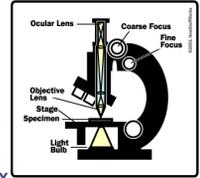


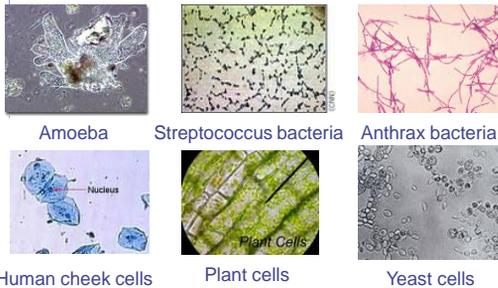
Cells and Microscopy

How Light Microscopes Work

- Obj. lens gathers light from the specimen and magnifies the image
 - Most scopes have several obj. lenses for different levels of magnification
- Ocular lens magnifies and transmits the image to your eye
 - This mag. is 10X
- To find the total magnification of the scope, multiply the mag. of the obj. lens by the mag. of the ocular lens.
 - For example: 40X (objective lens) x 10X (ocular lens) = 400X magnification

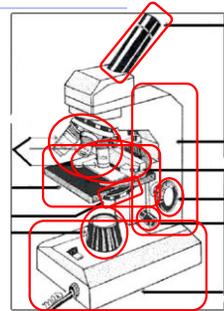


Images Produced by Light Microscopes



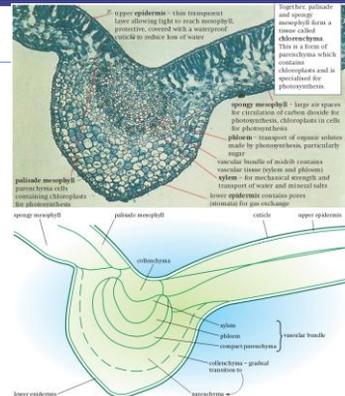
The Parts of a Light Microscope

- Light source: Could be a mirror, but most likely it is a bulb built into the base
- Diaphragm: Adjusts the amount of light striking an object
- Objective lens: Gathers light and magnifies image
- Ocular lens (eyepiece): Magnifies objects and focuses light to your eye
- Stage: Holds slide
 - Can be moved using the coarse or fine adjustment knobs to bring the object into focus
- Stage clips: Hold slide in place
- Base and arm: Structural support for the microscope



You need to be able to use scopes to create plan diagrams...

- Instructions are in your lab manual for today
- No sketching
- No shading
- No cells
- Outline tissues only



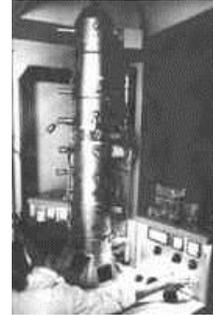
Microscope Tips:

- 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.

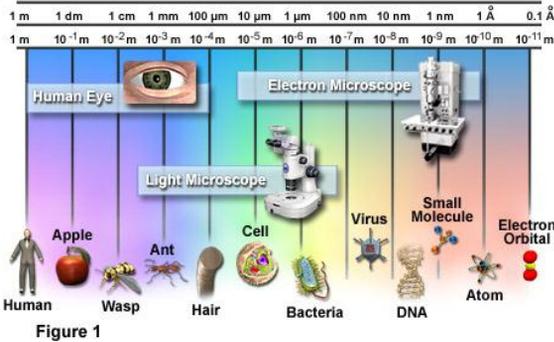


Beyond Light Microscopes

- Resolution: image crispness
- Magnification: zoom size
- Light microscopes are limited by their resolution.
 - Cannot produce clear images of objects smaller than 0.2µm
- 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

