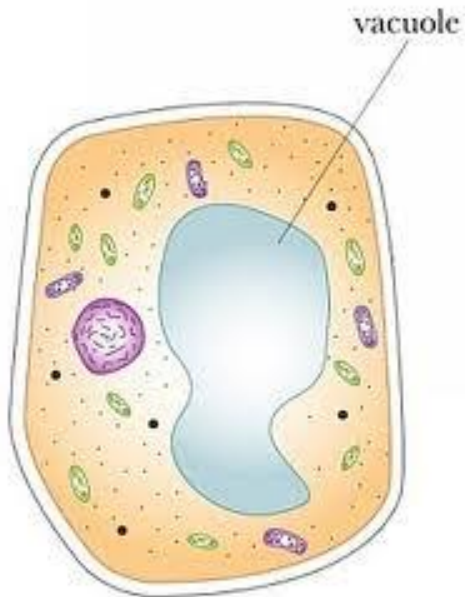
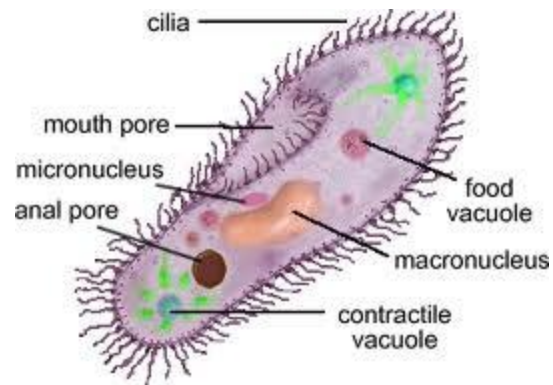


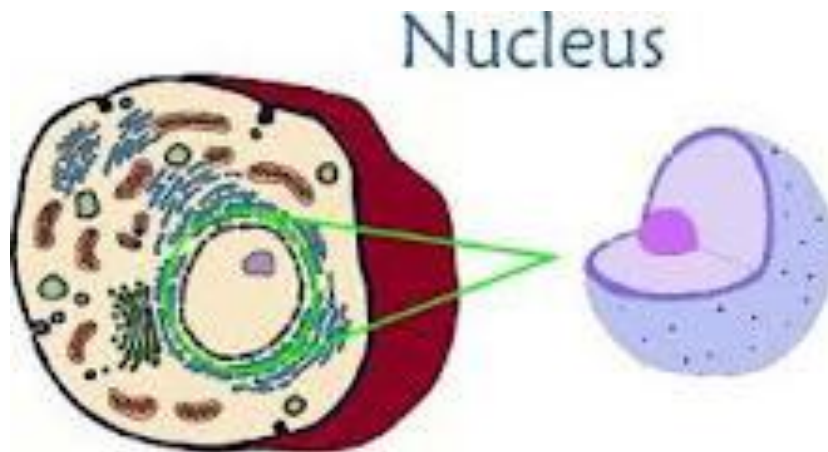
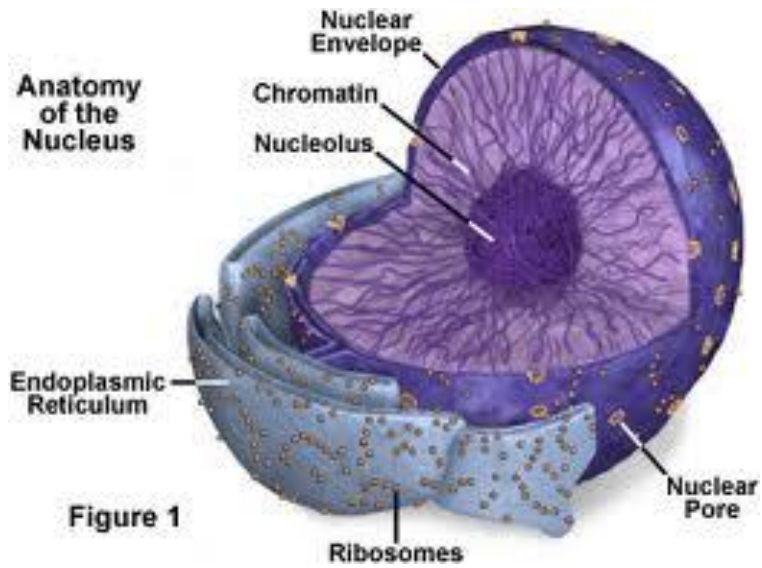
Vacuoles and vesicles

- Membranous organelles . Vacuoles are larger membrane enclosed structures while vesicles are smaller ones.
- In plants there is one large vacuole filled with water located centrally
- In protozoa (living in fresh water) there are many contractile vacuoles that can forcefully expel excess water accumulated in their cytoplasm
- Animal cell has many vacuoles and vesicles in their cytoplasm



