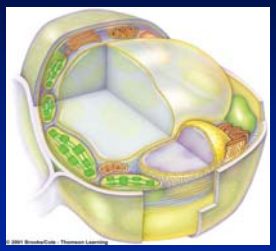
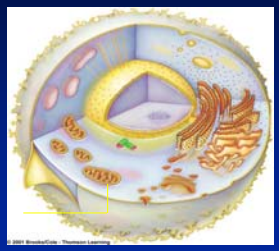
Reminder

- Midterm on Wed.
- No class on Monday
- Office hours after class in 5117 VLSB
- All lectures are now posted on Rachel's Paperless Handouts page on the Bio 11 website

Cell Composition





Early Cell Discoveries

- Early 1600s – Galileo Galilei used two lenses and a tube to examine insect eyes.
- Mid 1600s - Robert Hooke observed and described cells in bark.
- Late 1600s - Antony van Leeuwenhoek observed sperm, microorganisms.
- 1820s - Robert Brown observed and named nucleus in plant cells.

Cell Theory

1. All organisms are made of cells.
2. The cell is the smallest unit of life.
3. All cells are derived from pre-existing cells.

Types of Cells

There are two kinds of cells:

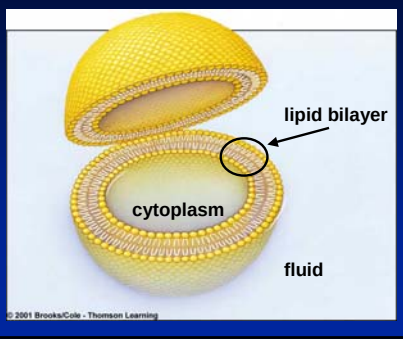
1. Prokaryotic (bacteria)
2. Eukaryotic (everything else)

Eukaryotic cells have organelles.

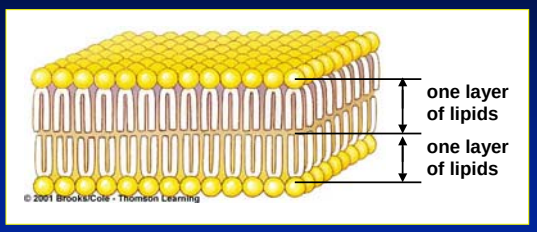
General Cell Structures

- Plasma Membrane
- Region where DNA is stored (Nucleus – eukaryotes)
- Cytoplasm

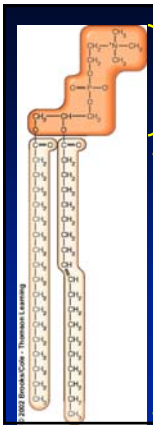
Plasma Membrane



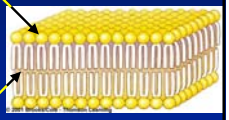
Plasma Membrane – lipid bilayer



Plasma Membrane phospholipid



Hydrophillic
Phosphate head
"polar"

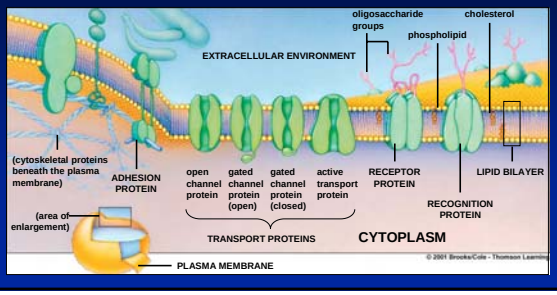


Hydrophobic
Fatty acid
tail
"nonpolar"

Fluid Mosaic Model of Cell Membranes

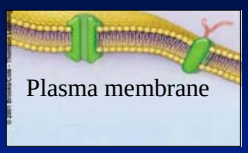
1. Cell membrane has a fluid quality.
2. Fluid bathes outer and inner surfaces.
3. Cytoplasm fills inside of cell (jelly-like, 80% water)
4. Membrane has mixed composition of lipids, sterols, and proteins
5. Constituents can drift within the cell membrane.

Plasma Membrane Fluid mosaic model



Cell Membrane Proteins

1. Transport proteins.
2. Receptor proteins.
3. Recognition proteins.
4. Adhesion proteins.



These membrane proteins control the flow of substances and signals into and out of the cell, thereby maintaining The cytoplasmic composition and volume.

