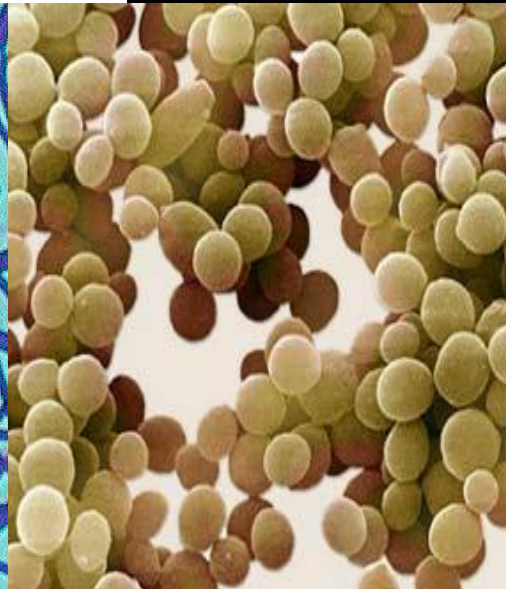
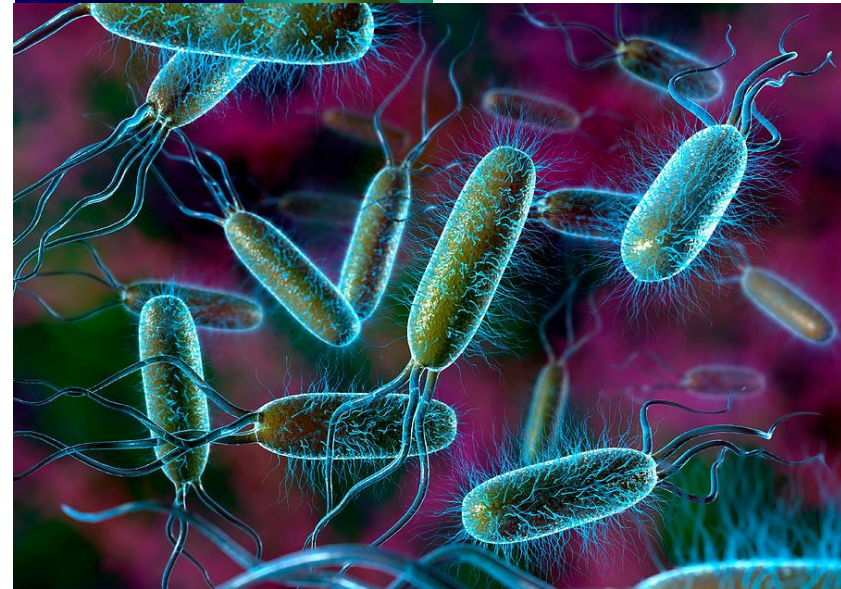




