

September 8, 2015
BSC 215

READING 87-99

Cytoplasmic Organelles- tiny cellular "machines"

- organelles allow the cell to be compartmentalized
- membrane-bound organelles: mitochondria, peroxisome, endoplasmic reticulum, Golgi apparatus, lysosome
- organelles not enclosed by a membrane: ribosomes, centrosomes
- organelle membrane is similar to plasma membrane so that substances can be transported b/w the two

Mitochondria

- energy production, "power plants" of the cell
- some ATP is produced via glycolysis, but most ATP is produced in the mitochondria
- human cell mitochondria each have their own DNA and enzymes required for protein synthesis. Also they each have their own ribosomes
- ribosomes: small, granular organelles that participate in protein synthesis
- Membrane bound
 - o Outer mitochondrial membrane: smooth
 - Large channels that permit molecules in cytosol to enter intermembrane space
 - o Inner mitochondrial membrane: numerous folds called cristae
 - Pretty much impermeable to most solutes except those that have specific transport proteins
- Double-membrane create 2 spaces w/in mitochondria
 - o Intermembrane space: space b/w the two membranes
 - o Matrix: innermost space
 - Mostly only DNA, mitochondrial proteins, and enzymes found here
- Oxidative catabolism: a series of rxns important to break down organic fuels, found in the matrix
 - o Only can be completed in the presence of oxygen
 - *Aerobic respiration*
 1. products of glycolytic catabolism & other fuels are oxidized
 2. energy released by these oxidation rxns is
 3. used to drive ATP synthesis

Peroxisome

- uses oxygen to carry out rxns
- their main rxn is to use molecular oxygen to oxidize and strip hydrogen atoms of certain organic molecules to produce hydrogen peroxide
- hydrogen peroxide & oxidative enzymes are responsible for:

- oxidizing toxic substances
 - ex: ethanol
 - these toxins are eliminated
 - very important in kidney and liver cells
 - breaking down fatty acids
 - products of this rxn are sent to cytosol to participate in anabolic respiration or go to mitochondria to be oxidized to ATP
 - synthesizing certain phospholipids
 - these phospholipids are critical components of the plasma membrane of some nervous system cells
 - often, diseases in the peroxisomes affects the nervous system
- this hydrogen peroxide isn't harmful to the cell because when it accumulates, an enzyme in the peroxisome turns the excess into water and oxygen
- example benefit of compartmentalizing

Ribosomes

- non-membrane bound organelles that are the site of protein synthesis
- made up of 2 subunits, each is made up of ribosomal RNA and proteins
- two types of ribosomes (they are structurally the same just different places in the cell)
 - free
 - suspended in the cytosol
 - they make proteins that are used by to cytosol
 - all ribosomes start out free, but some will attach themselves to the ER or the nuclear envelope
 - bound
 - associated w/ membranes of other structures
 - make proteins that will be exported from the cell, transported to other organelles, or inserted into the membrane

The Endomembrane System

- Organelles that transfer molecules from vesicles that exchange proteins and other molecules are part of this system
- They synthesize, modify, and package molecules produced by the cell
- includes the ER, Golgi, and lysosomes

Endoplasmic Reticulum

- the large, folded membrane surrounding the nucleus
- it is a highly folded phospholipid bilayer (single, continuous membrane enclosing a fluid-filled space called the ER lumen)
- Lumen: contains enzymes that catalyze rxns

Rough ER

- membrane is covered in bound ribosomes
- polypeptides synthesized on bound ribosomes pass through RER membrane into the lumen, where enzymes catalyze rxns that fold them into 3D shapes
- RER recognizes proteins that are shaped wrong and send them to the cytosol
- Many proteins that enter the RER are secretory proteins, those destined to be exported from the cell
 - o When the secretory protein is assembled, it leaves the RER through a transport vesicle
- RER acts as a "membrane factory"- membrane components for the entire cell are made there
- RER ribosomes also synthesize some cholesterol and phospholipids and inserts them into the membrane

Smooth ER

- lacks bound ribosomes
- plays no roll in protein synthesis
- Functions:
 - o Calcium ion storage
 - Important for muscle cells
 - o Detoxification reactions
 - o Lipid Synthesis

Golgi Apparatus

- located b/w RER and plasma membrane, is a group of flattened membranous sacs filled with enzymes and other molecules
- proteins and lipids from ER are modified, sorted, and packed for export
- Sacs are not continuous like in the ER, but separated from one another by thin spaces filled with cytosol
- Part that is closest to the ER receives transport vesicles from the ER and the farthest send the formed vesicles off

Lysosomes

- digestive functions of cells
- membrane-bound sacs that contain water and enzymes called, acid hydrolases
 - o these hydrolases are synthesized on bound ribosomes, modified in the ER, further modified in the golgi and then delivered to the lysosome in a transport vesicle