**CONCEPT:** EUKARYOTIC CELL ARTCHITECTURE

Main Eukaryotic Features

● Eukaryotic cells are _____ by a few distinct features

□ Eukaryotic cells store DNA in a **nucleus** that is enclosed by a double membrane **nuclear envelope**

- Contains **nuclear pores** which allows for transport in/out of the nucleus

- Contains **nucleoli**, where **ribosome** synthesis occurs

□ Eukaryotic cells have **organelles,** which are membrane bound

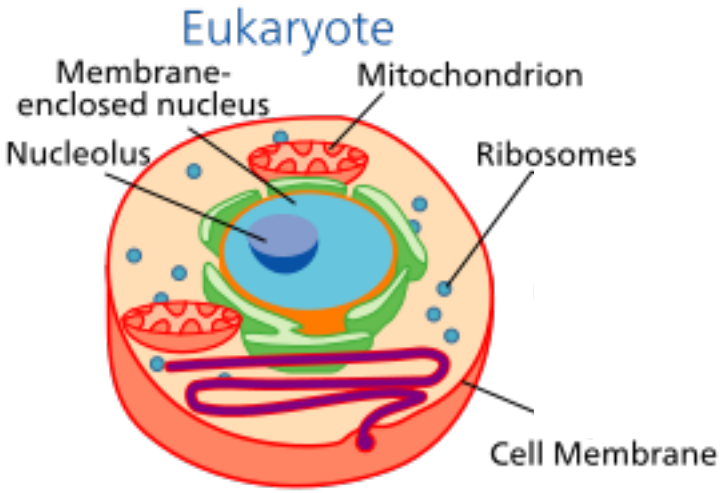
□ These cells **cytoskeletal** structural components which provide support to the cell

□ These cells have a **plasma membrane** to separate the intra and extracellular environment

- Formed by a **lipid bilayer** made of **amphipathic** lipids **(hydrophilic/hydrophobic)**

- Contains **membrane proteins** that allows for interaction between the intra / extracellular environment

**EXAMPLE:** Basic structure of a eukaryotic cell




Eukaryotic Organelles

● Eukaryotic cells contain numerous membrane bound _____, each with a different function

□ **Endoplasmic reticulum:** Proteins are synthesized and exported to other compartments

- Two main types: **Rough** (place of protein synthesis) and **Smooth** (place of lipid synthesis)

□ **Golgi Apparatus:** Place of protein modification, sorting, transport, and secretion

□ **Mitochondria:** Responsible for cellular respiration and production of **ATP**

- Contains own DNA, and ribosomes

□ **Chloroplast:** Location of photosynthesis as well as synthesis of organic molecules (sugars)

- Contains own DNA, and ribosomes

□ **Lysosome:** Responsible for intracellular digestion

□ **Peroxisomes:** Provides safe compartment for toxic chemical reactions and products (Hydrogen peroxide)

□ **Vacuoles:** Place for temporary storage

- Plant cells contain a single large vacuole that stores water to maintain **turgor pressure**