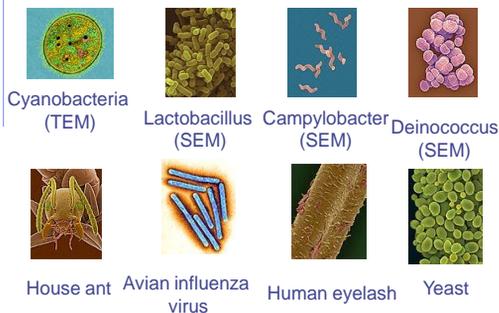


Types of Electron Microscopes

- 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

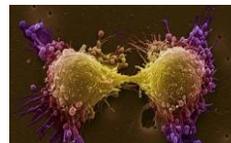
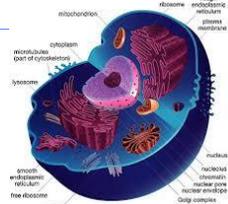


Images Produced by Electron Microscopes

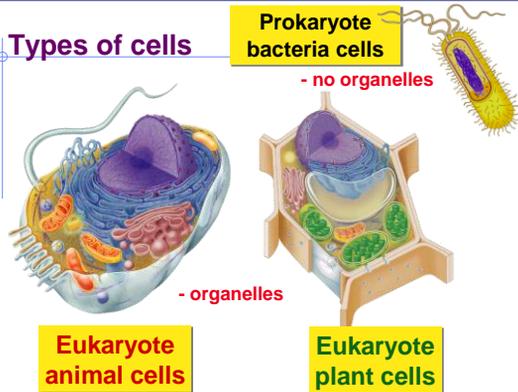


Cell Theory

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



Types of cells



**Prokaryote
bacteria cells**

- no organelles

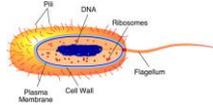
- organelles

**Eukaryote
animal cells**

**Eukaryote
plant 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



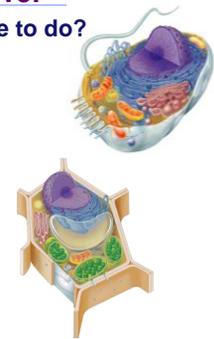
Why organelles?

- **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



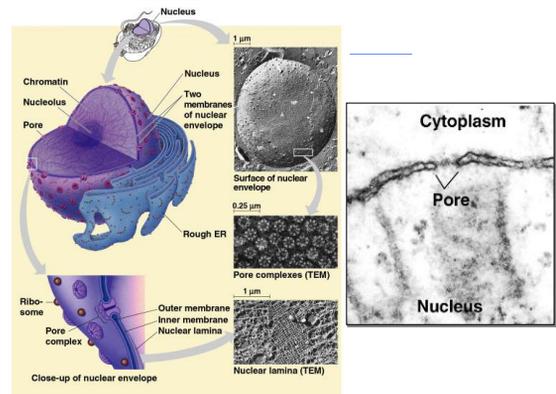
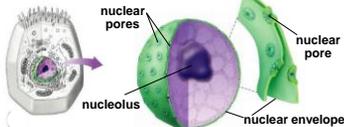
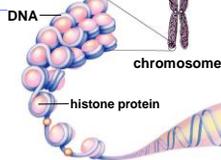
Nucleus

Function

- ♦ protects **DNA**

Structure

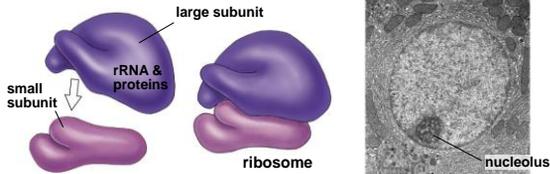
- ♦ **nuclear envelope**
 - double membrane
 - membrane fused in spots to create **pores**
 - ♦ allows large macromolecules to pass through



