

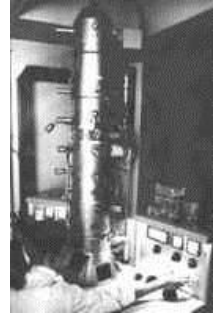
Microscope Tips:

- ALWAYS start on scanning obj. lens (red lens)
- Use coarse focus on scanning power only
- Fine focus will fine tune what you are examining at all levels of magnification
- If you can't see anything, go back to scanning and coarse focus up and down until you see the tissue or the slide.

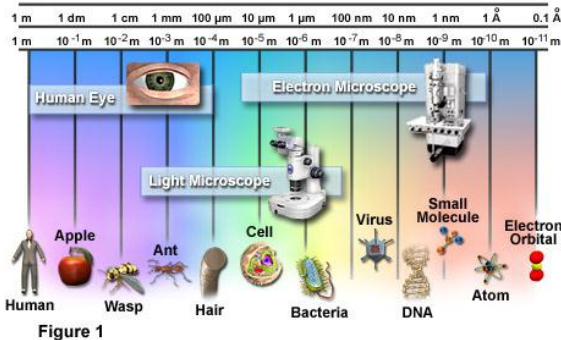


Beyond Light Microscopes

- Resolution: image crispness
- Magnification: zoom size
- Light microscopes are limited by their resolution.
 - Cannot produce clear images of objects smaller than $0.2\mu\text{m}$
- Electron microscopes use beams of electrons, rather than light, to produce images
 - ♦ Electron microscopes can view objects as small as the diameter of an atom

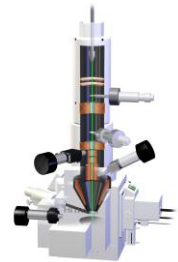


Relative Sizes and Detection Devices

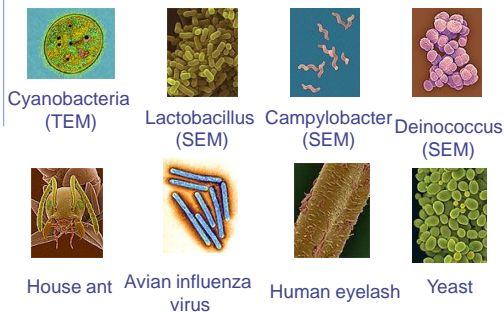


Types of Electron Microscopes

- Transmission electron microscopes (TEMs) pass a beam of electrons through a thin specimen
- Scanning electron microscopes (SEMs) scan a beam of electrons over the surface of a specimen
- Specimens for electron microscopy must be **preserved and dehydrated**, so living cells cannot be viewed

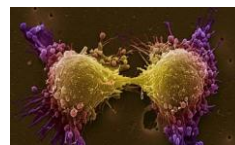
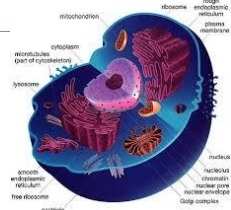


Images Produced by Electron Microscopes

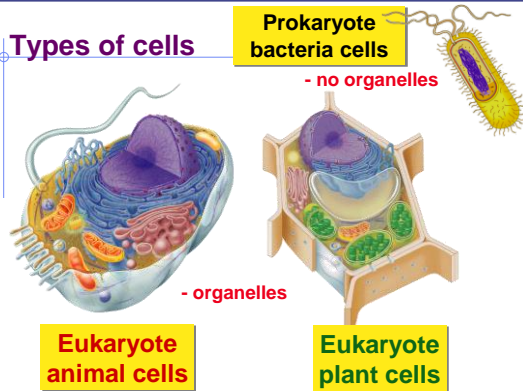


Cell Theory

- Cell = basic functional unit of life
- All cells come from other cells through division

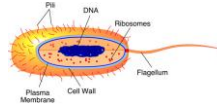


Types of cells



Prokaryote vs. Eukaryote

- Cell diameter: 0.5-5µm
 - Circular, free-floating DNA
 - DNA naked
 - Ribosomes: 18nm diameter
 - No membrane bound organelles, no ER
 - Cell walls
 - Bacteria
- Cell Diameter: 40µm, 1,000-10,000x size of prok's
 - DNA in double-membrane bound nucleus
 - DNA bound to protein
 - Ribosomes: 22nm diameter
 - Many organelles with specialized features
 - Some with cell walls
 - Plants, animals, fungi, protists



Why organelles?