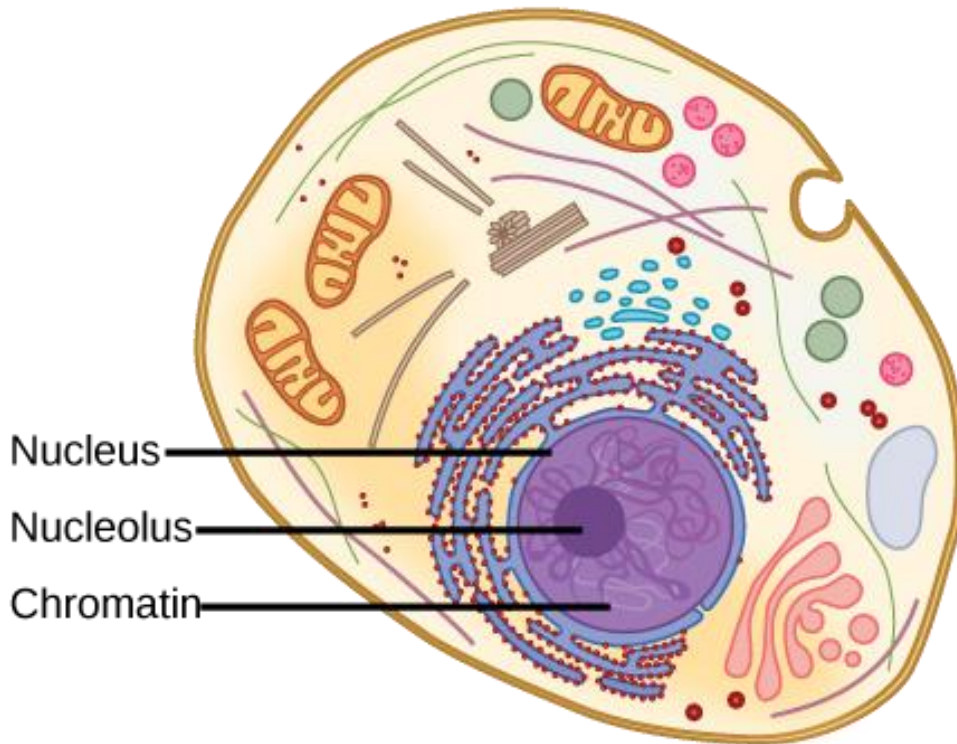
# BACTERIA





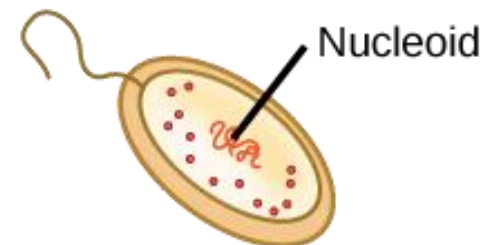
# Basic Cell Types

All cells consist of a **cytoplasm** enclosed within a **membrane**.



Eukaryote - the DNA is **partitioned off** in its own membrane-bound room called the **nucleus**.

Cells are typically categorized by how their genetic material is packaged:



Prokaryote - the DNA within a cell is **not separated from the cytoplasm**.

# Basic Classification of Organisms

1. Organisms can be classified as unicellular (consisting of a single cell; including most *bacteria*) or multicellular (including *animals*, *plants* and most *fungi*).
  2. Organisms can be classified as prokaryotic (made of cells that do not have a distinct *nucleus*) or eukaryotic (made of cells that have *true nucleus* and *organelles*)
- All known **prokaryotes** (*bacteria* and *archaea*) are **single cells**.
  - All **multicellular organisms** are **eukaryotes**.
  - Some eukaryotes, like *amoebae*, are free-living, single-celled entities.
  - All **plants** and **animals** are multicellular eukaryotic organisms.
  - While the number of cells in plants and animals varies from species to species, **humans contain ~100 trillion ( $10^{14}$ ) cells**.
  - The majority of organisms on Earth are prokaryotes...

# What are bacteria?

*Bacteria* (sin. *bacterium*) is the **oldest and most abundant** living organism on earth.



- There are approximately  **$5 \times 10^{30}$  bacteria on Earth.**
- Most bacteria are harmless, but a few are pathogens.
- A **gram of soil** typically contains about **40 million bacterial cells.**
- A **milliliter of fresh water** has about **a million bacterial cells** in it.

**Most bacteria have not been characterized yet...**

# General Characteristics

Bacteria can be **found everywhere**: in air, water, land, and living organisms including people.