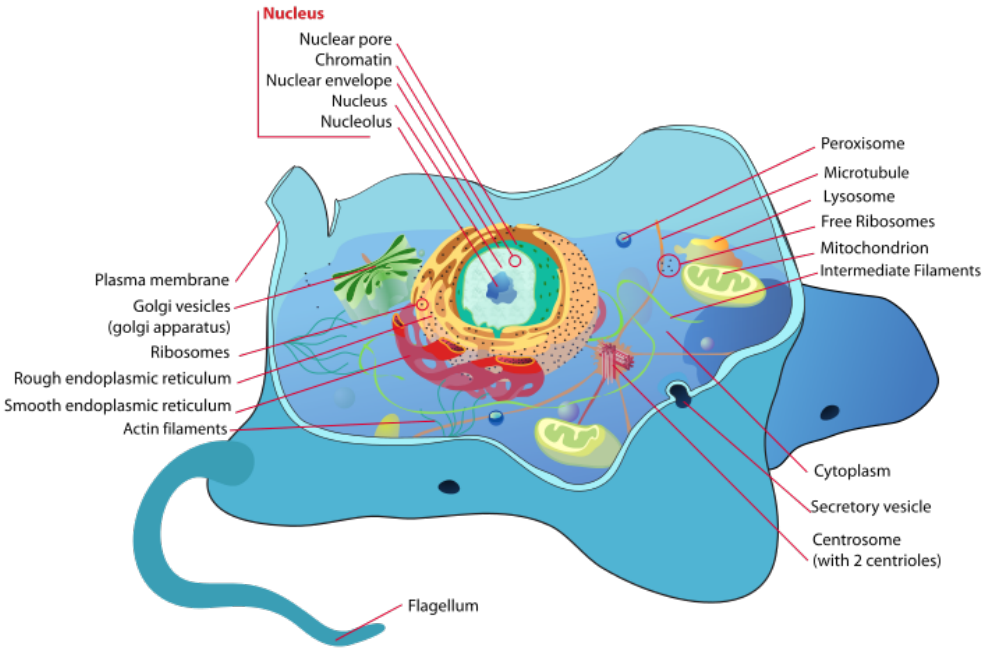
□ **Vesicles:** Transports materials to other cellular locations

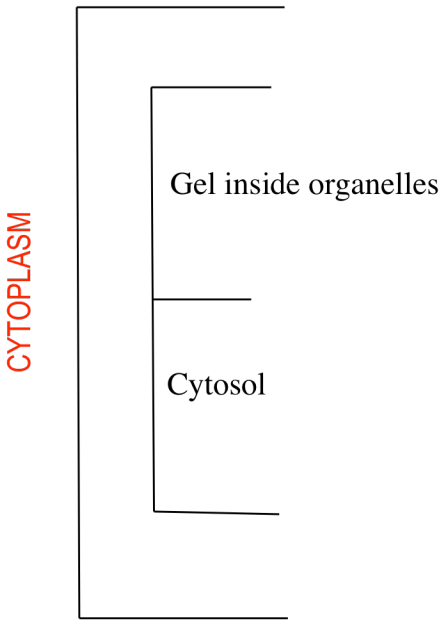
- Have major roles in **endocytosis** and **exocytosis** of materials

□ Cellular organelles are _____ in **cytosol** and are filled and surrounded by **cytoplasm**