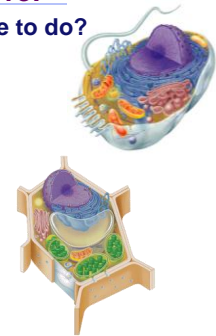
- Specialized structures**
 - specialized functions
 - cilia or flagella for locomotion
- Containers**
 - partition cell into compartments
 - create different local environments
 - separate pH, or concentration of materials
 - distinct & incompatible functions
 - lysosome & its digestive enzymes
- Membranes as sites for chemical reactions**
 - Surface area!!
 - unique combinations of lipids & proteins
 - embedded enzymes & reaction centers
 - chloroplasts & mitochondria



Cells gotta work to live!

What jobs do cells have to do?

- make proteins**
 - proteins control every cell function
- make energy**
 - for daily life
 - for growth
- make more cells**
 - growth
 - repair
 - renewal



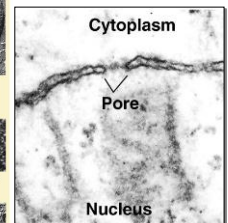
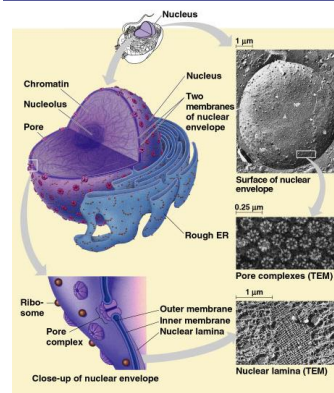
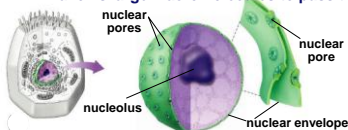
Nucleus

Function

- protects **DNA**

Structure

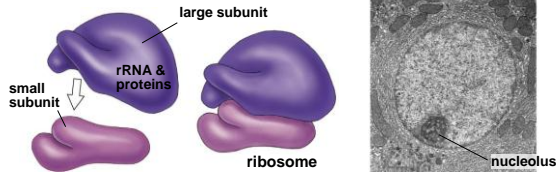
- nuclear envelope**
 - double membrane
 - membrane fused in spots to create **pores**
 - allows large macromolecules to pass through



Nucleolus

Function

- ♦ **ribosome production**
 - build ribosome subunits from rRNA & proteins
 - exit through nuclear pores to cytoplasm & combine to form functional **ribosomes**



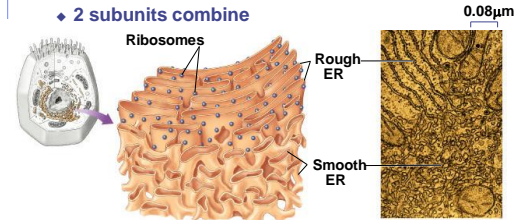
Ribosomes

Function

- ♦ **protein production**

Structure

- ♦ **rRNA & protein**
- ♦ 2 subunits combine



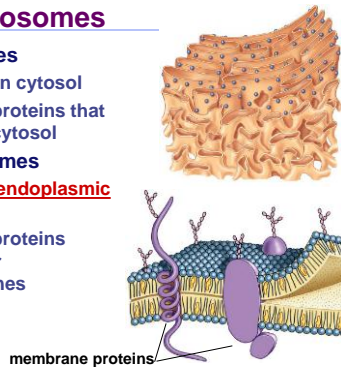
Types of Ribosomes

Free ribosomes

- ♦ suspended in cytosol
- ♦ synthesize proteins that function in cytosol

Bound ribosomes

- ♦ attached to **endoplasmic reticulum**
- ♦ synthesize proteins for export or for membranes



