

Cell theory

Cell theory has three components:

1. Every living organism has at least one cell.
2. The cell is the smallest unit of life
3. Only living cells can give rise to new cells
 - ❖ mitosis or meiosis

A cross-section diagram of an animal cell with the following labels: plasma cell membrane, cytoplasm, nucleus, golgi, mitochondria, and lysosome.

1. Every organism is made of cell(s)

- Prokaryotic cells
 - ❖ Bacteria, Archaea
- Prokaryotic cells
 - ❖ Have NO nucleus
 - ❖ Have no membrane bound organelles

Micrographs and diagrams of prokaryotic cells. On the left, a scanning electron micrograph shows a cluster of rod-shaped bacteria. On the right, a diagram of a prokaryotic cell is labeled with: Cell wall, Capsule, DNA (nucleoid), Plasma membrane, Mesosome, Ribosomes, and Circular Chromosome. A separate diagram shows a bacterium with flagella labeled as Bacterial flagellum.

1. Every organism is made of cell(s)

- Eukaryotic cells contain:
 - ❖ a membrane bound nucleus
 - ❖ DNA that is contained within the nucleus
 - ❖ membrane bound organelles.
- All eukarya (& protists) have one or more eukaryotic cells

A detailed cross-section diagram of a eukaryotic cell with the following labels: Mitochondrion, Golgi apparatus, Lysosome, Chloroplast, Vacuole, Smooth Endoplasmic Reticulum, Rough Endoplasmic Reticulum, Nucleolus, Nuclear Envelope, Nuclear Pore, Nuclear Lamina, Nuclear Matrix, and Nuclear Chromatin.

2. Smallest unit of life

- The cell is the smallest unit that has all the characteristics of life discussed in chapter 1
 - ❖ DNA
 - ❖ Energy utilization
 - ❖ Response to changes
 - ❖ Evolutionary change
 - ❖ Growth and development

3. Only cells can give rise to cells

- Cells are created by cell replication
 - ❖ Mitosis (except germ cells)
 - ❖ Meiosis (germ cells only)

A diagram illustrating the stages of mitosis: Prophase, Metaphase, Anaphase, and Telophase. It shows a parent cell dividing into two daughter cells. The word "Mitosis" is written at the bottom.

4.2 Cell components

- All prokaryotic and eukaryotic cells have these components:

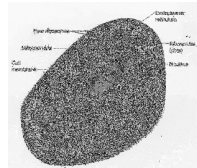
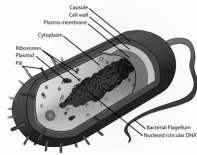
- ❖ Plasma membrane

- Even plant cells have plasma membrane

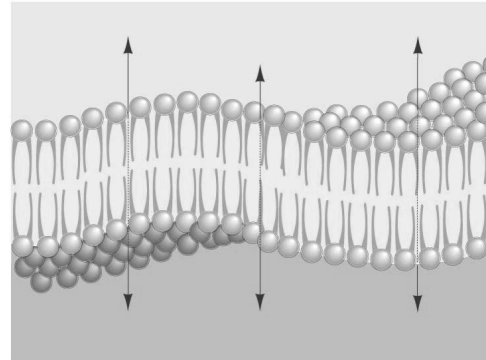
- ❖ Cytoplasm

- ❖ DNA

- ❖ The ability to obtain and utilize energy.



Plasma membrane



Plasma Membrane: Thin barrier separating inside of cell (cytoplasm) from outside environment

Function:

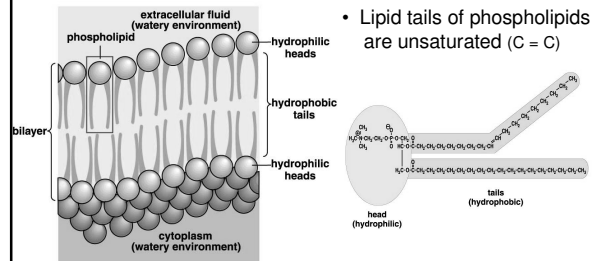
- 1) Isolate cell's contents from outside environment
- 2) Regulate exchange of substances between inside and outside of cell
- 3) Allows communication and interaction with other cells

All prokaryotic and eukaryotic cells have a plasma membrane

Even plant cells (though plants are special)

Phospholipid Bilayer: Double layer of phospholipids

- Hydrophilic ends form outer border
- Hydrophobic tails form inner layer



Cytoplasm

- Cytoplasm

- ❖ All material and structures that lie inside of the plasma membrane, except for the nucleus.

- Cytosol
 - Salts and organic materials
 - Organelles

- Cytosol

- ❖ The fluid component of cytoplasm.

DNA

- Deoxyribose nucleic acid (DNA)

- ❖ Genetic material, aka the hereditary blueprint.

- All living organisms have DNA as their genetic material.

- ❖ Some viruses use RNA, but viruses are currently considered non-living by most scientists.

Energy

- All cells must acquire and utilize energy.
 - ❖ Plant cells acquire energy through sunlight.
 - ❖ Animals cells acquire energy through eating food.

What about bacteria and archaea?

- All cells use the energy from food to break down or create new molecules of life.

What do prokaryotic cells have?

- Prokaryotic cells have:
 - ❖ Small size (usually less than 5 micrometers)
 - ❖ Nucleoid
 - Small space where the DNA is coiled.
- Some prokaryotic cells will have flagella
 - ❖ E. coli bacteria

Ok – eukaryotic cells are more complex.

What do I have know ?

Eukaryotic cells

- Major features:
 - ❖ Cytoskeleton
 - ❖ Membrane bound organelles
 - ❖ Membrane bound nucleus

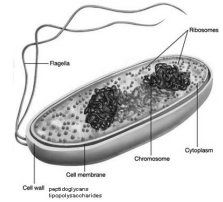
Cytoskeleton

Organelles

Nucleus

Nucleoid vs nucleus

- Nucleus is membrane bound, the nucleoid is not.
- Nucleoids are found in prokaryotic cells only.
- The membrane bound nucleus is found in eukaryotic cells only.



Cells are really small

- Cells are very small due to surface to volume ratios
- Large cells will have a greater volume
 - ❖ Greater nutrient and waste elimination needs.
 - ❖ This requires a GREATER surface area.