- Place of protein/lipid synthesis and other chemical reactions

**EXAMPLE:** Internal structure of a Eukaryotic cell and comparison between cytosol and cytoplasm

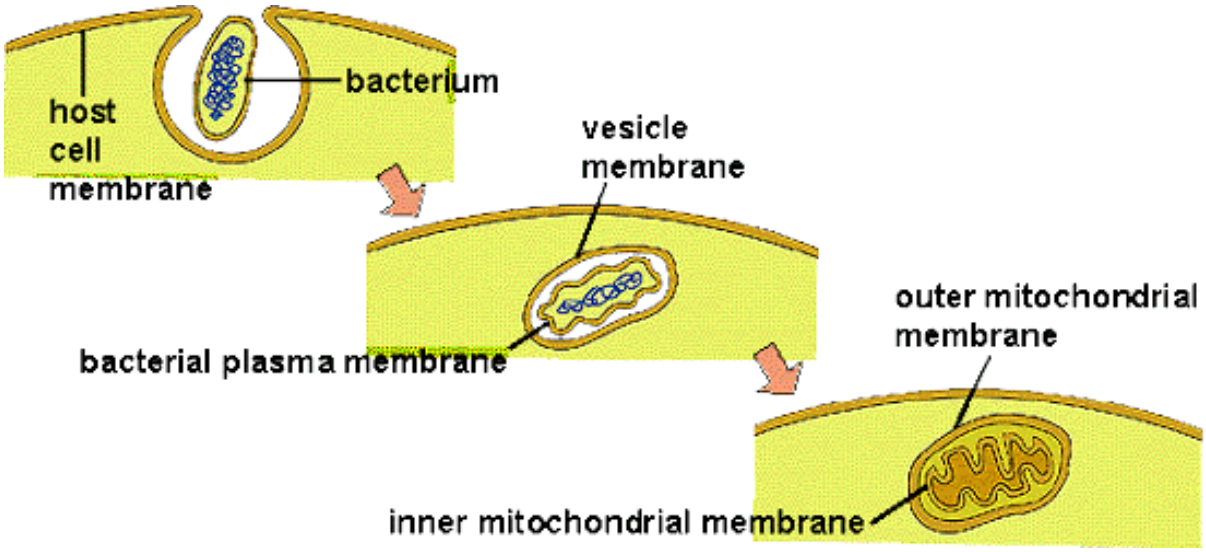


Eukaryotic Origins

- Multiple theories exist about the _____ of Eukaryotic cells
    - □ It is thought that Eukaryotic cells evolved from predatory prokaryotic cells
        - Larger Eukaryotic cell size is due to predation of smaller cells
    - □ **Endosymbiont Theory** explains the presence of mitochondria and chloroplasts
        - They contain their own DNA
    - □ Unknown if Eukaryotic cells came from a Bacteria or Archaea ancestor

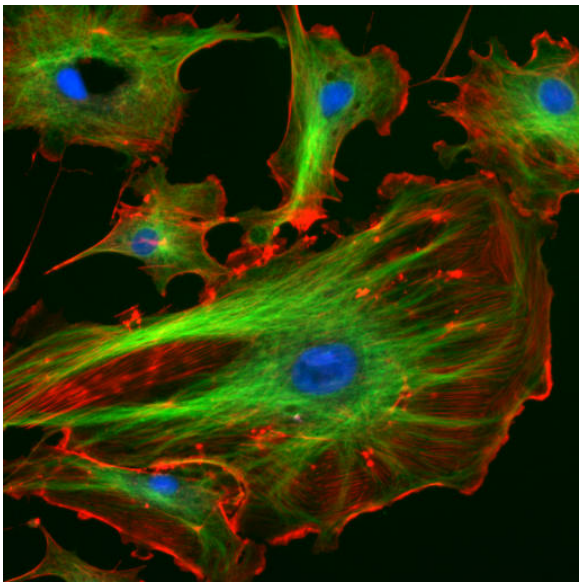
**EXAMPLE:** Representation of the endosymbiont theory explains how mitochondria evolved




Eukaryotic Structural Features

- Eukaryotic cells are supported through a complex _____ system
    - □ **Microtubules:** Hollow cylindrical proteins that are responsible for motility and cell organization/shape
    - □ **Microfilaments** (Actin filaments): Thin, polarized, proteins responsible for muscle contraction
    - □ **Intermediate filaments:** Provide a stable "scaffold" for cell structure.
    - □ These structural components provide the framework for internal transport
        - Motor proteins transport vesicles across the cell
    - □ They also provide the _____ support for cell division

**EXAMPLE:** Cellular staining of cytoskeletal structures. Actin filaments are red, and microtubules are green



Eukaryotic Genetic Features

● Eukaryotic DNA structure and _____ allow for tight control of gene expression and cell division

□ Eukaryotic DNA is formed into linear chromosomes, and packaged by histone proteins

- **Chromatin** is the combination of DNA and **histone** protein

- DNA packaging is necessary due to the size of the eukaryotic **genome**

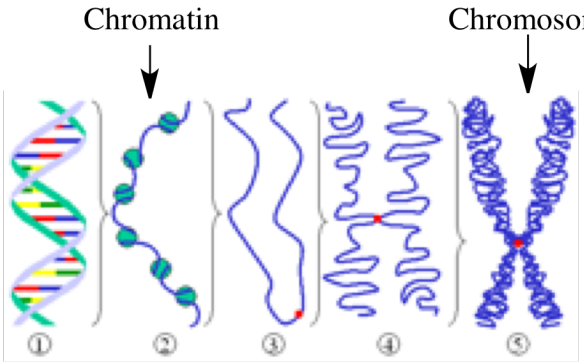
- Large stretches of "junk DNA" of unknown function

□ **Gene expression** is _____ by physically separating location of transcription and translation

