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Biology

Chapter 8

Cell membranes

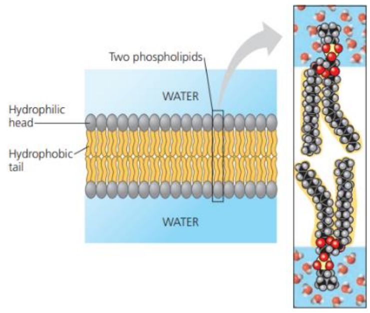
Med learn

❖ Introduction

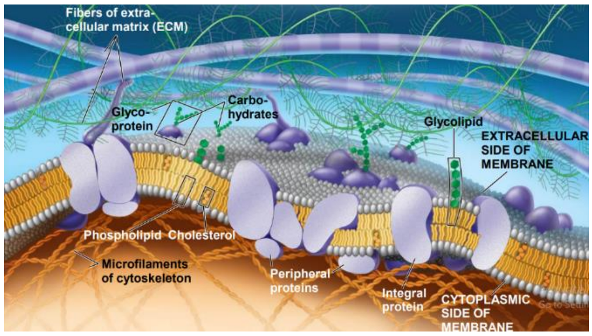
- The plasma membrane is the boundary that separates a living cell from its surroundings and controls all inbound and outbound traffic
- Plasma membrane exhibits **selective permeability** which control the passage of substances → allowing some substances to cross it more easily than others

❖ 8.1: [Cellular membranes are fluid mosaics of lipids and proteins]

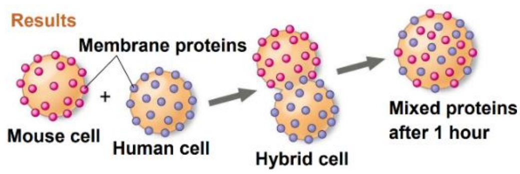
- **Lipids** and **proteins** are the main components of membranes, in addition to **carbohydrates**
- The most abundant lipids in most membranes are ➔ **phospholipids**



- A phospholipid is an **amphipathic** molecule, meaning it has both a **hydrophilic** region and a **hydrophobic** region
  - A phospholipid bilayer can exist as a stable boundary between two aqueous compartments because the molecular arrangement protect (hide) the hydrophobic tails of the phospholipids from water while exposing the hydrophilic heads to water
- **Some membrane proteins** can reside in the phospholipid bilayer and they are amphipathic
  - ➢ Consist of hydrophilic regions of proteins that connect with water in the cytosol and extracellular fluid, and hydrophobic parts that connect with a non-aqueous environment



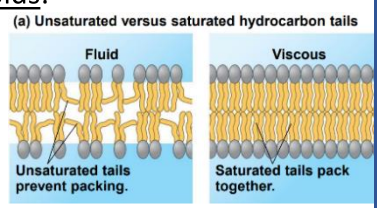
- **The fluid mosaic model** ➔ an accepted model **of the arrangement of molecules in the plasma membrane** in which a membrane is a collection of different proteins, often clustered in groups, embedded in the fluid matrix of the lipid bilayer
- Membranes are **dynamic:**
  - ➢ Most of the lipids and some proteins **can shift about sideways rapidly** about 10^7 times/second
  - ➢ **Rarely,** lipids may **flip-flop** across the membrane (switch from 1 phospholipid layer to the other)



- Proteins are much larger than lipids, but some proteins can move in the membrane **more slowly than lipids**
- Some membrane proteins seem to move in a highly **directed manner**, perhaps driven along cytoskeletal fibers in the cell

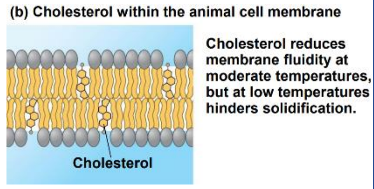
♦ The Fluidity of Membranes

- A membrane is held together mainly by **hydrophobic interaction**
  - ➢ Remember that hydrophobic interactions are much weaker than covalent bonds
- **As temperature cools** membranes switch from a fluid state to a solid state
- The temperature at which a membrane solidifies **depends on** the types of lipids:



  - Membranes rich in **unsaturated fatty** acids are **more fluid** than those rich in saturated fatty acids → because they cannot pack together closely due to **kinks** in the tails where **double bonds** are located

- **Steroids (cholesterol)** are fluidity buffer for the membrane (resist the changes in membrane fluidity)
  - At warm temperatures (such as 37ºC): Cholesterol **restrains (impedes) the movement** of phospholipids
  - At cool temperatures: Cholesterol maintains fluidity by **preventing tight packing** → by lowering the temperature required for the membrane to solidify
  - So, cholesterol makes solidifying or excessive fluidity very difficult



- Though cholesterol does not present in plants → they use **related steroid lipids** to buffer membrane fluidity

- Membranes must be fluid enough **to work properly**
  - The fluidity of a membrane affects both its permeability and the ability of membrane proteins to move to where their function is needed
  - When a membrane become **too fluid** or **solidifies** → its permeability changes and proteins (such as enzymes) in the membrane become inactive especially if their activity requires movement within the membrane

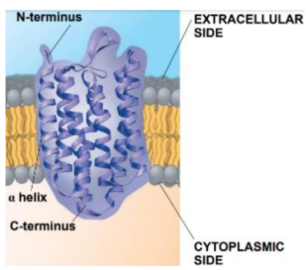
♦ Evolution of Differences in Membrane Lipid Composition

