plasma membrane

selectively permeable, fluid mosaic model.

amphipathic: both hydrophobic and hydrophilic

Nonpolar molecules, such as hydrocarbons, carbon dioxide, and oxygen, are hydrophobic, so dissolve/cross in the lipid bilayer without membrane proteins

proteins in plasma membrane functions

transport, enzymatic activity, signal transduction, cell-to-cell recognition, cell-to-cell attachments, ATTACHMENT TO THE CYTOSKELETON AND EXTRACELLULAR MATRIX:

Passive vs. Active Transport

Passive Transport: requires no energy, high to low

Ex: diffusion and osmosis

Osmosis: diffusion of free water across a selectively permeable membrane

simple diffusion: no protein channel, nonpolar molecules, water; ex "countercurrent exchange" to maximaize the rate of simple diffusion

Facilitated diffusion: a hydrophilic protein channel to speed up, water, ions, polar molecules

Hypertonic: more solute, less solvent

Hypotonic: less solute, mor solvent

Isotonic: two solutions containing equal concentration of solutes

water potential: the addition of solute lowers water potential

Water diffuses **toward the hypertonic** area (higher solute). Solutes diffuse to more hypotonic

Aquaporins: large quantities of water move via aquaporins, special water channel proteins that facilitate diffusion, function as gated channels (open and close)

Passive vs. Active Transport (cont)

Active Transport: requires energy (ATP), ions, polar molecules

1. Pumps or carriers carry particles across the membrane by active transport. Ions (charged particles) such as potassium and sodium can cross cell membranes only through certain proteins embedded in the membrane.

a. **sodium-potassium pump**: pumping two K+ ions for every three Na + ions.

b. **Proton pumps**: H+

c. **Cotransport**: sucrose in plants against a gradient in the company of protons.

2. Contractile Vacuole: pumps out excess water

3. **Exocytosis**: release/secrete macromolecules, vesticles containing macromolecules within the cell fuse with plasma membrane, releasing contents into external enviro-nement.

4. **Endocytosis**: takes in macromolecules, engulfing to form an intracellular vesicle.

a) **Phagocytosis**: engulfing into a vacuole.

b) **Receptor mediated endocytosis**: ligand binds to receptor, into a coated vesicle. ex: Cholesterol

Bulk flow movement is always from source (where it originates) to sink (where it is used).

Osmolarity: total solute concentration in a solution

Osmoregulation mainatains water balance and allows organisms to control their internal solute composition

Cell Membrane Receptors (first messenger)

Ion Channel receptors	open and shut a gate in a membrane, allowing an influx of ions, such as Na + , K+ , Ca 2+ , or Cl – ions.
G protein-coupled receptors (GPCR)	ligand binds, changes conformation, activates G protein, bonds to GTP, activates the enzyme adenylyl cyclase, convert ATP to cAMP
Receptor Tyrosine Kinases (RTKs)	enzymatic activity, catalyzes the transfer of phosphate groups from ATP to the amino acid tyrosine. After binding, the individual units aggregate and activate the tyrosine kinase region, which bonds to ATP..

Intracellular Receptor

intracellular recpetor	hydrophobic, non polar: steroids, thyroid hormones, and NO, nitric oxide, a gas
Transduction	Signal transduction pathway, a cascade effect, advantage is more opportunities to amplify the signal greatly.
Response	

Intracellular Receptor (cont)

1. They are characterized by a signal, a transduction, and a response. **2**. They are highly specific and regulated. **3**. One signal molecule can cause a cascade effect, releasing thousands of molecules inside a cell. **4**. They regulate cellular activity, altering gene expression, protein activity, or protein synthesis. **5**.These pathways evolved millions of years ago in a common ancestor.

Apoptosis - programme cell death

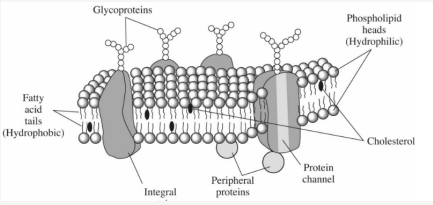
1. During **embryonic development**, when cells or tissues are no longer needed, they die and are engulfed by neighboring cells.

2. too much **genetic damage** that could lead to cancer.

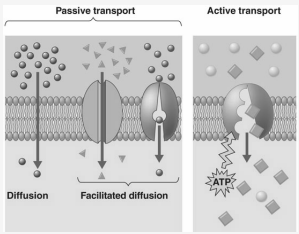
3. **defense** against infection by fungus and bacterium. dying so no living tissue to spread infection inside the plant.

4. In mammals, including humans, several different pathways involving enzymes called **caspases** carry out apoptosis.

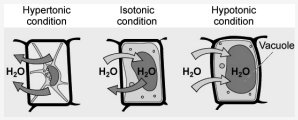
plasma membrane



Passive and Active Transport



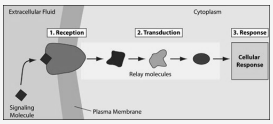
Hypotonic, Hypertonic, Isotonic solution



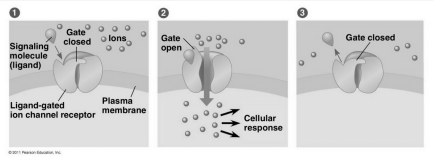
cell communication

Quorom Sensing	bacteria to monitor their population density to control gene expression. ex: biolumine-scence
Direct Contact	**gap junctions** permit the passage of materials directly from the cytoplasm of one cell to the cytoplasm of an adjacent cell. ex: Plasmodesmata
Local Signaling	**paracrine signaling**: short distance, one layer induces a nearby layer. **Synaptic Signaling**:nerve cell releases neurotransmitters.
Long Distance Signaling	Plant use **hormones** for long-d-istance signaling.

Three stages of Cell signaling

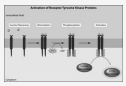


Ion Channel Receptor



G protein coupled receptor

RTKS



Origins of Cell Compartmentalization

Theory of **endosymbiosis**: a previously free-living prokaryotes (bacteria) was engulfed by another cell through endocytosis. After living together symbiotically for some tme, the once free-living prokaryote lost its independent functionality and gave rise to either the mitochondria or the chloroplasts.

Evidence supporting the evolution of mitochondria and chloroplasts via endosy-mbiosis includes the presense of double membranes, circular DNA, and ribosomes in both organelles.