Fluid Mosaic Model Animation

Nucleus

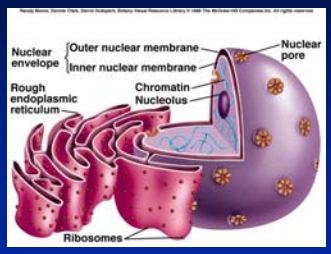
Function:

- Isolate DNA molecules from the metabolic machinery of cytoplasm.
- Maintain controlled environment for DNA functions and replication.

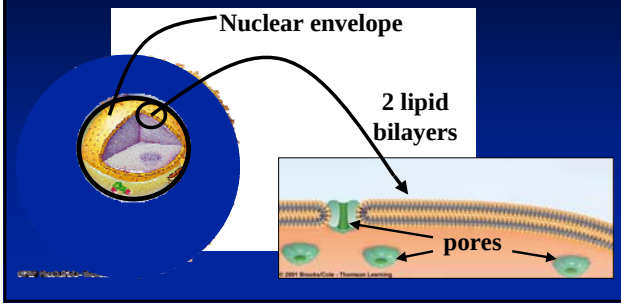
Nucleus

Components:

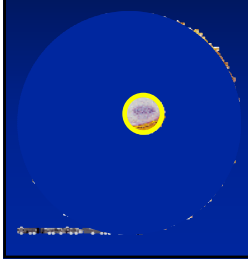
- Nuclear envelope
- Nucleoplasm
- Nucleolus
- Chromosomes
- Chromatin



Nuclear Envelope



Nucleolus



- Dense mass of material in nucleus
- May be one or more
- Cluster of DNA and proteins
- Materials from which ribosomal subunits are built

Chromatin v. Chromosome

- Chromatin is the cell's collection of DNA and associated proteins.
- Chromosome is a single DNA molecule and its associated proteins.

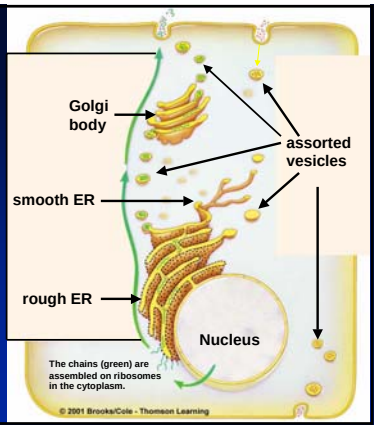
Endomembrane system

Function:

- Assemby of polypeptides on ribosomes.
- Modification of polypeptides into functions proteins.
- Transportation of proteins out of the cell.
- Also invloved in assembly and transportation of lipids.

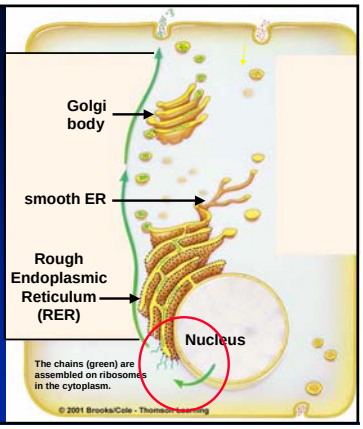
Endomembrane system

- Ribosomes
- Rough Endoplasmic reticulum (ER)
- Smooth ER
- Golgi bodies
- Vescicles



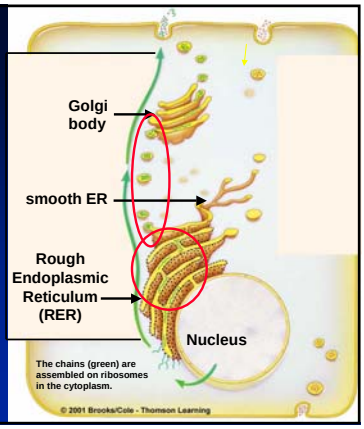
Endomembrane system

1. DNA coding for proteins make mRNA strands, which are transported out of the nucleus and onto ribosomes of the RER.
2. Ribosomes on the RER translate the mRNA code into strings of amino acids to form a polypeptide.



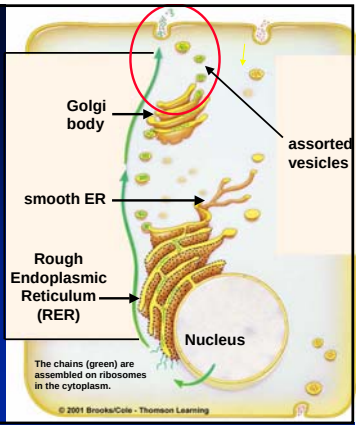
Endomembrane system

3. **Polypeptide chains are modified into functional proteins in the RER.**
4. Some proteins are packaged into vescicles, which transport the proteins to the Golgi body for more processing and preparation for their journey out of the cell.