Nuclear membrane

- This membrane separates DNA from the cytoplasm so that they maintain different chemical properties
- The membrane is also double layered with large openings in it called nuclear pores complexes
- These complexes are made of proteins to allow large molecules like RNA to pass through membrane
- Thousands of molecules move in and out through these pores each second



Interconversion of membranes

- All the membranes bounding organelles in the cell are made of 2 layers of phospholipid with associated proteins and other molecules
- Plasma membrane is continuous with ER, as the cell becomes larger, some of the ER moves to the surface to become plasma membrane. Membranous organelles can be converted from one form to another
- The entire set of membrane material is in a constant state of flux.

Mitochondria and chloroplast

- Associated with energy conversion reaction in cell

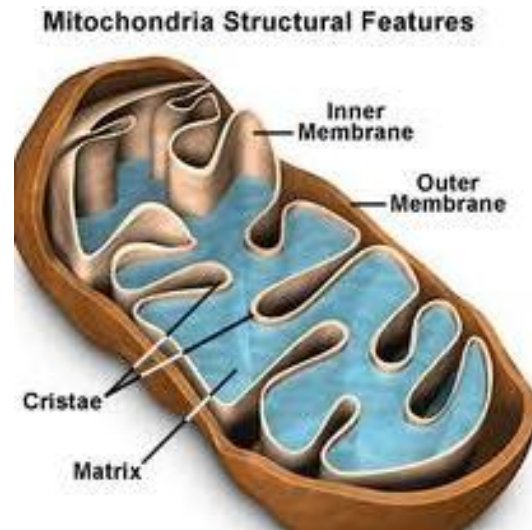
Both are different from other membranous organelles since:

1. Their membrane is chemically different than that of other membranous organelles
2. Have double layers of membranes
3. Both have DNA and ribosomes similar to the bacteria
4. Have certain degree of independence from the rest of the cell. They have ability (limited) to reproduce themselves but must depend on DNA from cell nucleus

Mitochondria

- Contains enzymes responsible for aerobic cellular respiration
- Consists of outer and inner folded membrane
- The inner folds are called cristae
- Aerobic cellular respiration: enzyme controlled reactions involved in the release of energy from food and requires oxygen
- Some of these enzymes are dissolved in the mitochondrial fluid and use DNA of mitochondria, while others are membranous and arranged in orderly sequence

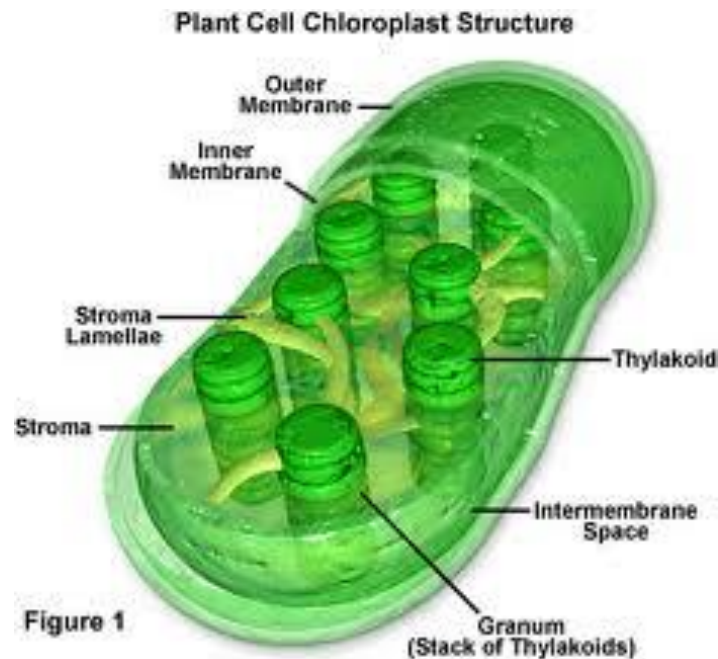
- Cells that require high amount of energy has many mitochondria ex: muscle cell
- Number of mitochondria varies from 10 to over 1000
- If it is functioning it swells. If not; it shrinks



Chloroplast

- Membranous saclike organelle that is responsible for the process of photosynthesis
- Contain green pigments called **chlorophyll** that are found in plant cells and other eukaryotic organisms that carry out photosynthesis
- Some cells have 1 large chloroplast, while others contain many small ones
- Photosynthesis is the metabolic process in which light is converted to chemical bond energy

- Thylakoid membranes: areas of concentrated chlorophyll and are stacked up to form grana of the chloroplast
- Stroma is the place between grana with no chlorophyll

