

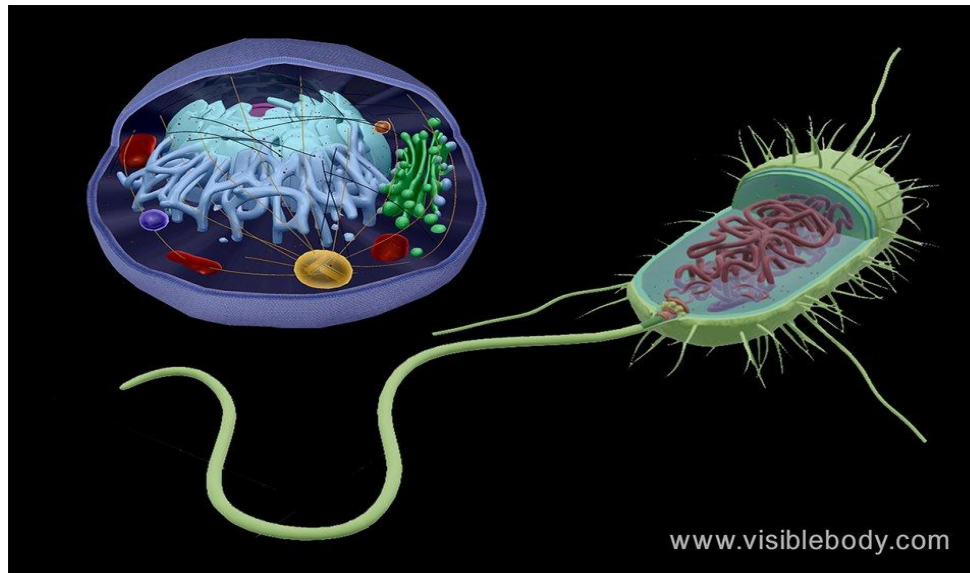
# Eukaryotic and Prokaryotic Cells



**Dr. Shler Ghafour Raheem**

BSc., MSc., PhD Medical Microbiology

shler.ghafour@tis.edu.iq



**Lecture No. 2**

# Objectives

- Cell and cell theory
- Comparison between prokaryote and Eukaryote
- Prokaryotic Communities: Quorum sensing
- Distinguishing Characteristics of Viruses, Viroids, and Prions

# What is a cell?

A cell is the smallest unit of life.

## The cell theory states:

- All living things are made of Cells.
- Cells are the basic units of structure and function in all living things.
- New cells are only made from existing cells.

# There are 2 kinds of cells:

□ **Eukaryotes:** Have a nucleus

- Examples of eukaryotes are **plants, animals, fungus, and protists**
- **More** complicated

□ **Prokaryotes:** Do NOT have a nucleus

- Examples of prokaryotes are **bacteria**
- **Smaller** than eukaryotes
- **Less** complicated

# Eukaryotic and Prokaryotic Cells

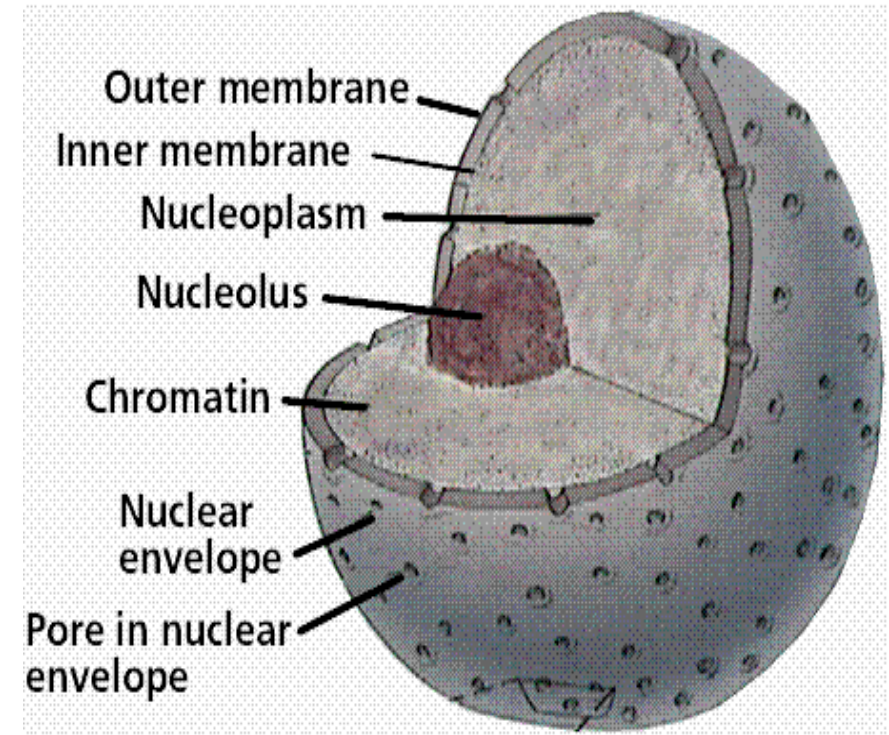
- Among clinically relevant organisms, **bacteria** are single-cell prokaryotic microorganisms.
- **Fungi** and **parasites** are single- cell or multicellular eukaryotic organisms, as are plants and all higher animals.
- **Viruses** are dependent on host cells for survival and therefore are not considered cellular organisms but rather infectious agents.
- **Prions**, which are abnormal infectious proteins, are also not considered living cells

□ A notable characteristic of **eukaryotic cells**, is the presence of membrane-enclosed organelles that have specific cellular functions.