Nucleolus

Function

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



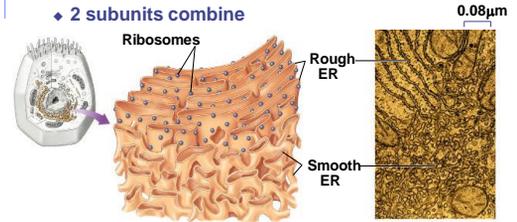
Ribosomes

Function

- ◆ **protein production**

Structure

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



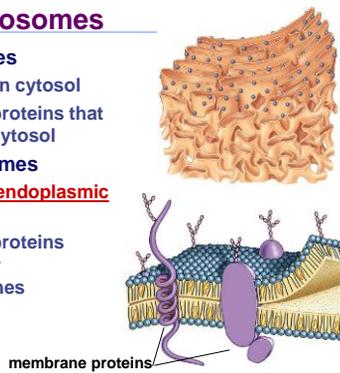
Types of Ribosomes

Free ribosomes

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

Bound ribosomes

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



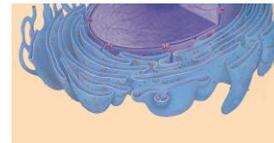
Endoplasmic Reticulum

Function

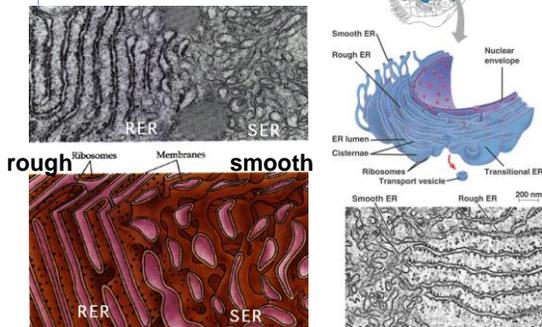
- ◆ **processes proteins**
- ◆ manufactures membranes
- ◆ synthesis & hydrolysis of many compounds

Structure

- ◆ membrane connected to nuclear envelope & extends throughout cell



Types of ER

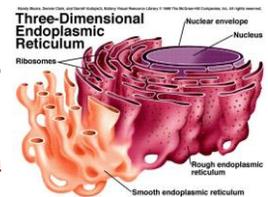


Smooth ER function

Membrane production

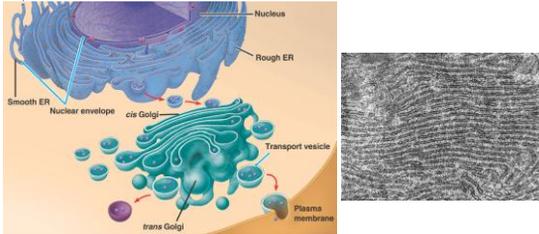
Many metabolic processes

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



Rough ER function

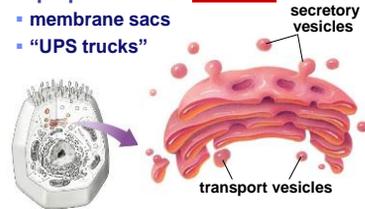
- Produce proteins for export out of cell
 - protein **secreting** cells
 - packaged into **transport vesicles** for export



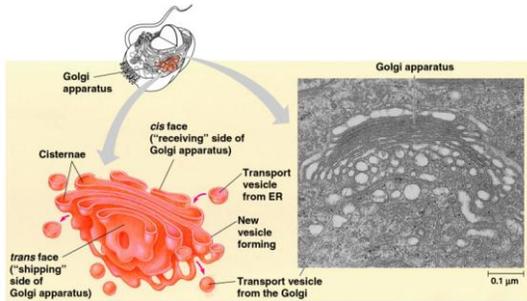
Golgi Apparatus



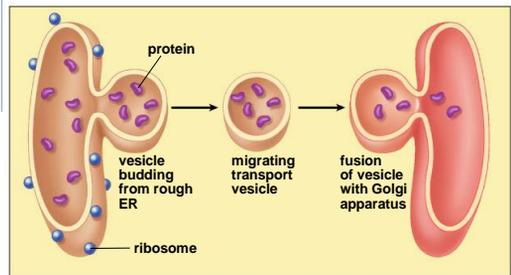
- Function
 - finishes, sorts, tags & ships cell products
 - like "UPS shipping department"
 - ships products in **vesicles**
 - membrane sacs
 - "UPS trucks"