- Variations in lipid composition of cell membranes of many species appear to be adaptations to specific environmental conditions, such as:
  - Fishes that live in extreme cold → have membranes with a high proportion of unsaturated hydrocarbon tails
  - Some bacteria and archaea live at temperatures **greater than 90°C** → their membranes include unusual lipids that prevent excessive fluidity at such high temperatures
  - Ability to change the lipid compositions in response to temperature changes has evolved in organisms that live where temperatures vary

♦ Membrane Proteins and Their Functions

- Phospholipids form the main fabric of the membrane & **Proteins determine** most of the membrane's **functions**
- There are two major populations of membrane proteins:

Integral proteins

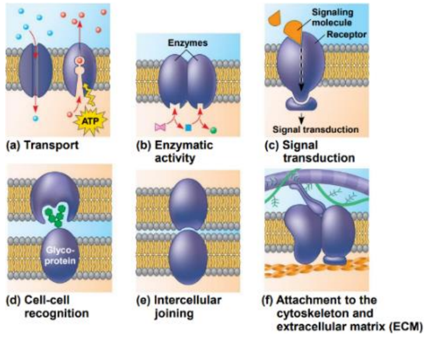


- **penetrate** the hydrophobic interior of the lipid bilayer
- **Transmembrane proteins:** Integral proteins that **span the membrane**
- The **hydrophobic part** of an integral protein consist of one or more stretches of nonpolar amino acids, often coiled into **α helices**
- The **hydrophilic parts** of the molecule are exposed to the aqueous solutions on either side of the membrane

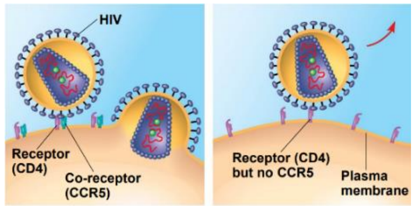
Peripheral proteins

- are **loosely bound to the membrane surface** (not embedded)

- On the cytoplasmic (inner) side of the plasma membrane → some membrane proteins are held in place by **attachment to the cytoskeleton**
- On the extracellular (outer) side of the plasma membrane → certain membrane proteins may **attach to materials outside the cell (ECM)**



- Cell-surface membranes can carry out <u>**several functions**</u>:
  - Transport
  - Enzymatic activity
  - Signal transduction
  - Cell-cell recognition
  - Intercellular joining
  - Attachment to the cytoskeleton and extracellular matrix (ECM)



(a) HIV can infect a cell with CCR5 on its surface, as in most people.
(b) HIV cannot infect a cell lacking CCR5 on its surface, as in resistant individuals.

- Cell-surface proteins are important <u>in the medical field, such as:</u>
  - **HIV** must bind to the immune cell surface protein **CD4** and a "co-receptor" **CCR5** in order <u>to infect a cell</u>
  - **HIV** cannot enter the cells of resistant individuals **who lack CCR5**
  - Drugs are now being developed to mask the **CCR5** protein

♦ The Role of Membrane Carbohydrates in Cell-Cell Recognition

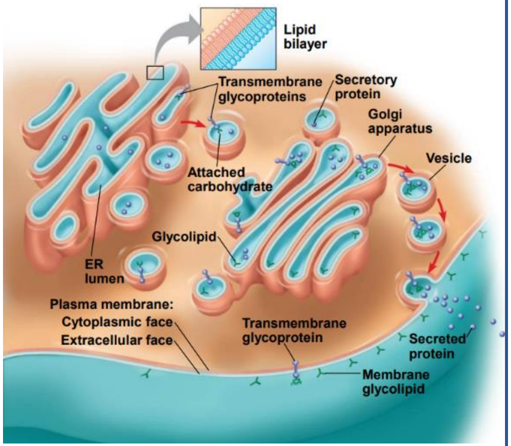
- **Cell-cell recognition:** The ability of cells to <u>distinguish</u> one type of neighboring cell from another, **by binding to molecules** (often containing <u>carbohydrates</u>) on the <u>outer surface</u> of the plasma membrane
- Membrane carbohydrates are usually short and may be **covalently bonded to:**
  - ✓ Lipids → forming **glycolipids**
  - ✓ Proteins → forming **glycoproteins**

- Carbohydrates on the extracellular side of the plasma membrane **vary among species**, individuals, and even cell types in an individual
  - For example: the four human **blood types** designated **A, B, AB, and O** reflect variation in the carbohydrate part of **glycoproteins** on the surface of red blood cells (**RBCs**)

♦ Synthesis and Sidedness of Membranes

- Membranes have **distinct** inner & outer faces and the two lipid layers may differ in lipid composition
- The asymmetrical distribution of proteins, lipids, and associated carbohydrates in the plasma membrane are determined when the membrane is built by the **ER and Golgi apparatus**
  - Membrane proteins and lipids **are synthesized in ER** (ribosomes of **RER**) → And then carbohydrates are **added to proteins** making them **glycoproteins**
  - In **Golgi** the glycoproteins are modified, and lipids acquire carbohydrates, becoming **glycolipids**
  - The glycoproteins, glycolipids and secretory proteins are **transported in vesicles** to their destination such as the plasma membrane → then vesicles **fuse** with the plasma membrane
  - The <u>outer face of the vesicle</u> becomes continuous with the <u>inner (cytoplasmic) face</u> of the plasma membrane

- The inner face of the vesicle becomes continuous with the outer (extracellular) face of the plasma membrane
- This releases the secretory proteins from the cell by **exocytosis**, and the membrane glycoproteins and glycolipids on the outside (extracellular) face of the plasma membrane



❖ 8.2: [Membrane structure results in selective permeability]