Endomembrane system

5. The Golgi body releases the prepared proteins and lipids in vescicles, which fuse with the cell plasma membrane and releases the proteins out of the cell.



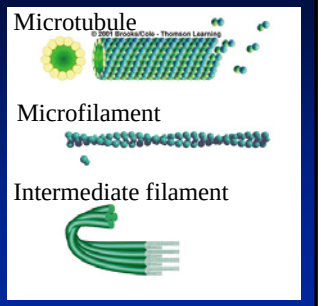
Cytoskeleton

- Interconnected system of protein filaments.
- Present in all eukaryotic cells.
- Basis for cell shape, internal organization and structural support.
- Allows organelle movement within cells, cell division and sometimes cell motility.

Cytoskeleton

3 General types:

- Microtubules – organize cell interior and move structures around
- Microfilaments – reinforce cell shape or cause it to change.
- Intermediate filaments – strengthen and maintain cell structures.



Eukaryotic cells

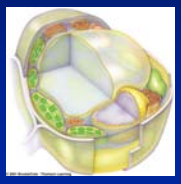
- Have a nucleus and other organelles.
  - Mitochondria
  - Chloroplast
  - Endoplasmic reticulum
  - Golgi body
- Eukaryotic organisms
  - Plants
  - Animals
  - Protistans
  - Fungi

Animal Cell Features

- Plasma membrane
- Nucleus
- Ribosomes
- Endoplasmic reticulum
- Golgi body
- Vesicles
- Mitochondria
- Cytoskeleton

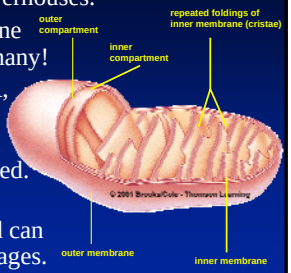
Plant Cell Features

- Plasma membrane
- Nucleus
- Ribosomes
- Endoplasmic reticulum
- Golgi body
- Vesicles
- Mitochondria
- Cytoskeleton
- Cell wall
- Central vacuole
- Chloroplast



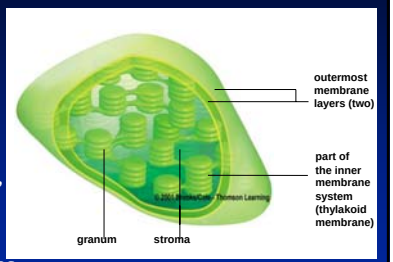
Mitochondria – animals & plants

1. Energy (ATP) producing powerhouses.
2. All eukaryotes have at least one mitochondrion. Some have many!
3. Mitochondria have own DNA, resemble bacteria. May have evolved from ancient bacteria that were engulfed, not digested.
4. Mitochondrial DNA is only inherited from the mother and can be used to trace maternal lineages. Useful in forensics.



Chloroplast - plants

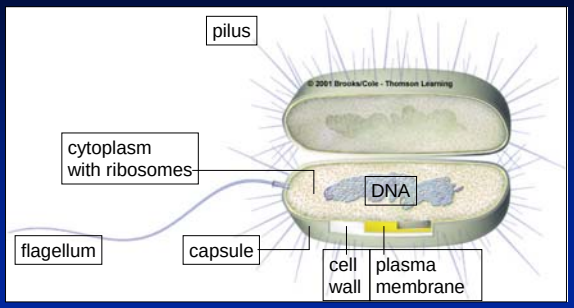
- Convert sunlight energy to ATP through photosynthesis.
- Like mitochondria, chloroplasts have their own DNA, RNA and ribosomes



Prokaryotic Cell Characteristics

1. No nucleus.
2. Most have cell wall.
3. Plasma membrane.
4. Small amount of cytoplasm.
5. Many small, free ribosomes where proteins are assembled.
6. Nucleoid is a region with a circular strand of DNA and is contiguous with the cytoplasm.
7. Flagella often present.
8. Pili (protein projections) help bacteria attach to surfaces

Prokaryotic Structure



Blue-Dog says "Good luck on the midterm!"