


CELL BIOLOGY
 Chapter 1.3 Membrane Structure
 Essential Idea: The structure of biological membranes makes them fluid and dynamic.

Understandings:

- Phospholipids form bilayers in water due to the amphipathic properties of phospholipid molecules. [Amphipathic phospholipids have hydrophilic and hydrophobic properties.]
- Membrane proteins are diverse in terms of structure, position in the membrane and function *model and falsification of theories (NOS).
- Cholesterol is a component of animal cell membranes.

I. Phospholipid bilayers

A. Phospholipids form bilayers in water due to the amphipathic properties of phospholipid molecules
What happens when you put a drop of oil in water?



Water is polar due to unequal sharing of electrons in the water molecule

Oil is nonpolar (hydrophobic). It will stay together in a shape with the smallest surface area possible when placed in water

photographyblogger.net

I. Phospholipid bilayers

Now add soap to the oil and water...



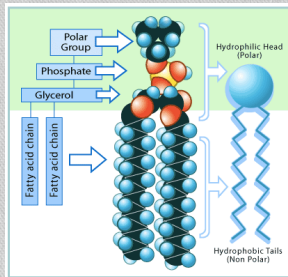

Soap is amphipathic, having both a hydrophilic and hydrophobic end, thus it is able to mix water and oil together.



coolscienceexperimentshq.com, mamagoode.net

I. Phospholipid bilayers

1. Phospholipids are amphipathic
 - a. Phosphate head is hydrophilic
 - b. Hydrocarbon tail is hydrophobic

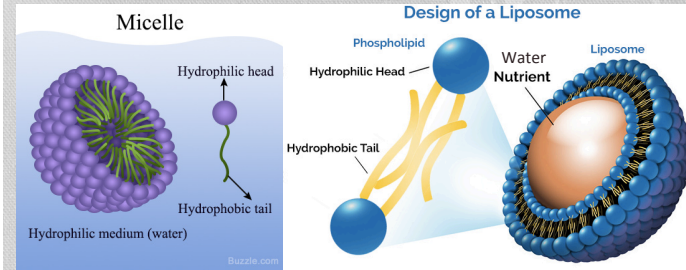


What happens when phospholipids are placed in water?

alevelnotes.com

I. Phospholipid bilayers

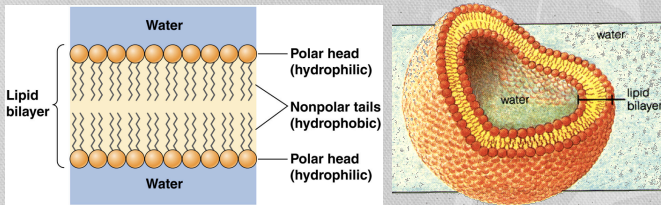
2. An emergent property arises as the phospholipids self-organize into a micelle or liposome. This keeps the hydrophobic tails "happy".



buzzle.com, livonlabs.com

I. Phospholipid bilayers

3. The most important arrangement of phospholipids for life is that of the phospholipid bilayer.



What models were proposed for the structure of the cell membrane?

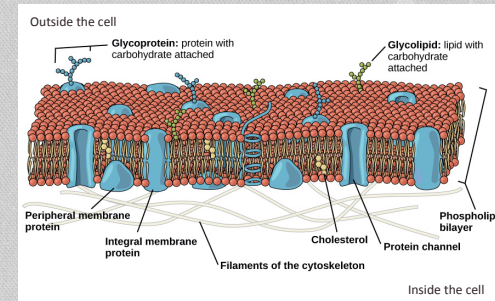
Why have there been changes to the proposed models?

What is the current accepted model?