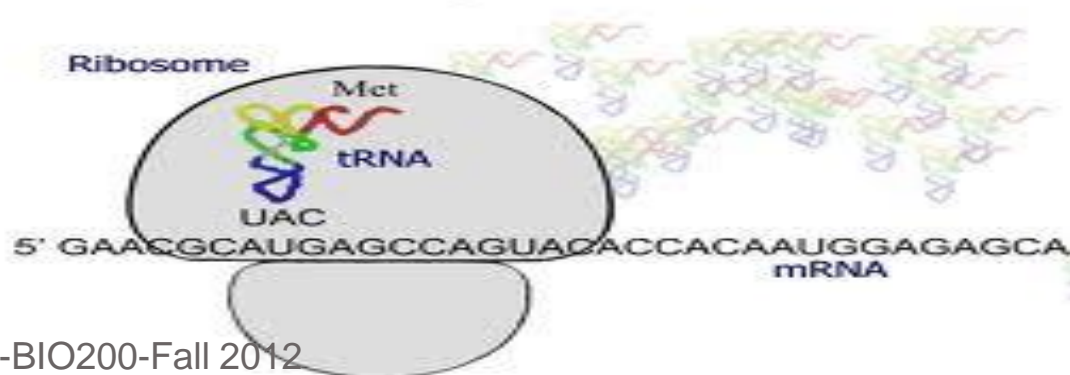


Non-membranous organelles

- Suspended in cytoplasm
- Associated with membranous organelles

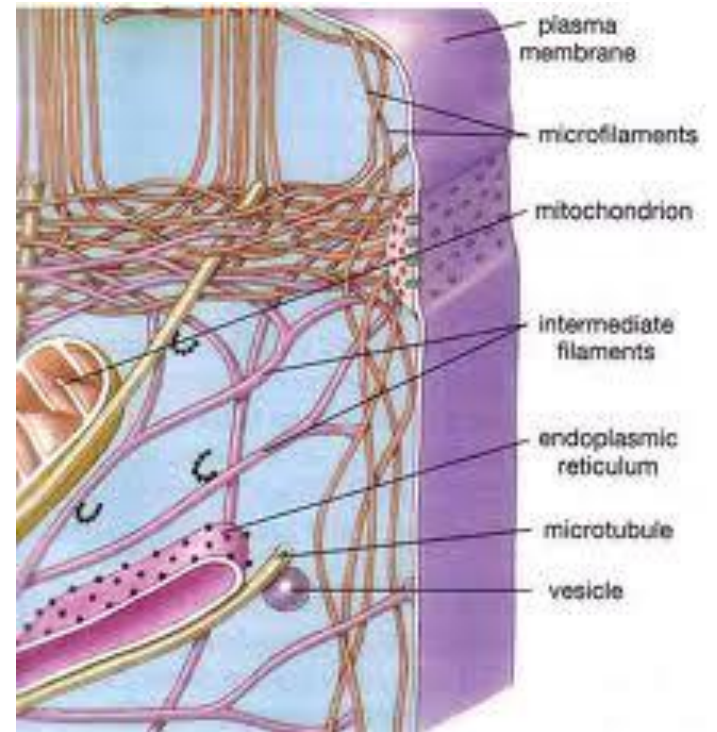
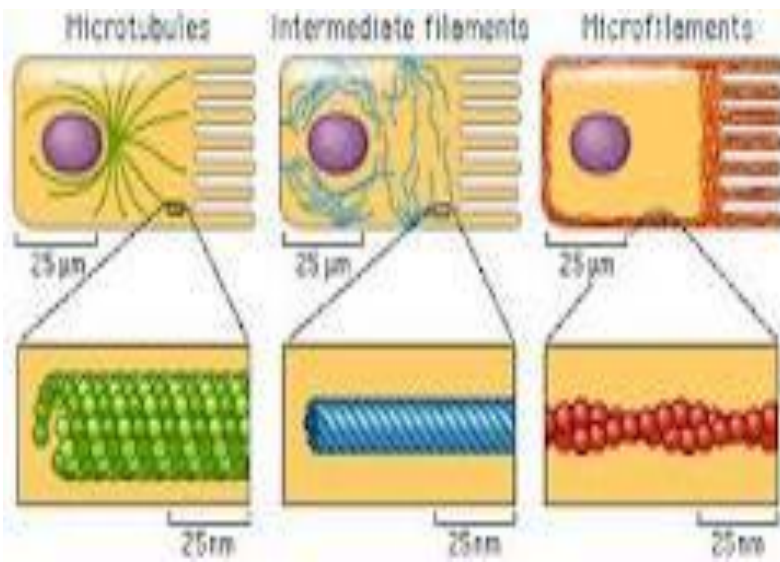
Ribosomes