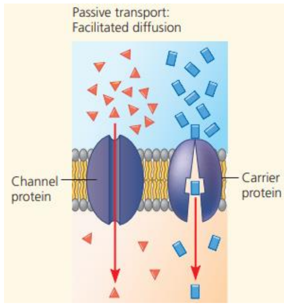
- A cell must exchange materials with its surroundings, a process controlled by the plasma membrane
- Plasma membranes are **selectively permeable**, regulating the cell's molecular traffic

♦ The Permeability of the Lipid Bilayer

- Hydrophobic (nonpolar) molecules (such as hydrocarbons, CO2, and O2) can dissolve in the lipid bilayer and pass through the membrane rapidly
- Hydrophilic molecules including ions and polar molecules (such as water, glucose and other sugars) do not cross the membrane easily
  - ➢ Proteins built into the membrane play key roles in regulating transport

♦ Transport Proteins

- **Transport proteins:** proteins that allow passage of hydrophilic substances across the membrane
  - ➢ A transport protein **is specific** for the substance it moves



- **Transport proteins are classified into:**

1) Channels:

- Transport proteins that have a **hydrophilic channel** in which ions or other certain molecules can use it as a tunnel or corridor
- Example:
  - ➢ **Aquaporins** are channels that facilitate the passage of water (Without aquaporins, water molecules can pass through the lipid bilayer but in a tiny amount)

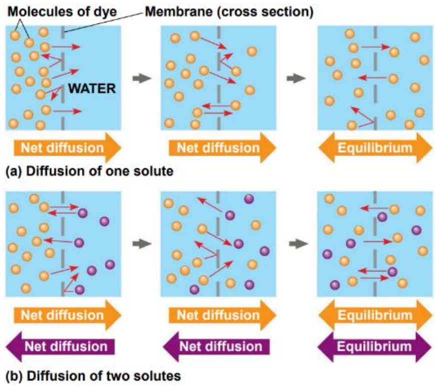
2) Carrier proteins:

- Transport proteins that bind to molecules and undergo conformational changes (**change their shape)** to translocate the binding site of a certain molecules, which allow **shuttling** them across the membrane

❖ 8.3: [Passive transport is diffusion of a substance across a membrane with no energy investment]

- **Diffusion:** It is the tendency of molecules to spread out evenly into the available space, due to constant random movement of these molecules (**Thermal** energy)
- Diffusion of a population of molecules may be **directional**
- **At dynamic equilibrium ➔** molecules cross the membrane in one direction as many as in the other

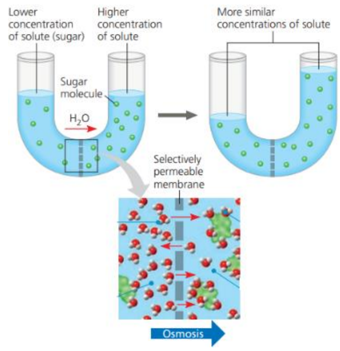
- Much of the traffic across cell membranes occurs by **diffusion** → When a substance is more concentrated on one side of a membrane than on the other, there is a tendency for the substance to diffuse across the membrane down its concentration gradient
    - ➢ The concentration gradient itself represents **potential energy** that drive diffusion
- Diffusion is a **passive transport** because no energy is needed



- **Rules of passive transport :**
    - Substances diffuse from where it is **more concentrated** to where it is **less concentrated** (**down concentration gradient**)
    - **No work (no energy)** must be done to move substances down the concentration gradient
    - Each substance diffuses down its own concentration gradient, unaffected by the concentration gradients of other substances
- **Examples:**
    - ✓ The uptake of oxygen by a cell performing cellular respiration

♦ Effects of Osmosis on Water Balance

- The movement of water across cell membranes and the balance of water between the cell and its environment are crucial to organisms



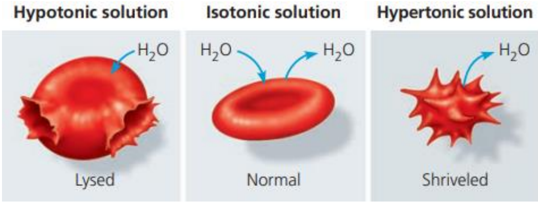
- **Osmosis:** is the diffusion of **water** across a selectively permeable membrane
- Water diffuses across a membrane from the region of **lower solute concentration (high water concentration)** to the region of **higher solute concentration (low water concentration)** until the solute concentration is equal on both sides
- Osmosis occurs when **solutes can't pass across the membrane** (because it is large or have low permeability) → so water moves toward solute
- Tight clustering of water molecules around the hydrophilic solute molecules makes some of the water unavailable to cross the membrane

♦ Water Balance of Cells Without Cell Walls

- **Tonicity:** It is a property of a solution that represents its ability to **cause a cell to gain or lose water**
    - ➢ The tonicity of a solution depends on the concentration of solutes that **cannot cross** the membrane relative to that inside the cell
    - ➢ If there is a **higher concentration (Hypertonic)** of non-penetrating solutes in the surrounding solution than the cytosol → water will tend to **leave** the cell
    - ➢ If there is a **lower concentration (Hypotonic)** of non-penetrating solutes in the surrounding solution than the cytosol → water will tend to **inter** the cell

- If a cell without a cell wall (such as an animal cell) is immersed in the following solutions:
    - **Isotonic** solution (iso = same): solute concentration **is the same inside and outside the cell**
        - ➢ No net water movement across the plasma membrane (Water diffuses across the membrane, but at the same rate in both directions) ➔ **Dynamic equilibrium**