Person Education, academic.brooklyn.cuny.edu

II. Membrane Proteins

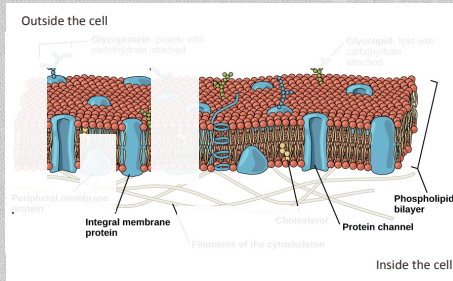
- A. Membrane proteins are diverse in terms of structure, position in the membrane, and function



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II. Membrane Proteins

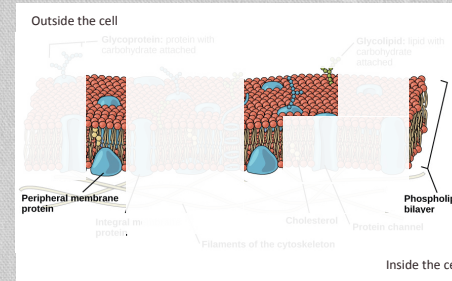
1. Integral proteins are permanent and may either go all the way through the membrane (polytopic) or they may be attached to just one side (monotopic).



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II. Membrane Proteins

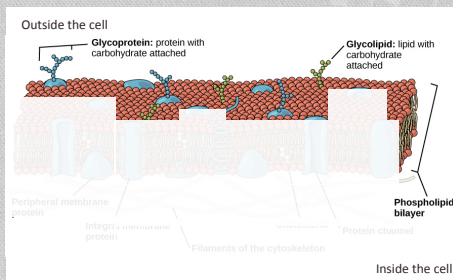
2. Peripheral proteins are usually temporary and may be attached to the surface or monotopic.



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II. Membrane Proteins

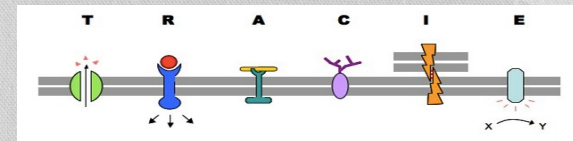
3. Glycoproteins have a oligosaccharide (few sugar) chain attached, and are important in cell recognition by the immune system and act as hormone receptors.



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II. Membrane Proteins

- B. For the types of cell membrane proteins just remember **TRACIE**:



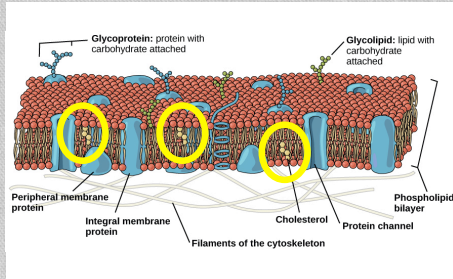
1. Transport: protein channels (facilitated) and pumps (active)
2. Receptors: peptide-based hormones (i.e. insulin)
3. Anchorage: cytoskeleton attachments and extracellular matrix
4. Cell recognition: MHC (major histocompatibility complex) and antigens
5. Intercellular joinings: tight junctions and plasmodesmata
6. Enzymatic activity: metabolic activities (i.e. electron transport chain)

moniquelovesib.weebly.com

III. Cholesterol in Membranes

A. Cholesterol is a component of animal cell membranes

1. Allows phospholipids to pack more tightly regulating the flexibility and fluidity of the cell membrane.



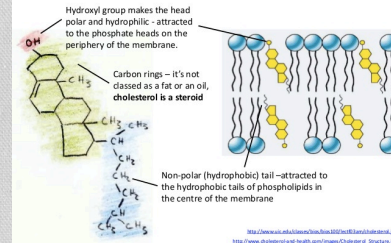
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III. Cholesterol in Membranes

So what happens to my cells if my body does not intake or produce cholesterol? I won't have to worry about high blood pressure, heart attacks, and stroke right?

1.3.U3 Cholesterol is a component of animal cell membranes.