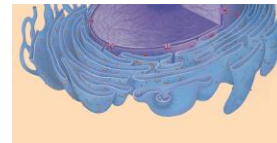
Endoplasmic Reticulum

Function

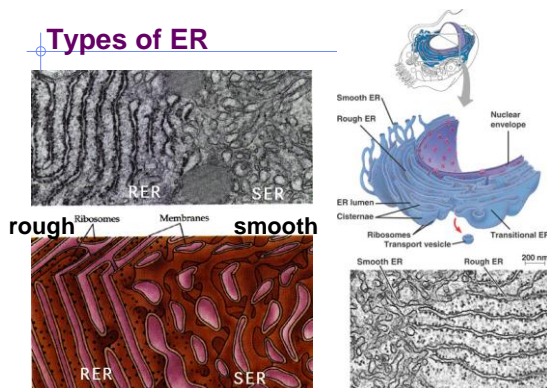
- ♦ **processes proteins**
- ♦ manufactures membranes
- ♦ synthesis & hydrolysis of many compounds

Structure

- ♦ membrane connected to nuclear envelope & extends throughout cell



Types of ER

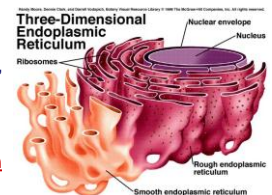


Smooth ER function

Membrane production

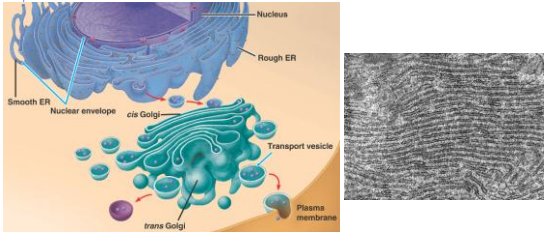
Many metabolic processes

- ♦ **synthesis**
 - synthesize lipids
 - ♦ oils, phospholipids, steroids & sex hormones
- ♦ **hydrolysis**
 - **hydrolyze glycogen** into glucose
 - **detoxify drugs & poisons**



Rough ER function

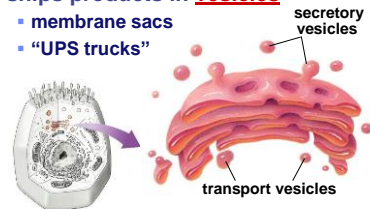
- Produce proteins for export out of cell
 - protein **secreting** cells
 - packaged into **transport vesicles** for export



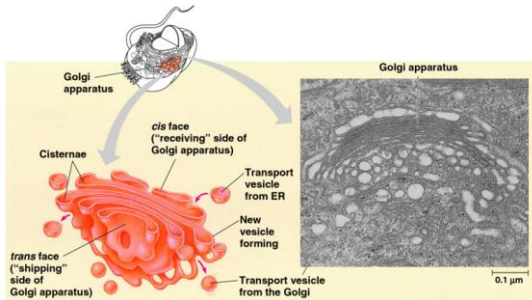
Golgi Apparatus



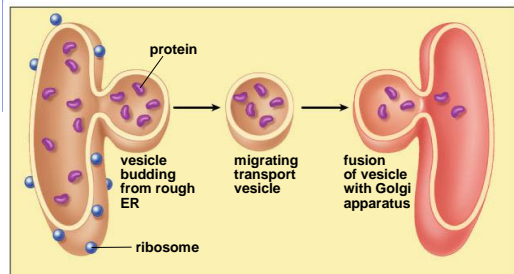
- Function
 - finishes, sorts, tags & ships cell products
 - like "UPS shipping department"
 - ships products in **vesicles**
 - membrane sacs
 - "UPS trucks"