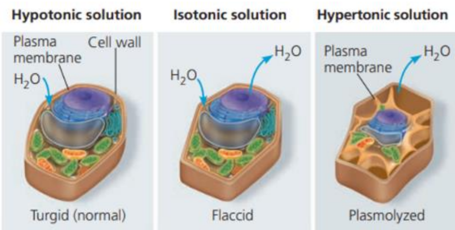
- **Hypertonic** solution (hyper = more): Solute concentration **is greater outside than inside the cell**
  - Cell loses water → shrivel (shrink) and probably die
- **Hypotonic** solution (hypo = less): Solute concentration **is less outside than inside the cell**
  - Cell gains water → swell and lyse (burst)



- Animal cells, such as this red blood cell, do not have cell walls
  - The healthy state for animal cells when they immersed isotonic solution

♦ Water Balance of Cells with Cell Walls

- The cell wall **helps maintain the cell's water balance**
- If a cell with a cell wall (such as a plant cell, prokaryote …) is immersed in the following solutions:
  - **Isotonic** solution: no net tendency for water to enter and the cells
    - The cell become **flaccid** (limp) → the plant **wilts**
  - **Hypertonic** solution: cell loses water
    - The cell **shrivels** and the membrane pulls away from the cell wall, causing the plant to **wilt**
    - A potentially lethal effect is **plasmolysis**
  - **Hypotonic** solution: the cell swells until the wall opposes uptake
    - The cell is now **turgid** (firm)

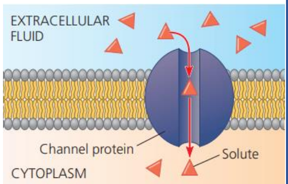


- The healthy state for most plant cells when they immersed and swelling in a hypotonic solution

- **Osmoregulation:** It is the control of solute concentrations and water balance which is a necessary adaptation for life in some environments, for example:
  - **Paramecium** (unicellular eukaryote) which is hypertonic to its pond water environment, has a contractile vacuole that acts as a pump
  - Bacteria and archaea live in hypersaline (excessively salty) environments have cellular mechanisms to balance internal and external solute concentrations

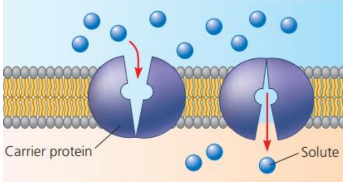
♦ Facilitated Diffusion: Passive Transport Aided by Proteins

- **Facilitated diffusion:** Diffusion across **transport proteins**
  - Transport proteins facilitate (speed) the passive movement of molecules across the membrane
- Facilitated diffusion is considered **passive transport** because the solute is moving **down its concentration gradient**, a process that requires **no energy**
- Most transport proteins are very specific to transport some substances but not others
- Transport proteins include:
  - **channel proteins**, such as:
    - ✓ **Aquaporins** which facilitate the diffusion of water
    - ✓ **Ion channels** which facilitate the transport of ions



    - Some ion channels, called **gated channels**: open or close in **response to a stimulus**
    - For example, **in nerve cells**, ion channels open in response to **electrical stimulus**

- o **Carrier proteins**, such as:
  - ✓ **Glucose transporter**



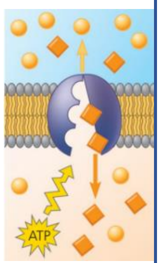
- Facilitated diffusion does not alter the direction of transport, but **facilitate** and **speeds** transport of a solute by providing efficient passage through the membrane
- Certain **kidney cells** also have a **large number of aquaporins** allowing reabsorption water from urine before it is excreted

❖ 8.4: [Active transport uses energy to move solutes against their gradients]

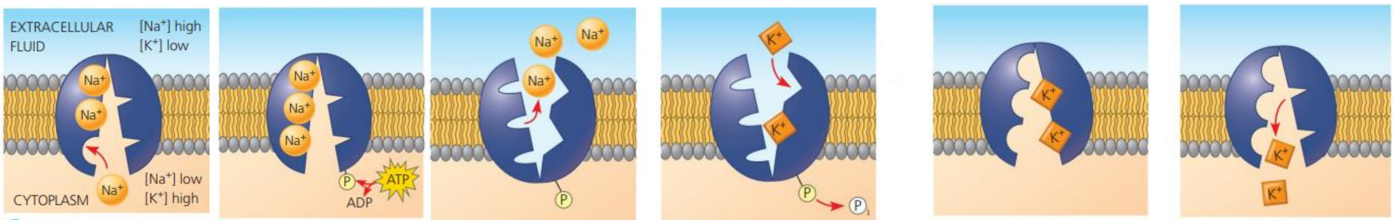
- Some transport proteins, can move solutes **against their concentration gradients** (from the side where they are less concentrated to the side where they are more concentrated) → **energy is required**, So this transport is called ➔ **active transport**

♦ The Need for Energy in Active Transport

- Active transport requires energy, usually in the form of **ATP hydrolysis**
- **All** transport proteins that move solutes against their concentration gradients are **carrier proteins**
- Active transport allows cells to maintain concentration gradients that differ from their surroundings
- For example:
  - o **Inside** an animal cell has a **much higher potassium** (K^+) and a much **lower sodium** (Na^+) concentration compared to its surroundings



✓ This is controlled by the **sodium-potassium pump**, a **transport protein** that is energized by transfer of a phosphate group from the hydrolysis of ATP, induce the protein to change its shape in a manner that **translocates** a solute bound to the protein across the membrane



1 Cytoplasmic Na^+ binds to the sodium-potassium pump. The affinity for Na^+ is high when the protein has this shape.
2 Na^+ binding stimulates phosphorylation by ATP.
3 Phosphorylation leads to a change in protein shape, reducing its affinity for Na^+, which is released outside.
4 The new shape has a high affinity for K^+, which binds on the extracellular side and triggers release of the phosphate group.
5 Loss of the phosphate group restores the protein's original shape, which has a lower affinity for K^+.
6 K^+ is released; affinity for Na^+ is high again, and the cycle repeats.

