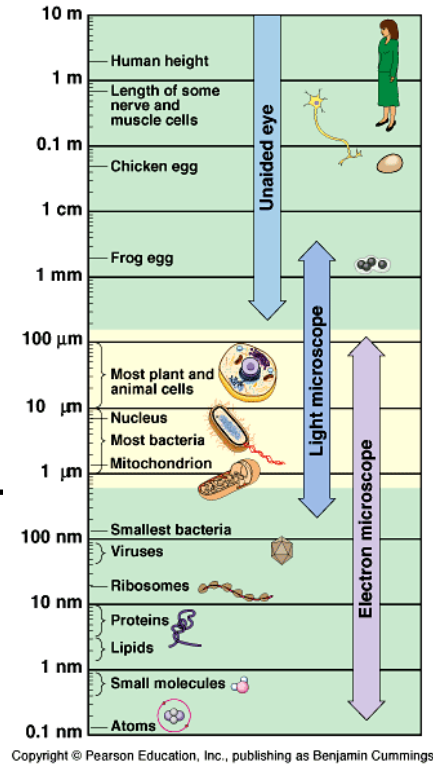


Cell Parts Notes

Essential Question?

What is the Relative Size of cells compared to other things?

Most cells are between 1 and 100 micrometers (microns) that is 10^{-3} mm.



What tools / Techniques allow us to study objects that small?

Microscopes

- Light Microscope - Uses visible light to cast a shadow. + can view live organisms. - Cells often must be stained to give contrast. Resolution of only $.2 \mu\text{m}$.
- Scanning Electron Mic. (SEM) uses an electron beam instead of light. + Smaller size of beam allows resolution of $.002 \mu\text{m}$ (2 nanometers). - Complicated processing (coat cells in metals) cannot view live organisms, can only image the surface of a cell.
- Transmission EM (TEM) - similar to SEM except can only view slices to show internal structure.

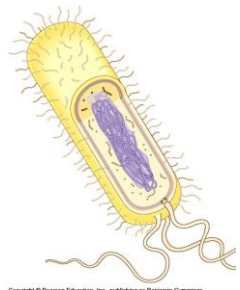
Cell Fractionalization

- Put cells in blender to shred into their constituent parts.
- Place blended material in a centrifuge spinning at 100,000+ rpm. (the gravitron on speed)
- Components are layered based on weight.

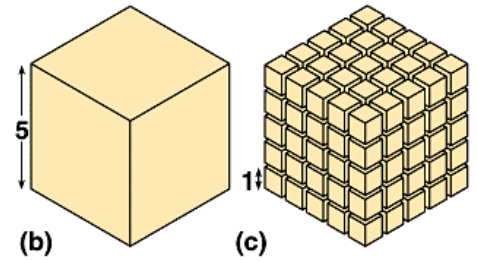
How do Prokaryotic cells differ from eukaryotic ones?

Prokaryotes can perform all of the same essential functions. The basic difference is in the lack of specialized compartments (organelles) which improve the efficiency of these tasks in eukaryotes that possess them.

Benefits of Prok. - Drawbacks of Prok. -



Surface area increases while total volume remains constant



How does cell size affect the efficiency of a cell?

Smaller cells have a better ratio of surface to volume and are more efficient.

What forms the outside covering of the cell?

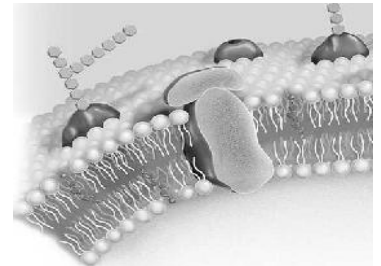
All Cells Have a Cell Membrane

- Provides separation between the cell and its environment

How is the outer covering designed?

Fluid Mosaic Model-

- Made from phospholipids
- Bilayer - two Phospholipid layers
- Semipermeable - some molecules can not pass through. Based on size and chemistry. (more in Ch. 8)
- Exterior Hydrophylic
- Interior Hydrophobic
- Overall structure is a fluid with a mosaic of proteins embedded in it. (Picture ping-pong balls covering the surface of a pool with a few larger items floating in it. Inner Tube, Dive Flag, fountain)



What fills most of the inside of a cell?