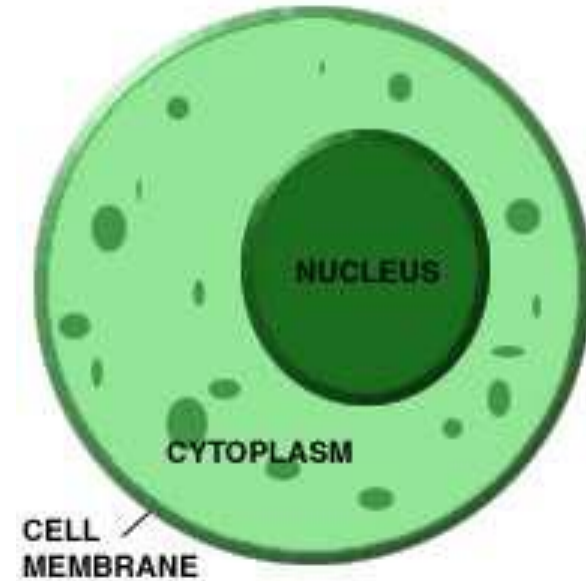
**Examples of these organelles and their respective functions include:**

- **Endoplasmic reticulum:** process and transport proteins
- **Golgi body:** modification of substances and transport throughout the cell, including internal delivery of molecules, and exocytosis or secretion of other molecules
- **Mitochondria**—generate energy (ATP)

- **Lysosomes:** Structure membrane bound sac containing hydrolytic enzymes.
- **Nucleus:** Provide a membrane enclosure for chromosomes. The genetic material (DNA) is stored in the nucleus and holds information a cell needs to reproduce itself.
- **Cytoskeleton:** Provides support for cellular structure, organization, and movement.

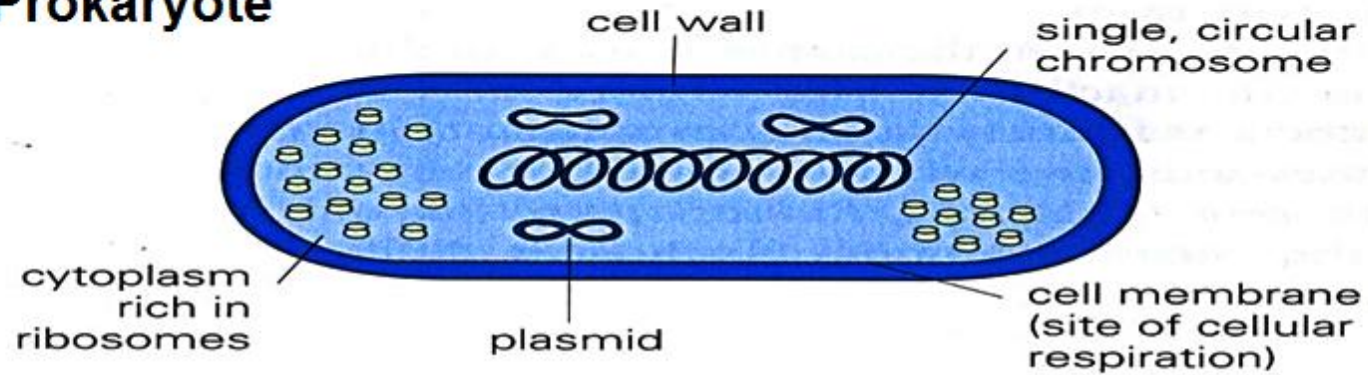


- ❑ Prokaryotic cells, such as **bacteria**, do not contain organelles. All functions take place in the **cytoplasm or cytoplasmic membrane** of the cell.
- ❑ Prokaryotic and eukaryotic cell types differ considerably at the macromolecular level, including **protein synthesis machinery, chromosomal organization, and gene expression.**
- ❑ One notable structure present only in prokaryotic bacterial cells is a cell wall composed of **peptidoglycan**. This structure has an immeasurable effect on the practice of diagnostic bacteriology and the management of bacterial diseases.