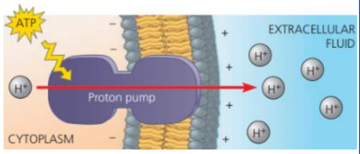
♦ How Ion Pumps Maintain Membrane Potential

- **Membrane potential:** is the voltage across a membrane
  - ➢ Voltage is created by differences in the distribution of positive and negative ions across a membrane
  - ➢ The cytoplasmic side of the membrane is **negative in charge relative** to the extracellular side
  - ➢ The voltage across a membrane ranges from about -50 to -200 millivolts (mV)
    - o The **minus sign** indicates that the **inside of the cell is negative relative to the outside**

- **Two** combined forces, collectively called the **electrochemical gradient**, drive the diffusion of **ions** across a membrane:
  - **A chemical force** (the ion's **concentration gradient**)
  - **An electrical force** (the effect of the **membrane potential** on the ion's movement)

- In the case of ions, the does not diffuse simply down its concentration gradient but, more exactly, down its electrochemical gradient. For example:
  - When Na^+ gated channels open facilitating Na^+ diffusion → then Sodium ions fall down their electrochemical gradient, driven by the concentration gradient of Na^+ and by the attraction of these cations to the negative side (inside) → So, both electrical and chemical contributions to the electrochemical gradient act in the same direction

- **Electrogenic pump:** It is a transport protein that **generates voltage** across a membrane, such as:
  - **Sodium-potassium pump** is the major electrogenic pump in animal cells
    - ➢ Which pumps **3 sodium** ions out of the cell for every **2 potassium** ions it pumps into the cell
  - **proton pump** is the major electrogenic pump in plants, fungi & bacteria
    - ➢ which actively transports hydrogen ions (H^+) **out** of the cell

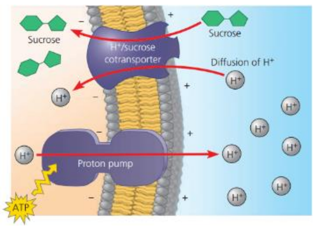


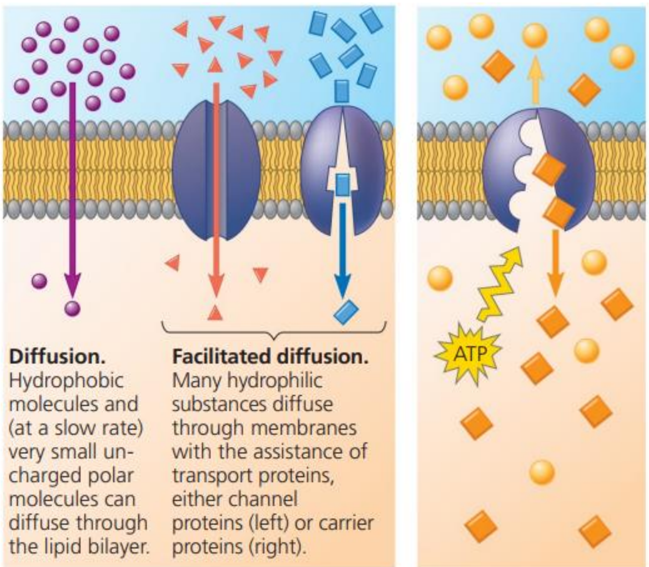
- Electrogenic pumps help **store energy that can be used for cellular work**

♦ Cotransport: Coupled Transport by a Membrane Protein

- **Cotransport** occurs when active transport of a solute indirectly drives transport of other substances
  - ➢ ATP hydrolysis **indirectly** provides the energy necessary for cotransport

- A transport protein (cotransporter) can couple the "**downhill**" **diffusion** of the solute to the "**uphill**" **transport** of a second substance **against** its own concentration gradient
  - **H^+/sucrose** cotransporter is a carrier protein in a plant cell is able to use the **diffusion of H^+ down** its electrochemical gradient into the cell to drive the **uptake of sucrose against** its electrochemical gradient



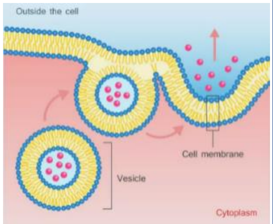


❖ 8.5: [Bulk transport across the plasma membrane occurs by exocytosis and endocytosis]

- **Small molecules** and water enter or leave the cell **through the lipid bilayer or via transport proteins**
- **Large molecules** (such as polysaccharides and proteins), cross the membrane in **bulk via vesicles**
  - ➢ Bulk transport requires energy
- Endocytosis & exocytosis also provide mechanisms for rejuvenating or remodeling the plasma membrane

♦ Exocytosis

- Mean that the cell **secretes** certain molecules by the fusion of vesicles with the plasma membrane
- A transport vesicle that has budded from the Golgi apparatus ➔ moves along microtubules of the cytoskeleton to the plasma membrane ➔ the two membranes fuse ➔ the vesicle release its content outside the cell, and the vesicle membrane becomes part of the plasma membrane
- Many secretory cells use exocytosis to **export their products**
  - ➢ **pancreas cells** secrete insulin into the extracellular fluid by exocytosis
  - ➢ Nerve cells use exocytosis to release **neurotransmitters** that signal other neurons or muscle cells