Cholesterol



bioknowledgey.com

2. Without cholesterol
 - a. phospholipids would be too fluid
 - b. ions would freely enter (bad for most metabolic processes that rely on ion gradients).
 - c. the tails would be packed too tightly allowing the membrane to solidify and the membrane to crack! (not really)

CELL BIOLOGY

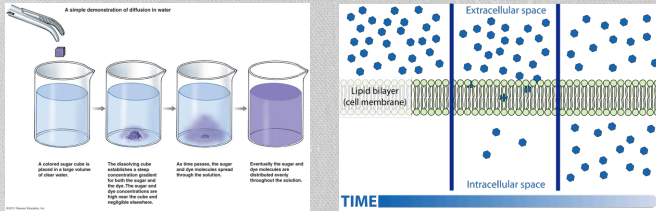
Chapter 1.4 Membrane Transport
Essential Idea: Membranes control the composition of cells by active and passive transport

Understandings:

- Particles move across membranes by simple diffusion, facilitated diffusion, osmosis, and active transport *experimental design (NOS)
- The fluidity of membranes allows materials to be taken into cells by endocytosis or released by exocytosis.
- Vesicles move materials within cells.

I. Simple Diffusion

- A. Particles move across membranes by simple diffusion, facilitated diffusion, osmosis, and active transport.
1. Diffusion is the passive movement (based on the kinetic energy in the system) of particles down a concentration gradient (high to low concentration).

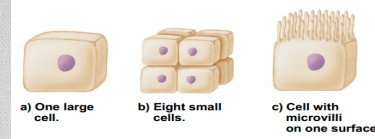


Pearson Education, biologyguide.net

I. Simple Diffusion

2. Factors affecting the rate of diffusion

Temperature	• Higher temperature → Diffuse Faster
Surface Area	• Larger surface → Diffuse Faster
Concentration Gradient	• Higher Gradient → Diffuse faster
Size of Particles	• Smaller particles → Diffuse faster
Diffusion Medium	• Solid → Slowest • Liquid → Faster • Gas → Fastest

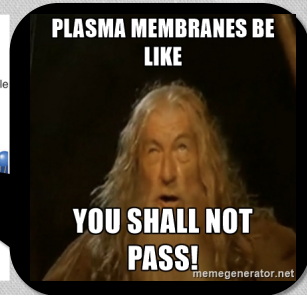
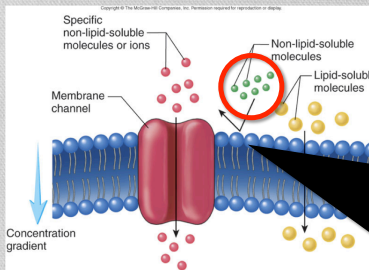


Which cell will be more efficient at absorbing nutrients and excreting wastes?

smbiology.onlinetuition.com, Pearson Education

I. Simple Diffusion

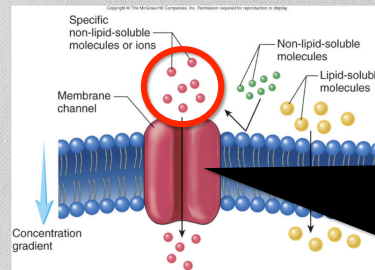
- B. The phospholipid bilayer is selectively permeable (controlled entry/exit of molecules)



McGraw-Hill Companies, memegenerator.net

II. Facilitated Diffusion

- A. Some ions and molecules may pass through specific channels in the membrane based on their concentration gradient.

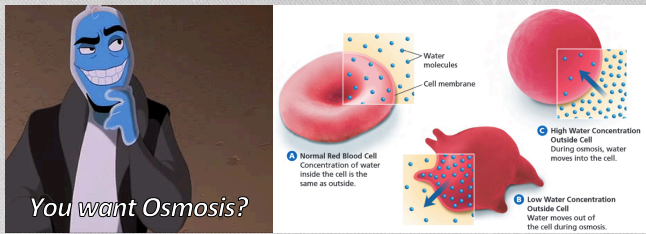


McGraw-Hill Companies, memegenerator.net

III. Osmosis

A. Water can move freely through the membrane or through aquaporins (integral protein channels) based on the concentration of solutes.