- Cytoplasm
 - Everything between the cell membrane and the nucleus that is not an organelle.
 - Mostly water with lots of dissolved molecules necessary to carry out metabolic functions.

What structures perform all of the functions of a cell?

- Organelles
 - Structures that work like miniature organs carrying out specific functions for the cell.

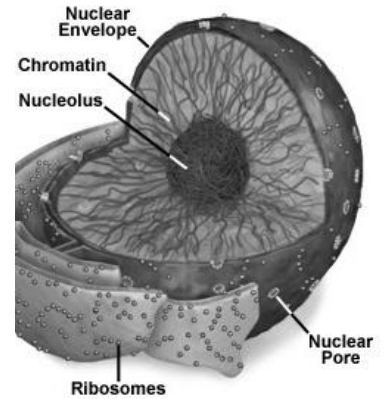
Which organelles control the cell and carry out the instructions?

➤ Nucleus

- Found in all Eukaryotes
- Surrounded by Nuclear Envelope - phospholipid like all memb. (pores allow RNA , Ribosomes out)

Functions

- Stores Genetic information as Chromatin (DNA)
- Controls all cell functions
- Nucleolus
 - Makes ribosomes



- Ribosomes

- Found in cytoplasm (free) and on rough ER (bound)
- 2 parts each made of protein & rRNA
- Produce _____ by following instructions from _____

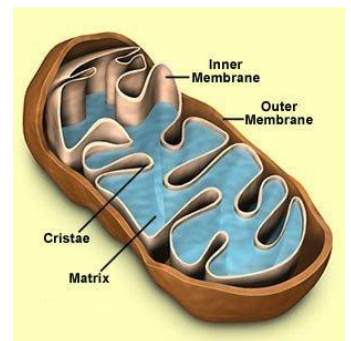


Membrane Bound Organelles (all unique to Eukaryotes)

What provides the energy to power the cell?

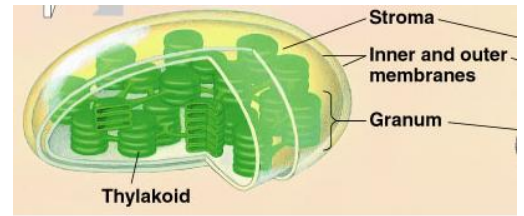
Mitochondria

- Found in all eukaryotes
- Function
 - Cellular respiration - Convert chem. Energy of food into Free Energy to power cell functions
 - Double membrane- outer, inner folded (cristae) to increase surface area (site of most rxns),
 - Matrix within inner membrane (contains rRNA, enzymes, ribosomes)



Chloroplasts

- Found only in Plant cells (some protozoan)
- Structure - Double lipid membrane
 - Membrane bound disks (thylakoid) filled w/ chlorophyll. Arranged in stacks called grana. Stroma (Fluid similar to matrix of Mitochondria)
- Function
 - Photosynthesis- Convert solar energy (sun) into chemical energy (sugar)
- Chlorophyll - primary photo pigment,



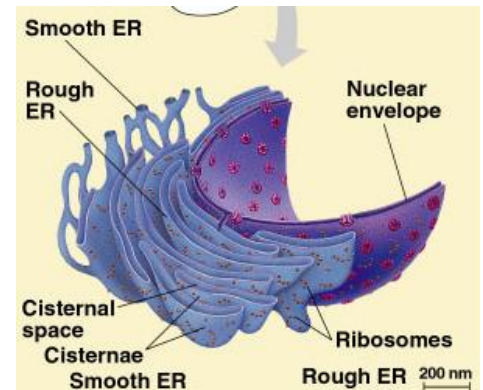
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The Endomembrane System:

Which organelles are involved in transporting and processing materials?

Endoplasmic Reticulum (ER)

- Structure -Single lipid membrane in winding interconnected channels
- Two types of ER
 - Rough ER - covered w/ bound ribosomes (loc near nucleus). Site of much protein production.
 - Smooth ER contains no ribosomes (loc farther from nuc). Lipid synthesis, toxin metabolism, carbohydrate storage / release. Muscle cells only- electrical impulse transmission, stimulation of muscle proteins causing contraction.