- Responsible for protein synthesis from amino acids
- Composed of RNA and protein
- Made of 2 subunits: large and small one
- Assist in the joining of amino acids to form protein
- Many are attached to the rough ER since they are active sites for protein production
- Some float free in cytoplasm wherever proteins are being assembled
- Liver cells have highest number of ribosomes since they are active in producing proteins



Microtubules, Microfilaments, and Intermediate filaments

- Elongated protein structures in the cytoplasm
- Interconnect and some are attached to the plasma membrane forming the cytoskeleton of the cell
- Provide the cell with shape, support, and ability to move
- Are important in cell division for the movement of chromosomes that contain DNA
- Transport organelles from one part of the cell to another



Centrioles

- Arrangement of 2 microtubules sets at right angles to each other.
- Each set of microtubules is composed of 9 groups of short microtubules arranged in cylinder
- Centrioles of many cells are located in region called centrosome located close to the nuclear membrane

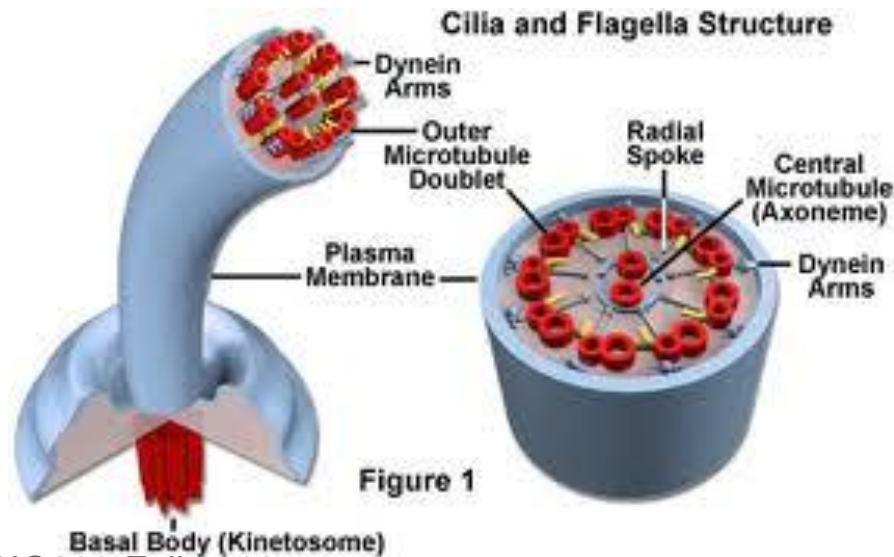


- During cell division, centrioles are responsible for organizing microtubules into complex of fibers called spindle
- Individual microtubules of spindle are called spindle fibers
- Spindle is structure to which chromosomes are attached, so that they can be separated properly during cell division
- Centrioles are found in animal cell and not in plant cell

Cilia and Flagella

- Microscopic hair-like structures projecting from cell surface
- Composed of microtubules covered by plasma membrane
- Flagella are long, few, and move with undulating whiplike motion
- Cilia are short, numerous, and move back and forth
- Both function to move the cell through the environment

- Both cilia and flagella are constructed of a cylinder of 9 sets of microtubules similar to those in centriole, but have they have additional 2 microtubules in the center. This arrangement is referred to as **9+2** arrangement.



Inclusions

- Collection of materials with no defined structure
- Could be concentration of stored materials. Ex: starch grains, oil droplets or could be granules
- They are temporarily sites for storage of nutrients and wastes
- Certain bacteria store in their inclusions crystals of a substance known to be harmful to insects

Nuclear components

- One of the first structures identified in the cells. Cell can not live without nucleus
- Red blood cells are made in the bone marrow with nucleus; before they are released in the blood stream to carry oxygen and carbon dioxide, they lose their nuclei. So red blood cells function only for 120 days before they disintegrate.
- Nucleus has double layered membrane with pores. Nucleus contains DNA, since it has instructions needed by the cell. Chromatin is composed of large molecules of DNA along with proteins. During cell division, chromatin becomes tightly coiled into short dense structure called chromosome.

- Nucleus also contains nucleoli. Nucleolus is the site of ribosomes manufacture. Specific parts of cell's DNA are involved in the manufacture of ribosomes. Nucleolus is composed of this DNA, specific granules, and fibers used in the manufacture of ribosomes and partially complete ribosomes
- The final component of nucleolus is the **nucleoplasm** which is the liquid matrix of the nucleus. It is made of water, nucleic acids, the molecules used in the construction of ribosomes, and other nuclear material.