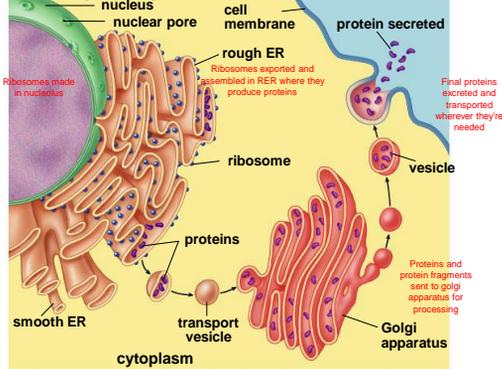
Golgi Apparatus



Vesicle transport



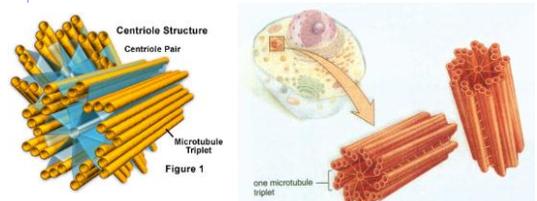
Putting it together... Making proteins



Centrioles



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



Lysosomes

Function

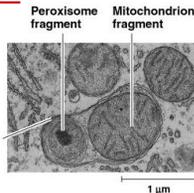
- ◆ **little “stomach” of the cell**
 - digests macromolecules
- ◆ **“clean up crew” of the cell**
 - cleans up broken down organelles

Structure

- ◆ vesicles of digestive enzymes

synthesized by rER, transferred to Golgi

only in animal cells



(b) A lysosome in action

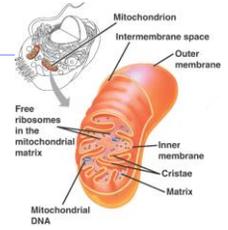
Mitochondria

Function

- ◆ **cellular respiration**

Structure

- ◆ 2 membranes
 - smooth outer membrane
 - highly folded inner membrane
 - ◆ **cristae**
- ◆ 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

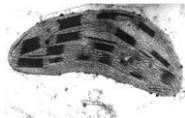
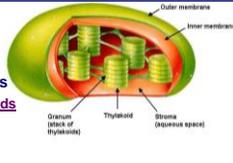
- ◆ class of plant structures = **plastids**
 - **chloroplasts**
 - store chlorophyll & function in photosynthesis

Structure

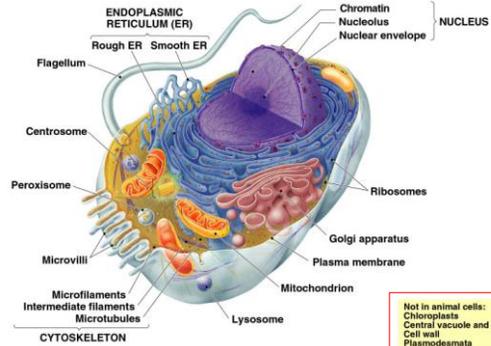
- ◆ 2 membranes
- ◆ **stroma** = internal fluid-filled space
 - DNA, ribosomes & enzymes
 - **thylakoids** = membranous sacs where ATP is made
 - **grana** = stacks of thylakoids

Why internal sac membranes?

increase surface area for membrane-bound enzymes that synthesize ATP

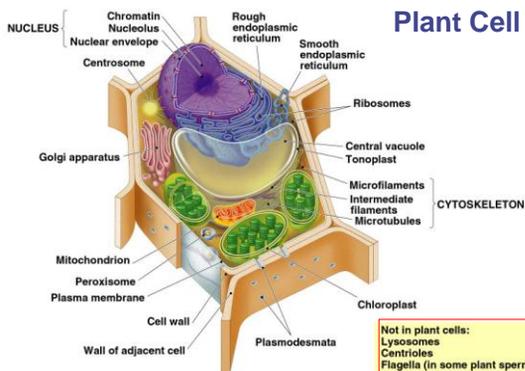


Animal Cell



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?