Golgi Apparatus

- Structure - flattened stack of membrane sacks (stack of pancakes)
 - Cis face - receiving side
 - Trans face - shipping side

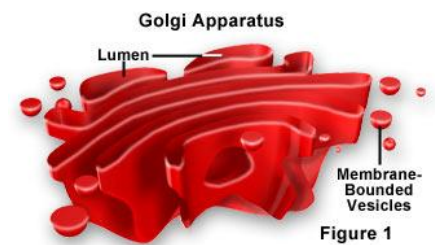
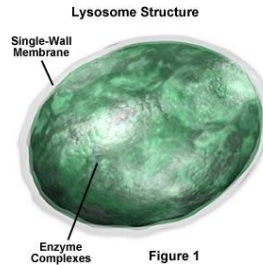


Figure 1

- Function
 - takes in materials (polypeptides or lipids) on Cis face, alters them into final working version
 - bud off of trans face in vesicle to cell membrane, organelles or export out of cell

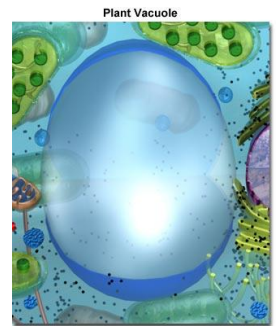
Lysosomes

- Structure - Small membrane sacks filled with digestive enzymes.
- Function -
 - digestion of worn out organelles (autophagy)
 - digestion of phagocytized (eaten) food in protozoans / bacteria in white blood cells.
 - Aptopsis - programmed cell death that removes damaged cells or unneeded cells (embryology)

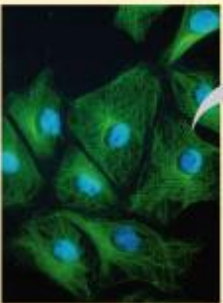
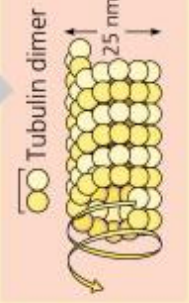
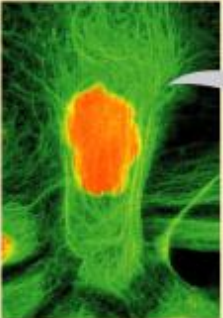

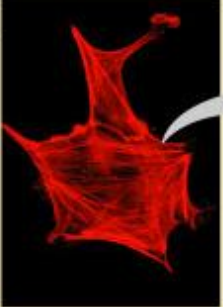
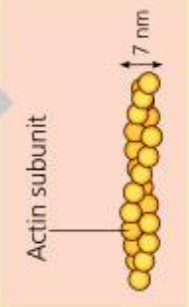
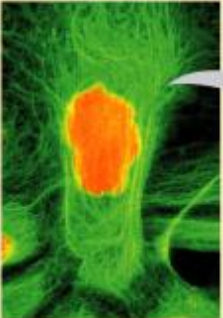



Vacuoles

- Structure - hollow membrane sack
- Function
 - Storage of many excess materials (cellular Tupperware)
 - Plants (Central Vacuole) - fill with water to pressurize (Turgor pressure) plant cells.
 - When they lose pressure, plants wilt.