♦ Endocytosis

- In endocytosis, the cell **takes in** macromolecules by forming vesicles from the plasma membrane
- Endocytosis is a reversal of exocytosis, involving different proteins
- The plasma membrane sinks inward to form a pocket ➔ then, as the pocket deepens it pinches in forming a vesicle containing material that had been outside the cell
- There are **three types** of endocytosis:

1) Phagocytosis (cellular eating)

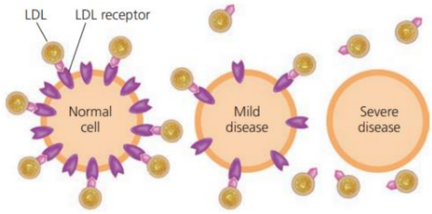
- ▪ The cell engulfs a particle in a food vacuole by extending pseudopodia
- ▪ The vacuole fuses with lysosomes to digest the particles

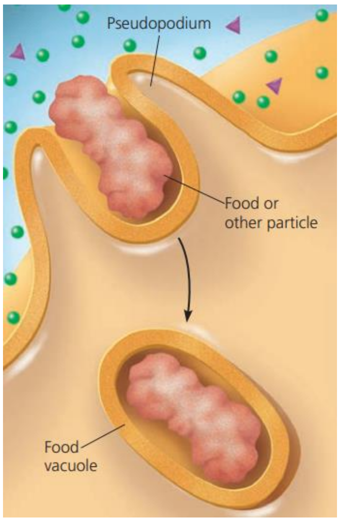
2) Pinocytosis (cellular drinking)

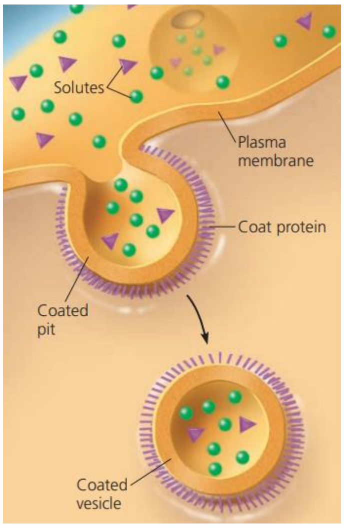
- ▪ Molecules dissolved in a droplet are taken up when extracellular fluid is gulped into tiny vesicles
- ▪ Pinocytosis is non-specific for the substances it transports

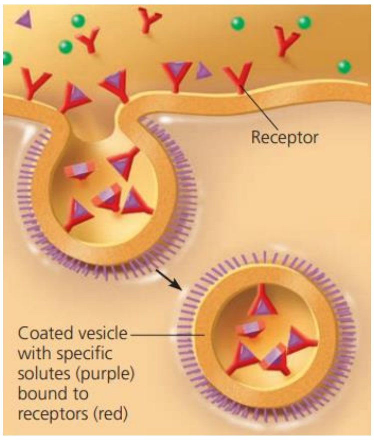
3) Receptor-mediated endocytosis

- ▪ A type of pinocytosis that enables the cell to acquire bulk quantities of **specific substances**
  - ➢ Molecules from the extracellular fluid bind to the receptors → then transported into a vesicle
  - ➢ Emptied receptors are recycled to the plasma membrane
- ▪ Human cells use receptor-mediated endocytosis to **take in cholesterol** for membrane synthesis and the synthesis of other steroids
  - ➢ Cholesterol travels in the blood in particles called **low-density lipoproteins (LDLs)** → which is a complex of lipids and a protein
  - ➢ **LDLs** bind to **LDL receptors** on plasma membranes and then enter the cells by endocytosis
  - ➢ Individuals with the inherited disease called **familial hypercholesterolemia** have missing or defective LDL receptor proteins so cannot enter cells









Past Papers

1. Cell membranes are made up of a mosaic of:

A. Phospholipids and proteins
B. Cellulose and proteins
C. Starch and proteins
D. Nucleic acid and proteins
E. Only phospholipids

Answer: A

2. What are the membrane structures that function in active transport?

A. Peripheral proteins
B. Carbohydrates
C. Receptor proteins
D. Carrier proteins
E. All of the above

Answer: D

3. Facilitated diffusion:

A. Requires either channel or carrier proteins
B. Occur down a concentration gradient
C. Require the hydrolysis of ATP
D. Occur in all cells
E. All of the above are correct except C

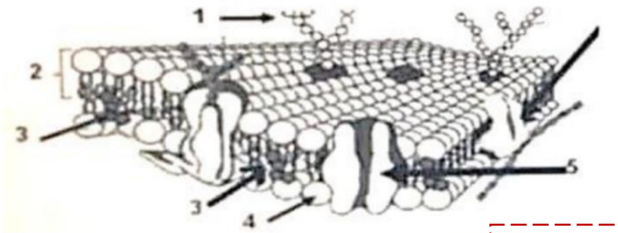
Answer: E

4. Which of the following is an electrogenic pump?

A. Na^+-K^+ pump
B. Glucose carrier
C. H^+ pump
D. All of the above
E. Only A and C

Answer: E

5. Which structure:



- **Can function as aquaporin?**

A. 1
B. 2
C. 3
D. 4
E. 5

Answer: E

- **Can be ABO blood group marker?**

A. 1
B. 2
C. 3
D. 4
E. 5

Answer: A

6. Lipid soluble (hydrophobic) small molecules like CO_2 and O_2 enter the cell by

A. Diffusion through channel protein
B. Diffusion through the lipid bilayer
C. Osmosis
D. Active transport
E. Bulk transport

