

Prokaryotes vs. Eukaryotes

Similarities~

1. bound by plasma membrane
2. contains cytoplasm
3. contains chromosomes
4. contains ribosomes

Differences~

prokaryotes	eukaryotes
- DNA in nucleoid	- DNA in nucleus
- no membrane-bound organelles	- cytoplasm with membrane-bound organelles
- smaller size	- larger size
- smaller ribosomes	- larger ribosomes
- circular DNA	- linear DNA

Surface Area

large S.A. to volume ratio to...

perform cellular metabolism more efficiently & exchange materials with environment more efficiently

as cell increases in volume and S.A. decreases...

a higher demand of resources creates a limitation

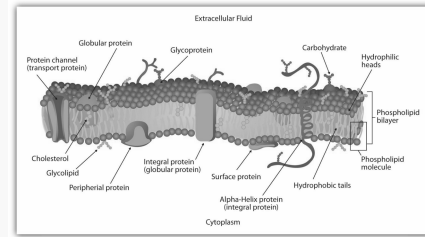
microvilli: long finger-like projections

increase S.A. (little change to volume)

compartmentalization =

metabolic processes can happen simultaneously & enzymes built into membrane (for metabolism)

Plasma Membrane



- **selective permeability:** regulates the passage of substances across the membrane
- **'fluid mosaic':** (1) phospholipid bilayer that shifts and moves (2) various proteins embedded
- **phospholipids** → hydrophilic head (polar) & hydrophobic tail (nonpolar)
- **cholesterol** → regulates fluidity of membrane as temp. changes ("fluidity buffer")
- **glycolipids** → membrane carbohydrates bonded to lipids
- **glycoproteins** → membrane carbohydrates bonded to proteins

Membrane Activity

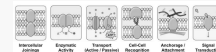
CAN enter

- small nonpolar molecules (gases)
- hydrophobic molecules
- small polar molecules (water)

CAN'T enter

- ions
- hydrophilic molecules (charged)
- large polar molecules (glucose)

6 Membrane Protein Functions



- **integral proteins:** throughout the hydrophobic interior
- **peripheral proteins:** loosely bound to the surface of the membrane

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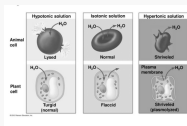
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Passive Transport Vocab

-passive transport:	diffusion of a substance with NO use of energy
-diffusion:	movement of a substance <i>down</i> its concentration gradient (HIGH to LOW)
-osmosis:	diffusion of water across a membrane (HIGH to LOW of water)
-facilitated diffusion:	diffusion of a substance with the assistance of transport proteins
	ex) K ⁺ leaves the cell; water from aquaporins
-carrier protein:	a change in shape moves the substance across
-channel protein:	a channel which molecules pass through
-gated channels:	channels that open/close in response to stimulus
	ex) electrical, binding of a substance, or pressure
-aquaporin:	channel protein that facilitates osmosis by passing a LOT of water

Tonicity



Active Transport Vocab

-active transport:	moving a substance across a membrane against the concentration gradient WITH energy (LOW to HIGH)
-sodium-potassium ion pump:	movement of Na ⁺ out of the cell and K ⁺ into the cell
-electrogenic pump:	generates a voltage across a membrane while pumping ions
	ex) Na ⁺ /K ⁺ pump (animals); proton pump (plants, bacteria, fungi)
-proton pump:	transport of H ⁺ ions out of the cell
-sucrose/H⁺ cotransport:	movement of H ⁺ into a cell down its gradient (taking sucrose w/ it) & then H ⁺ transported out of cell (proton pump)
-exocytosis:	secretion of a substance by the fusion of vesicles on the membrane
-endocytosis:	1. phagocytosis 2. pinocytosis 3. receptor-mediated endocytosis
1. phagocytosis	engulfing "food" or other particles
2. pinocytosis	engulfing extracellular fluid molecules
3. receptor-mediated endocytosis	engulfing bulk quantities of substances