The Cytoskeleton: Internal Framework and Movement

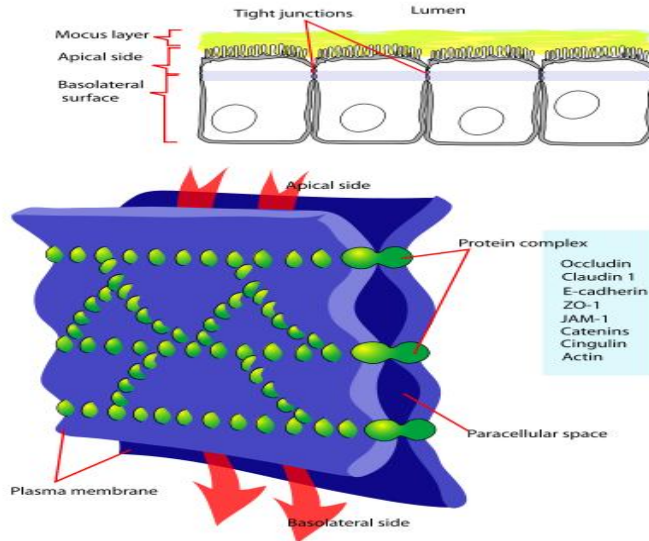
Table 7.2 The Structure and Function of the Cytoskeleton		
Property	Microtubules	Intermediate Filaments
Structure	Hollow tubes; wall consists of 13 columns of tubulin molecules	Fibrous proteins supercoiled into thicker cables
Diameter	25 nm with 15-nm lumen	8–12 nm
Protein subunits	Tubulin, consisting of α -tubulin and β -tubulin	One of several different proteins of the keratin family, depending on cell type
Main functions	Maintenance of cell shape (compression-resisting “girders”) Cell motility (as in cilia or flagella) Chromosome movements in cell division Organelle movements	Maintenance of cell shape (tension-bearing elements) Anchorage of nucleus and certain other organelles Formation of nuclear lamina
	 	 
	 	 

SOURCE: Adapted from W. M. Becker, L. J. Kleinsmith, and J. Hardin, *The World of the Cell*, 4th ed. (San Francisco, CA: Benjamin Cummings, 2000), p. 753.

Cell Junctions

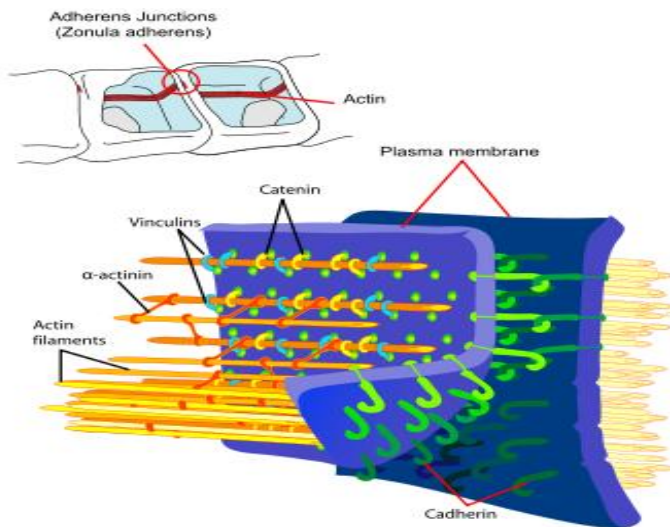
Tight Junction - Think Ziploc seal.

Primarily used between epithelial tissues that line organs. Form seal that prevents diffusion of material BETWEEN cells.



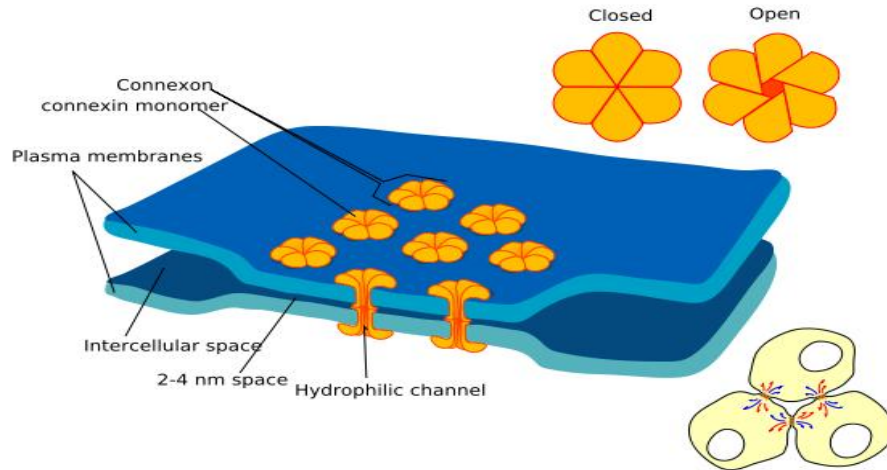
Anchoring Junction - Think Velcro

Used where extremely strong connections between cells are essential. Between cells in muscle and other load bearing structures. Between cells that cant afford to be pulled apart.



Communicating Junction - Think valves

Used between cells that share nutrients and chemical messages. Also found in some types of nerve



Cell Wall