Answer: B

7. The role of cholesterol on the membrane fluidity of animal cells is to:

A. Restrain (limits) movement of phospholipids at high temperature
B. Prevent tight packing of phospholipids at low temperature
C. Restrains movement of proteins at low temperature
D. Preventing tight packing of proteins at high temperature
E. A and B

Answer: E

8. In order for a protein to be an integral membrane protein it would have to be:

A. Hydrophilic
B. Hydrophobic
C. Amphipathic, with at least one hydrophobic region
D. Completely covered with phospholipids
E. Exposed on only one surface of the membrane

Answer: C

9. Which of the following is true of integral membrane proteins?

A. They lack tertiary structure
B. They are loosely bound to the surface of the bilayer
C. They are usually transmembrane proteins
D. They are not mobile within the bilayer
E. They serve only a structural role in membranes

Answer: C

10. The primary function of polysaccharides attached to the glycoproteins and glycolipids of animal cell membranes is

A. To facilitate diffusion of molecules down their concentration gradients
B. To actively transport molecules against their concentration gradients
C. To maintain the integrity of a fluid mosaic membrane
D. To maintain membrane fluidity at low temperatures
E. To mediate cell-to-cell recognition

Answer: E

11. Which of the following statements correctly describes the normal tonicity conditions for typical plant and animal cells?

A. The animal cell is in a hypotonic solution, and the plant cell is in an isotonic solution
B. The animal cell is in an isotonic solution, and the plant cell is in a hypertonic solution
C. The animal cell is in a hypertonic solution, and the plant cell is in an isotonic solution
D. The animal cell is in an isotonic solution, and the plant cell is in a hypotonic solution
E. The animal cell is in a hypertonic solution, and the plant cell is in a hypotonic solution

Answer: D

12. Which of the following functions of membrane proteins involves surface carbohydrate?

A. Cell-cell recognition
B. Enzymatic activity
C. Transport
D. Tight junctions
E. None of the above

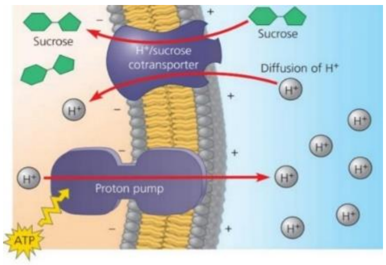
Answer: A

13. What kinds of molecules pass through a cell membrane most easily?

A. Large and hydrophobic
B. Small and hydrophobic
C. Large polar
D. Ionic
E. Monosaccharides such as glucose

Answer: B

14. In the figure shown, a proton passes to the cytosol:



A. Down its concentration gradient
B. By simple diffusion
C. Against its concentration gradient
D. Down its electrochemical gradient
E. None of the above

Answer: D

15. What is the voltage across a membrane called:

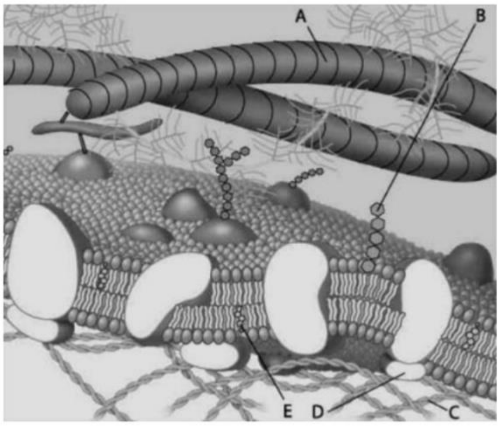
A. Water potential
B. Chemical gradient
C. Membrane potential
D. Osmotic potential
E. Electrochemical gradient

Answer: C

16. According to the figure below, answer the following questions:

➤ **Which component is the peripheral protein?**

A. A
B. B
C. C
D. D
E. E



Answer: D

➤ **Which component is cholesterol?**

A. A
B. B
C. C
D. D
E. E

Answer: E

➤ **Which component is a glycolipid?**

A. A
B. B
C. C
D. D
E. E

Answer: B

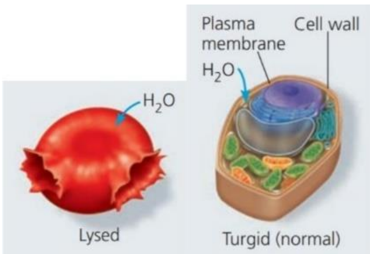
17. Which of the following is involved in engulfing of droplets contains dissolved materials?

A. Phagocytosis
B. Pinocytosis
C. Receptor mediated endocytosis
D. Exocytosis
E. Facilitated diffusion

Answer: B

18. These cells can be found in:

A. Hypertonic solution
B. Hypotonic solution
C. Isotonic solution
D. None of the above
E. All of the above



Answer: B

19. “Co-transport” is:

A. Coupling of uphill to a downhill one
B. Using of ATP to transport materials against their concentration
C. Using of ATP to transport materials down their concentration
D. “Proton-sucrose” co-transporter is an example for this process
E. Both A and D are correct

Answer: E

20. Water enters and leaves plant and animal cells by:

A. Pinocytosis
B. Simple diffusion
C. Osmosis
D. Co-transport
E. Bulk transport

Answer: C

21. Low density lipoproteins (LDL) enter cells by:

A. Pinocytosis
B. Phagocytosis
C. Active transport
D. Receptor mediated endocytosis
E. Passive transport

Answer: D

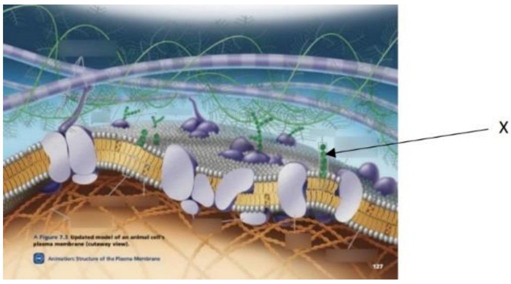
22. Channel proteins are required for:

A. Osmosis
B. Facilitated diffusion
C. Active transport
D. Phagocytosis
E. A and B are correct

Answer: B

23. The part pointed at (X) in the figure represents

A. Carbohydrate
B. Cholesterol
C. Phospholipid
D. Collagen fiber
E. Fatty acid



Answer: A

24. Which of the following is involved in the Na^+ passive transport across plasma membrane?

A. ATP
B. Electrical membrane potential (electrical force)
C. Gated channel proteins
D. Na^+ concentration gradient (chemical force)
E. B and D are correct

Answer: E

25. One of the functions of cholesterol in animal cell membrane is to:

A. Store energy
B. Maintain membrane fluidity
C. Speed diffusion
D. Phosphorylate ADP
E. None of the above

Answer: B

26. What mechanisms do plants use to transport sucrose produced by photosynthesis into specialized cells in leaves against its concentration gradient?

A. Diffusion
B. Sucrose pumping
C. Cotransport
D. Receptor mediated endocytosis
E. Phagocytosis

Answer: C

27. The sodium-potassium pump

A. Moves sodium ions into the cell and potassium ions out of the cell
B. Is an electrogenic pump
C. Moves sodium and potassium ions into the cell
D. Moves sodium and potassium ions along their electrochemical gradients
E. All of the above

Answer: B

28. The process that molecules move into cells via vesicles is

A. Co-transport
B. Facilitated diffusion
C. Endocytosis
D. Secretion
E. None of the above

Answer: C

29. Cell membranes are asymmetrical. Which of the following is a most likely explanation?

A. The “innerness” and “outerness” of membrane surfaces are predetermined by bound ribosomes
B. Proteins can only span cell membranes if they are hydrophobic
C. Cell membranes communicate signals from one organism to another
D. Cell membranes proteins are determined as the membrane is being packaged in the ER and Golgi
E. Cell membrane orientation is determined by free ribosomes

Answer: D

30. The extracellular matrix is thought to participate in the regulation of animal cell behavior by communicating information from the outside to the inside of the cell via integrins:

A. True
B. False

Answer: A

31. Osmosis refers to

A. the movement of water molecules across a selectively permeable membrane
B. the diffusion of hydrophobic molecules across a selectively permeable Membrane
C. the diffusion of any material across a selectively permeable membrane
D. a type of active transport
E. the movement of water molecules across the cell wall of plant cells

Answer: A

32. Which of the following could generates voltage across cell membrane?

A. Na^+/K^+ pumps
B. H^+/Sucrose cotransporter
C. H^+ pumps
D. Aquaporins
E. A and C

Answer: E

33. Which of the following statements is correct about aquaporins?

A. Are membrane carrier protein
B. Composed only of non-polar amino acids
C. Facilitated the passage of hydrophobic molecules across cell membrane
D. Are mainly found in the cytosol
E. Facilitated the passage of water molecules across cell membrane

Answer: E

34. ECM proteins are made by ribosomes associated with rough ER

A. False
B. True

Answer: B

35. Cytoplasmic connection(s) between adjacent eukaryotic cells occur(s) through:

A. gap junctions
B. Plasmodesmata
C. Desmosomes
D. tight junctions
E. either plasmodesmata or gap junctions

Answer: E

36. Which of the following processes in the cell uses transport proteins?

A. Pinocytosis
B. Exocytosis
C. Simple diffusion
D. All of the options
E. Cotransport

Answer: E

37. Molecules that can diffuse across a membrane include:

A. small polar molecules
B. Lipoproteins
C. Proteins
D. small nonpolar molecules

Answer: D

38. Which of the following statements about cotransport across a membrane is correct?

A. In cotransport, both solutes that are being transported are moving down their chemical gradients.
B. Cotransport involves the hydrolysis of ATP by the transporting protein
C. The sodium- potassium pump is an example of a cotransport protein
D. A cotransport protein is most commonly an ion channel
E. Cotransport proteins allow an ATP-powered pump to drive the active transport of a solutes

Answer: E

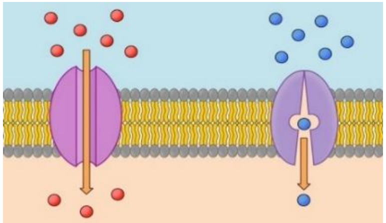
39. When a plant cell such as one from a peony stem, is submerged in a vary hypotonic solution, what is likely to occur?

A. The cell membrane will lyse
B. The cell will become flaccid
C. The cell will burst
D. The cell will become turgid
E. Plasmolysis will shrink the interior

Answer: D

40. The figure shows …

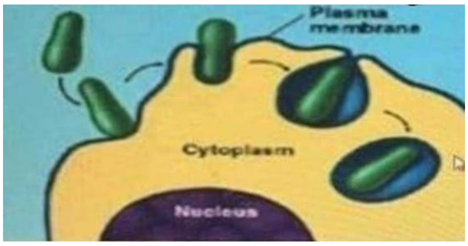
A. Co-transport
B. Osmosis
C. Ion pumping
D. Facilitated diffusion
E. Phagocytosis



Answer: D

41. The process in the figure demonstrates?

A. Pinocytosis
B. Phagocytosis
C. receptor-mediated
D. photosynthesis
E. Contractile vacuole



Answer: B

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