- Transcription occurs in nucleus; Translation occurs in cytoplasm

□ Eukaryotic cell division can result in genetically identical cells (**mitosis**) or genetically similar cells (**meiosis)**

**EXAMPLE:** Process of DNA packaging into chromatin (2) and chromosomes (5)



Multicellular Structures

● Eukaryotic cells can form extracellular matrixes and multicellular organisms

□ The **extracellular matrix** attaches cells together and provides _____ structure

- Generally made up of collagen and proteoglycans

- Is flexible, allowing for movement of the cells or organisms

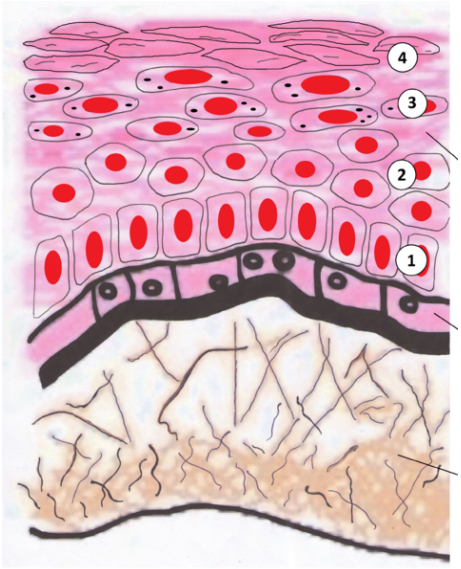
□ Plant cells have cell walls made up of cellulose, which provide support to the cell

- **Plasmodesmata** connect plant cells through cytoplasmic bridges between cell walls

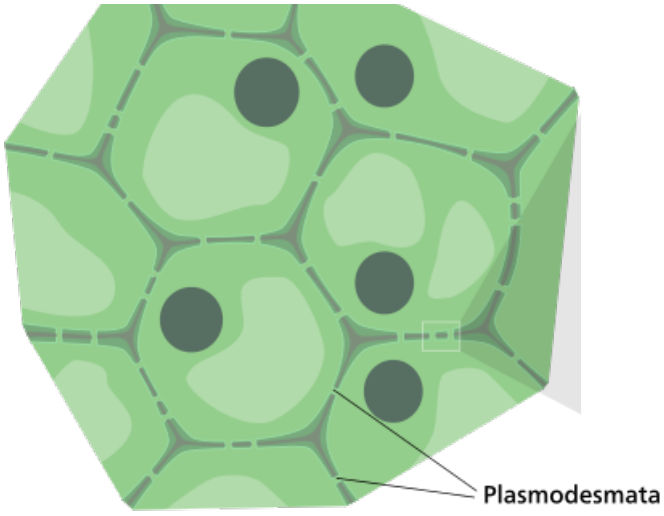
□ Groups of cells eventually evolved to multicellular tissues and organisms, which allowed for cell **differentiation**

**EXAMPLE:** 1. Extracellular matrix extends from the bottom layer of skin cells. 2. Plant cells connected by plasmodesmata

**1.**




**2.**



**PRACTICE:**

1. Which of the following is true about eukaryotic cells?
    a. They all contain a plasma membrane, a cell wall, and divide through mitosis
    b. They all contain a plasma membrane, store their DNA in a nucleus, and have membrane bound organelles
    c. They all contain a plasma membrane, have cytoskeletal elements, and do not contain a nucleus
    d. They all contain a plasma membrane, divide through mitosis, and do not contain a nucleus

2. Which of the following organelles is the place of protein synthesis?
    a. Golgi
    b. Vesicle
    c. Nucleus
    d. Endoplasmic Reticulum

3. Which of the following is not a major structural component of the eukaryotic cell?
    a. Microtubulues
    b. Actin Filaments
    c. Plasmodesmata
    d. Intermediate Filaments

4. The extracellular matrix is important because it does what?
    a. Allows water to flow in and out of the cell
    b. Attaches cells together and provides support for multicellular structures
    c. Connects plant cells through a cytoplasmic bridge
    d. Provides support to the plasma membrane from inside the cell