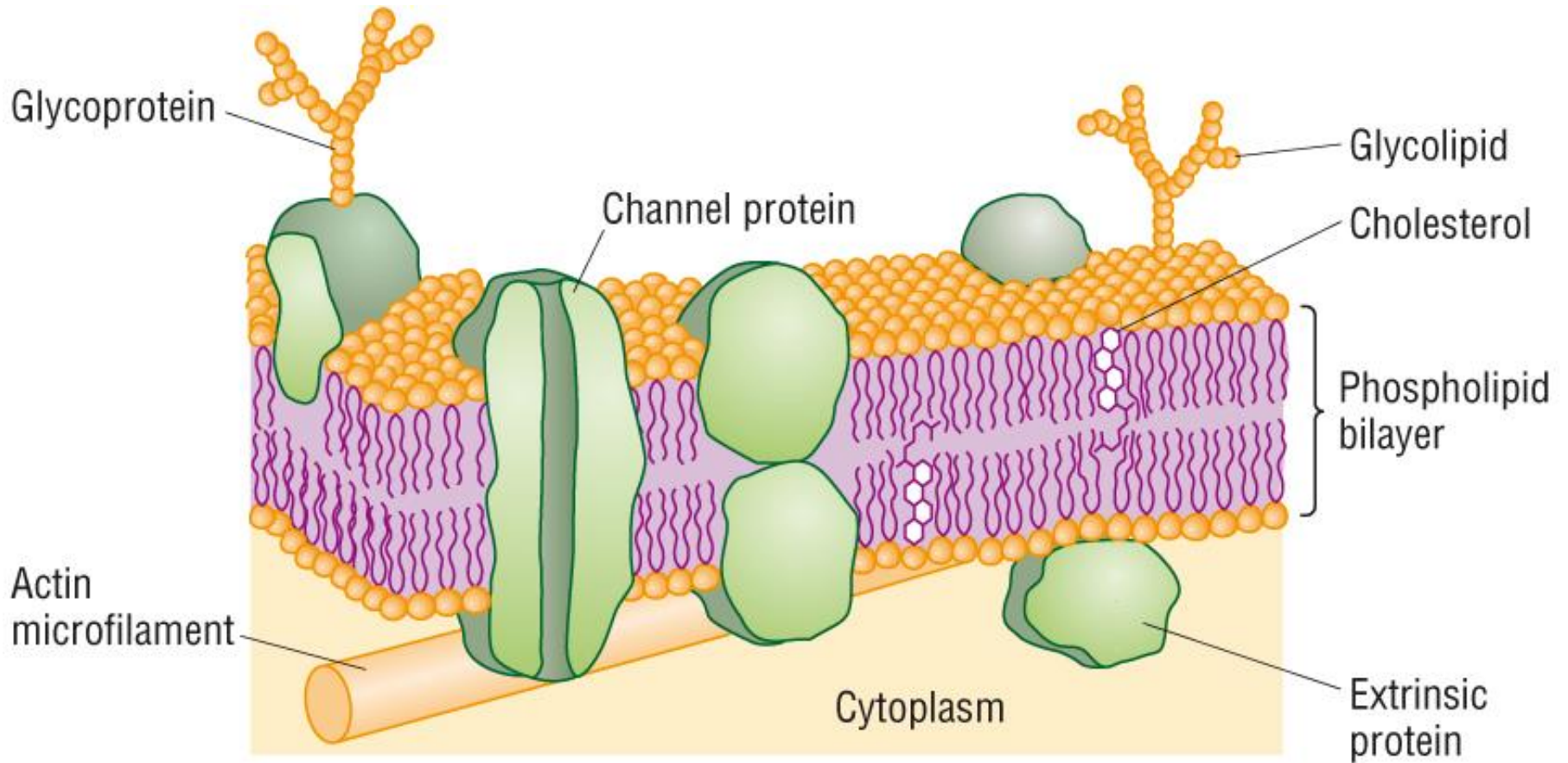


# The current model of membrane structure

- The current accepted model is called the **Fluid Mosaic Model** of membrane structure.



# The Fluid Mosaic Model (the current model)





# Membrane Components

- Cholesterol – gives stability.
- Intrinsic channel proteins – allow molecules through.
  - Some actively pump molecules though.
- Extrinsic proteins/glycoproteins/glycolipids.
  - Hormone receptors.
  - Cell signalling.
  - Metabolism.



# The effects of temperature on membrane permeability

- Follow the practical activity sheet & answer the questions to the best of your ability.
- You will be assessed on your ability to:
  - Plot a graph of results.
  - Use your biological knowledge to answer the questions.