Cell theory

1. All living things are made up of cells	unicellular or multicellular
2. Cells are the smallest and most basic unit of life	prokaryotic or eukaryotic
3. All cells come from pre-existing cells.	

Prokaryotic or Eukaryotic

Prokaryotic	no nucleus	Eukaryotic	has nucleus
	no membrane bound organelles		membrane bound organelles
	division process is binary fission		division process is mitosis
	unicellular		unicellular or multicellular

Prokaryotic or Eukaryotic (cont)

cell wall made of peptidoglycan	in fungi or plants with cell walls made of chitin or cellulose
smaller cells	larger cells
bacterial cells	animal or plant cells
all cells have cell membrane, cytoplasm, ribosomes, genetic material (DNA or RNA)	

Organelles

Cell (Plasma) Membrane	Phospholipid bilayer that surrounds the cell to control what goes in and out of the cell
Cytoskeleton	Network of threadlike fibers made of proteins to give the cell shape, move organelles around, provide structural support for animal cells

Organelles (cont)

Cytoplasm	jelly-like substance mainly made up of H2O that holds everything in place and provides solution for chemical reactions to take place in
Nucleus	genetic material that's surrounded by a nuclear membrane with nuclear pores that control what goes in and out that protects the DNA that controls the activities of the cell
Nucleolus	inside the cell that makes mRNA which makes ribosomes

Organelles (cont)

Ribosomes	located on the Rough ER and floating in cytoplasm that make proteins in a process called translation
Rough Endoplasmic Reticulum	Hugs the nuclues and has ribosomes on it that makes proteins
Smooth Endoplasmic Reticulum	has no ribosomes and is attached to the Rough ER that makes lipids (membranes), destroy toxins (liver), and regulates calcium (muscles)
Golgi Apparatus	folded membrane that gets vesicles of protein from ER to process, sort, and ship proteins where needed

Organelles (cont)

Vesicles	"mini-cart" that transports proteins around the cell
Lysosomes	Contains enzymes that break down the dead stuff and apoptosis
Vacuoles	small and numerous in animal cells but one large one in plants cells that act as a storage
Centrioles/Centrosomes	made of microtubules that happen in cell division helping cells divide by pulling chromosomes apart
Cilia	shorter, more numerous, like tiny oars (hairs) that move fluid across cell surface
Flagella	longer, fewer (tail) that move entire cell

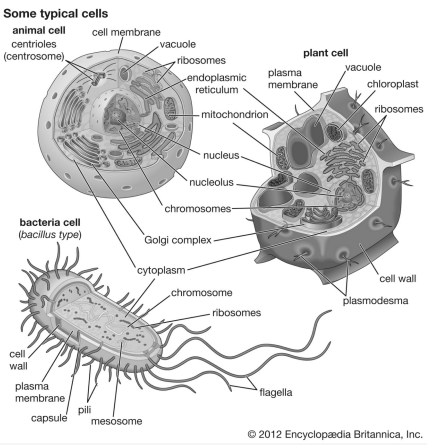
Organelles (cont)

Mitochondria	inner membrane and matrix (fluid) where cellular respiration happens (breaks down food to release energy as ATP)
Chloroplast	grana (stacks) and stroma (fluid) where photosynthesis happens (converts energy from sun to energy in sugar)
Cell Wall	Provides structural support and protection for bacteria, plant and fungi cells. Bacteria's made with peptidoglycan. Plant's made with cellulose. Fungi's made with chitin.

Organelles (cont)

Peroxisomes	membrane-bound organelles primarily involved in lipid metabolism and the conversion of reactive oxygen species

Animal, Plant, Prokaryotic cells

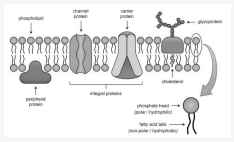


Plant Cell:
chloroplast
central vacuole
cell wall

Animal Cells:
cilia and flagella
centrioles
lysosomes

Bacterial Cells
capsules

Cell membrane



Phospholipid Bilayer: amphipathic
- hydrophilic heads
- hydrophobic tails

Fluid Mosaic Model

membrane is a fluid structure with "mosaic" of various proteins embedded/attached to bilayer	phospholipids provides fluidity and elasticity
	proteins and other molecules embedded in membrane