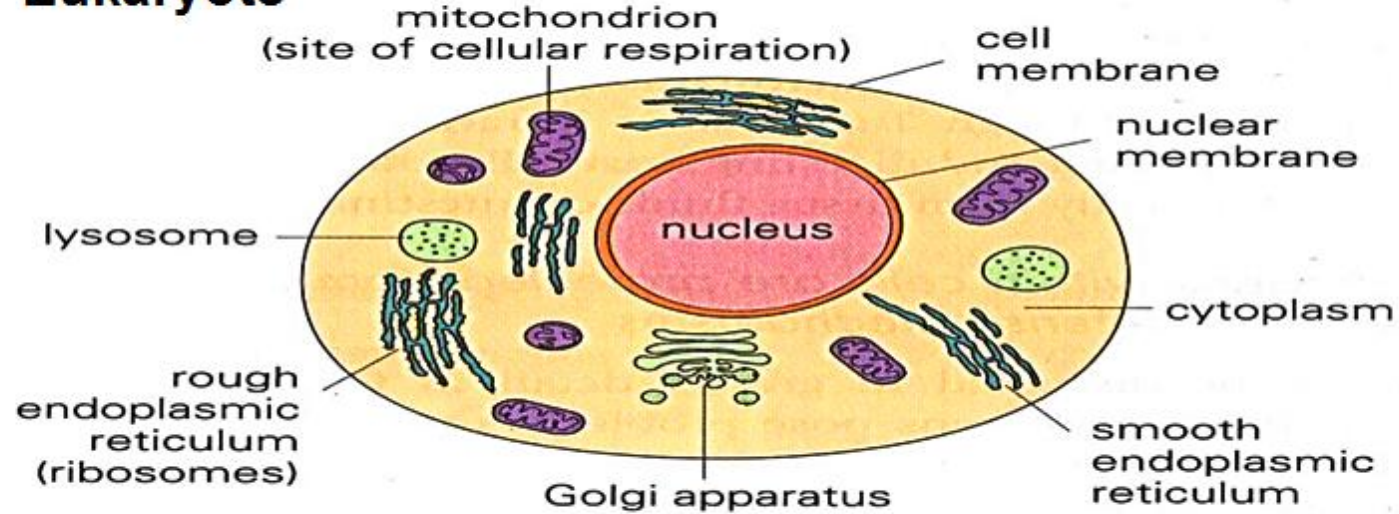




## Prokaryote



## Eukaryote



**Fig. 1.1** Prokaryote and eukaryote cells. The major features of cellular organization are shown diagrammatically.

## Summary of differences between prokaryote and eukaryote cells

<b>Prokaryotic cells</b>	<b>Eukaryote cells</b>
Small cell (< 5µm)	Larger cells (> 10 µm)
Always unicellular	Often multicellular
No nucleus or any membrane bound organelles	Always have nucleus and membranes bound organelles.
DNA circular, without proteins	DNA is linear and associated with proteins to form chromatin.
Ribosomes are small 70S	Ribosomes are large 80S
No cytoskeleton	Always have cytoskeleton
Motility by rigid rotating flagellum made from flagellin	Motility by flexible waving cilia or flagella made from tubulins.
Cell division is by binary fission	Cell division is by meiosis and mitosis.
Reproduction is always asexual	Reproduction is sexual and asexual.

# Prokaryotic Communities: Quorum sensing

- Many bacteria exploit a cell–cell communication mechanism called **quorum sensing** to regulate the transcription of genes involved in diverse physiologic processes, including bioluminescence, plasmid conjugal transfer, and the production of virulence determinants.
- Quorum sensing depends on the production of one or more diffusible signal molecules (eg, acetylated homoserine lactone [AHL]) termed **autoinducers** or **pheromones** that enable a bacterium to monitor its own cell population density.
- The cooperative activities leading to **biofilm** formation are controlled by quorum sensing. It is an example of multicellular behavior in prokaryotes.

## **Question:**

Why viruses are not considered as cells.

- The unique properties of viruses set them apart from living creatures. Although viruses have genetic material (DNA or RNA) they are not cellular, lacking cell membranes, cytoplasm and the machinery for synthesizing macromolecules, depending instead upon host cells for this process.
- Viruses are known to infect a wide variety of plant and animal hosts. However, most viruses are restricted to infecting specific types of cells of only one host species, a property known as “tropism”.
- Further diversity of viruses is exhibited by their broad array of strategies for replication and survival.

# Prions

- Prions are infectious protein particles responsible for a group of transmissible and/or inherited neurodegenerative diseases as a result of prion protein misfolding
- Studies have identified a specific protein in preparations from scrapie infected brains of sheep that can reproduce the symptoms of scrapie in previously uninfected sheep.

# Viroids

Viroids are small, circular, single-stranded molecules of infectious RNA that cause several plant diseases.

# Distinguishing Characteristics of Viruses, Viroids, and Prions

Viruses	Viroids	Prions
Obligate intracellular agents	Obligate intracellular agents	Abnormal form of a cellular protein
Consist of either DNA or RNA surrounded by a protein coat	Consist only of RNA; no protein coat	Consist only of protein; no DNA or RNA

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