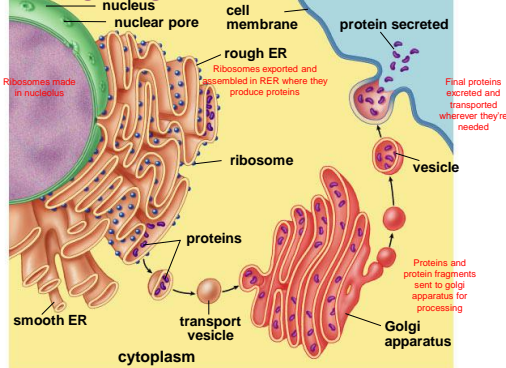
Golgi Apparatus



Vesicle transport



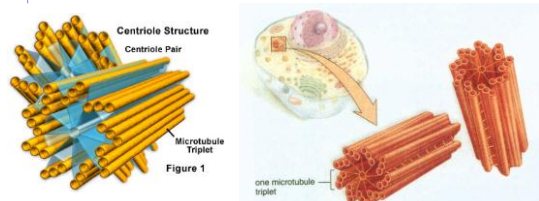
Putting it together... Making proteins



Centrioles



- Function
 - Guide spindle fibers in nuclear division
 - Only in animal cells
- Structure
 - Hollow cylinder made of protein microtubules



Lysosomes

Function

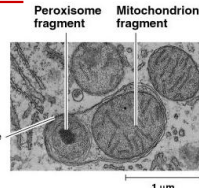
- ♦ **little “stomach” of the cell**
 - digests macromolecules
- ♦ **“clean up crew” of the cell**
 - cleans up broken down organelles

Structure

- ♦ vesicles of digestive enzymes

synthesized by rER,
transferred to Golgi

only in
animal cells



(b) A lysosome in action

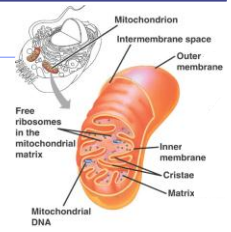
Mitochondria

Function

- ♦ **cellular respiration**

Structure

- ♦ 2 membranes
 - smooth outer membrane
 - highly folded inner membrane
 - ♦ **cris^tae**
- ♦ fluid-filled space between 2 membranes
- ♦ internal fluid-filled space
 - **mitochondrial matrix**
 - DNA, ribosomes & enzymes



Why 2 membranes?

increase surface
area for membrane-
bound enzymes
that synthesize ATP

Chloroplasts

Chloroplasts are plant organelles

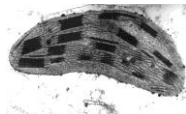
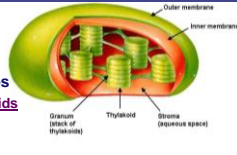
- ♦ class of plant structures = **plastids**
 - **chloroplasts**
 - store chlorophyll & function in photosynthesis

Structure

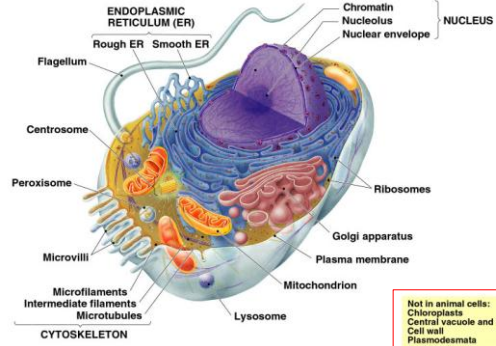
- ♦ 2 membranes
- ♦ **stroma** = internal fluid-filled space
 - DNA, ribosomes & enzymes
- ♦ **thylakoids** = membranous sacs where ATP is made
- ♦ **grana** = stacks of thylakoids

Why internal sac membranes?

increase surface area for
membrane-bound enzymes
that synthesize ATP

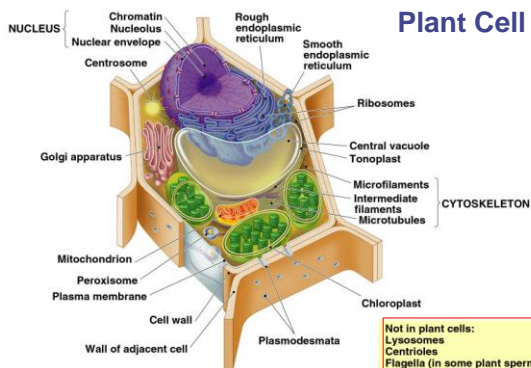


Animal Cell



Not in animal cells:
Chloroplasts
Central vacuole and tonoplast
Cell wall
Plasmodesmata

Plant Cell



Not in plant cells:
Lysosomes
Centrioles
Flagella (in some plant sperm)

Questions?