Structure of Cellular Membrane

main components	phospholipids and proteins
other important molecules	cholesterol and carbohydrates

Proteins

Functions	transport, enzymatic activity, signal transduction, cell to cell recognition, intercellular joining, attachment to cytoskeleton and extracellular matrix

Proteins (cont)

Integral Proteins	embedded in
Peripheral Proteins	attached to surface

Cholesterol

at warm temperatures	restrains the movement of phospholipids and reduces fluidity
at cool temperatures	maintains fluidity by preventing tight packing

Carbohydrates

cell to cell recognition	cell's ability to distinguish one type of neighboring cell from another
membrane carbohydrates	interact with the surface molecules of other cells, facilitating cell to cell recognition

Selective Permeability

Allows some materials, but not all to go through

can easily pass: small, non polar, nonionic hydrophobic, neutral molecules and H2O	cannot easily pass: large (must use vesicles), polar (must go through proteins), ionic, hydrophillic

Cellular Transport

Concentration	# of molecules of a substance in a given volume
Concentration Gradient	differnce in concentration (mass) of a substance from one location to another

Passive or Active Transport

Homeostasis

the need for an organism to maintain and regulate constant or stable internal conditions	Growth and homeostasis are maintained by the constant movement of molecules across membranes.

Passive Transport

Molecules moving DOWN their concentration gradient from HIGH to LOW with NO ENERGY until EQUILIBRIUM is reached

Simple Diffusion	The spreading out of molecules
ion channels	transport proteins allow ion to flow from a high to low concentration

Facilitated Diffusion	transport protein (channel or carrier) helps to facilitate the diffusion of molecules	aquaporins: tunnel that allows water to go through the membrane

Passive Transport (cont)

Osmosis	Simple diffusion of water across a semiperrmeable membrane	Hypertonic solutions = more solutes, less water; water moves out of cell to SHRIVEL
		Hypotonic solutions = less solutes, more water; water moves into the cell to SWELL/-BURST
		Isotonic Solution = equal solutes and water; cell STAYS THE SAME

Active Transport

molecules moving AGAINST the concentration gradient from LOW to HIGH concentration

Active Transport (cont)

Molecular Pumps	Cell uses energy to pump molecules across a membrane through a protein channel (sodium potassium pump and proton pump)
Cotran-sport	single ATP-powered pump that transports solute indirectly
Exocytosis	cell uses energy to export materials out of the cell with a vesicle

Active Transport (cont)

Endocy tosis	cell uses energy to import materials into the cell with a vesicle	Phagoc-ytosis = cell "eat-ing" (cell engulfs solids into vesicle and digests them)
		Pinocy-tosis = cell "dri-nking" (cell engulfs liquids into vesicle and digests them)

SA:V Ratio

Formulas	Surface Area: 6 *(*lw)
	Volume: l*w*h
Steps to find SA:V	1. calculate SA
	2. calculate V
	3. Divide SA by V

As cell size increases, the SA:V ratio decreases and the cell becomes less efficient at moving things in and out of the cell
= cell must stop growing or dividing

Cell size

Why are cells small?	To maintain a larger surface area to volume ratio. The smaller the cells are, the faster and more efficient things can go in and out of the cell.

Water Potential

Ψ = ΨS + ΨP	ΨS: solute potential
	ΨP: pressure potential
ΨS = -iCRT	i: ionization constant
	C: concentration (M)
	R: pressure constant (0.0821 liters bars/mole K)
	T: temperature in Kelvin (^{o}C +273)

Water Potential (cont)

Osmotic Potential	the potential of H2O moving from hypotonic solutions to hypertonic solutions (High water potential to low water potential)

Turgor Pressure: When a plant cell is placed in a hypotonic solution and gains a lot of water, the cell wall presses back on the cell membrane to prevent the cell from bursting.

Osmoregulation

the control of water balance

organisms without cell walls that live in hypertonic or hypotonic enviro-nment	Osmoregulation maintains water balance and allows organisms to control their internal solute composition/water potential.