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Endosymbiont Theory

- mitochondria and chloroplast originated as prokaryotic cells engulfed by a eukaryotic cell & evolved into a single organism

supporting evidence~

1. both have 2 membranes (when engulfed)
2. both contain ribosomes
3. both are autonomous (grow & reproduce on own)
4. both make own proteins
5. both have DNA

Endomembrane System (cont)

5. vesicles/vacuoles
6. plasma membrane

Water and Osmotic Potential

Water Potential

Water potential (ψ): H₂O moves from high ψ → low ψ potential

Water potential equation:

$$\psi = \psi_s + \psi_p$$

- Water potential (ψ) = free energy of water
- Solute potential (ψ_s) = solute concentration (osmotic potential)
- Pressure potential (ψ_p) = physical pressure on solution; *turgor pressure (plants)*
 - Pure water: $\psi_p = 0$ MPa
 - Plant cells: $\psi_p = 1$ MPa

Ψ_s (or Ψ_π): due to molarity ---- negative value (higher M = more negative)

↳ determines the *tonicity* (hypertonic = high M/more - & hypotonic = low M/less -)

Ψ : tells the *direction* the water will go

Ψ_p : 0 when exposed to open air

Endomembrane System

PARTS	ROLES
1. nuclear envelope	synthesize proteins
2. ER	transport proteins
3. golgi apparatus	metabolism (& movement of lipids)
4. lysosomes	detoxification



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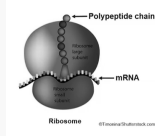
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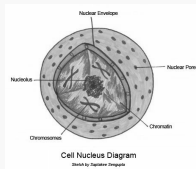
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Ribosomes



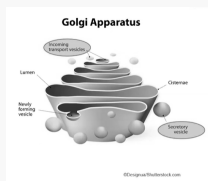
- **function:** synthesize proteins from mRNA (made from rRNA and proteins)
- **free ribosomes:** suspended in the cytosol (enzymes)
- **bound ribosomes:** attached to the ER/nuclear envelope (proteins for membranes; packaging w/in organelles; export from cell)

Nucleus



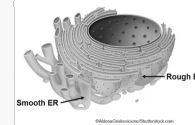
- **nuclear envelope:** double membrane enclosing the nucleus
- **nuclear pores:** holes in the nuclear envelope (regulate entry/exit of proteins and RNAs)
- **chromosome:** coiled up DNA
- **chromatin:** mass of uncoiled DNA
- nucleolus:** center of the nucleus responsible for rRNA synthesis & assembling subunits for ribosomes

Golgi Apparatus



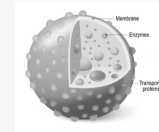
- (made of flattened membrane-bound sacs -- cisternae)
- **function:** modifies proteins and sends them to destination & makes some macromolecules

Endoplasmic Reticulum



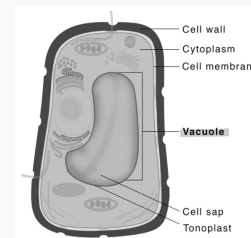
- **rough ER:** (ribosomes attached) packages proteins synthesized from ribosomes
- **smooth ER:** (NO ribosomes) detoxification & lipid synthesis

Lysosome



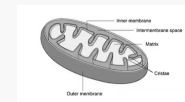
- (sacs that contain hydrolytic enzymes)
- **function:** digest materials (w/ enzymes) & recycle intracellular materials

Vacuole



- **food vacuole:** engulf (phagocytosis) materials as food for the cell
- **contractile vacuole:** moves excess water out of the cell
- **central vacuole of plants:** play roles in growth, storage, & rid of toxic substances

Mitochondria



- (has a double membrane and contains folds -- cristae)
- **function:** synthesize energy/ATP (cellular respiration -- Krebs Cycle and ETC)

Chloroplast



- **function:** photosynthesis

(made of *grana* stacked together to make *thylakoids* inside the *stroma*)

1. **amyloplasts:** stores starch and sugars
2. **chromoplasts:** pigment synthesis and storage

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