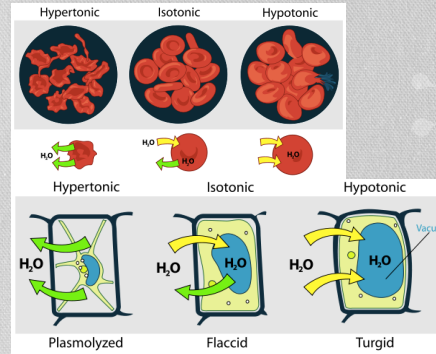
Why is important for the cell to regulate the movement of water?



Osmosis Jones, goorichscience.com

III. Osmosis

Why is important for the cell to regulate the movement of water?



- Hypertonic – high concentration of solutes; low concentration of water
- Isotonic – equal concentration of solutes / water
- Hypotonic – low concentration of solutes; high concentration of water.

LadyofHats

III. Osmosis

B. Importance of osmotic control – solution must be isotonic to prevent damage to cells and tissues

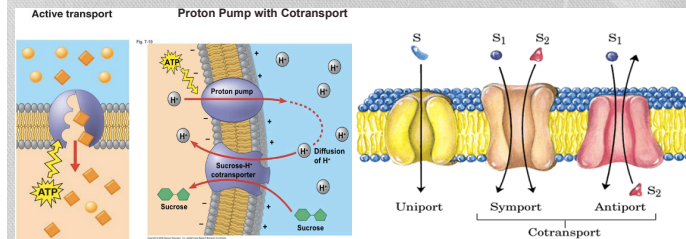
1. Intravenous (IV) fluids –proper rehydration/fluid loss
2. Rinse/eye wash – to reduce damage to cells
3. Skin grafts – to keep damaged tissue moist before surgery
4. Donor organs – to keep organs viable during transport



pregnancysicknesssupport.org.uk, laboratoryequipment.com, A.D.A.M., medscape.com

IV. Active Transport

A. Requires energy (ATP) for integral proteins to transport substances against their concentration gradient (low to high).



Why is ATP required by all of these processes?

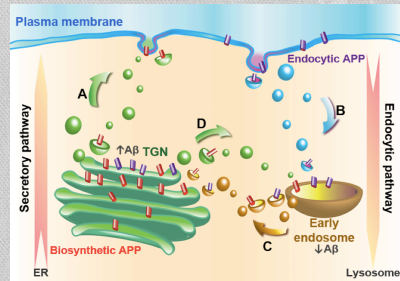
Which process(es) above is/are primary active transport? Secondary?

Pearson Education, nepel.ac.in

V. Vesicle Movement in Cells

A. Vesicles move materials within cells

1. Vesicles carry materials around the cell and to the cell membrane from the endoplasmic reticulum / golgi apparatus to be released.

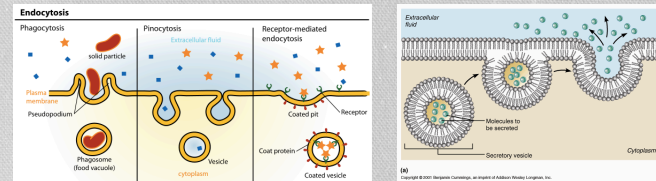


stemcellcenter.berkeley.edu

VI. Endocytosis and Exocytosis

A. The fluidity of membrane allows materials to be taken into cells by endocytosis or released by exocytosis

1. Endocytosis pinches off a small portion of the cell membrane to form a vesicle, encapsulating extracellular fluid and any materials in the fluid.
2. Exocytosis is the fusion of a vesicle with the cell membrane, releasing substances to the outside of a cell



LadyofHats; Benjamin Cummings