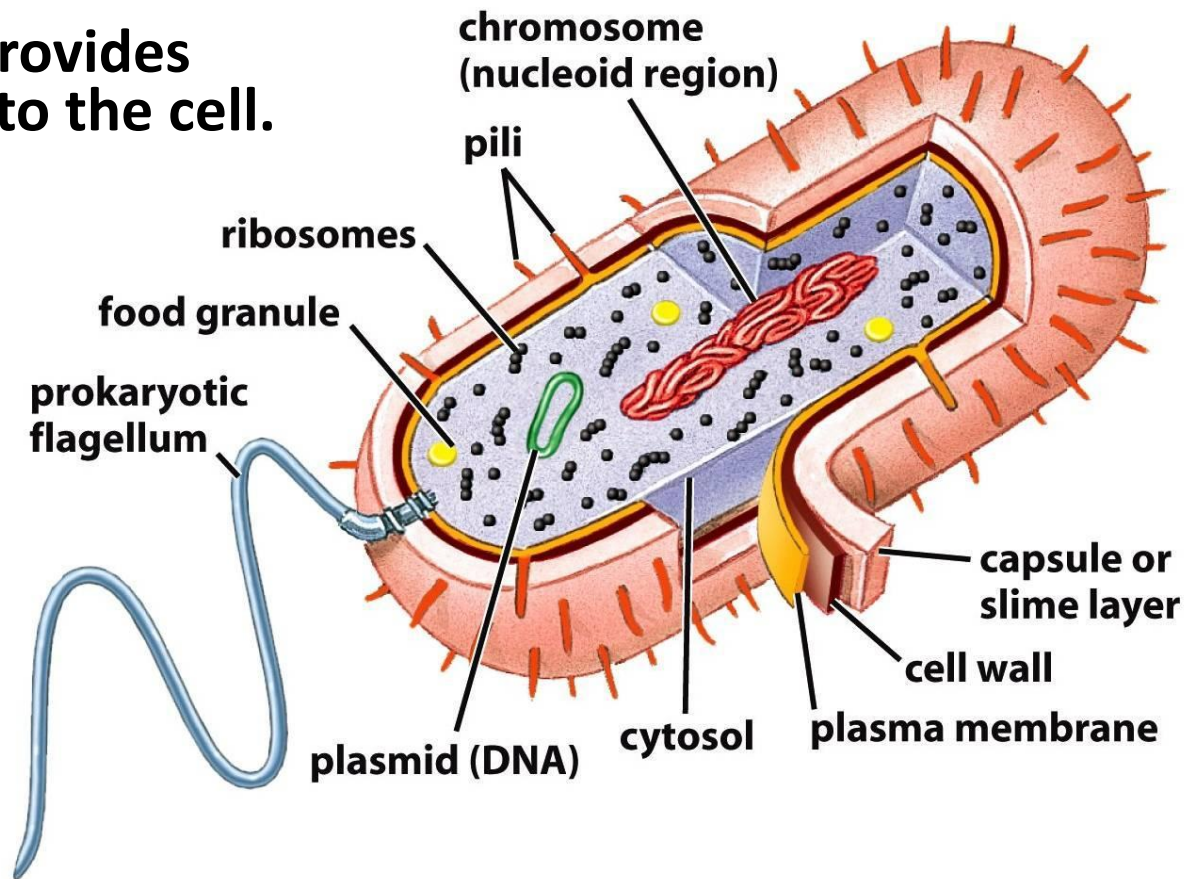
1. All are **unicellular** (one-celled structural level).
2. All are **prokaryotic** (lack nucleus).
3. All have **cell walls** (made of *peptidoglycan* composed of disaccharides and amino acids, but no cellulose).
4. Exceptional **diversity** in size, shape, and *metabolism*.
5. Can live in both **aerobic** (with O<sub>2</sub>) and **anaerobic** (without O<sub>2</sub>) environments.
6. Bacteria **reproduce** (make more of themselves).
7. Bacteria **need food**.

**Billions on and inside  
your body right now!**

# Typical Structure

- Bacterial **cell wall** provides **structural integrity** to the cell.

- **Plasmids** are small **independent** “extra” pieces of **DNA**, often coding for non-essential advantageous traits (can be easily *lost*, *gained* and *transferred* between bacterial cells).



- **Pili** are *protein tubes* that extend out from the outer membrane; used for **attachment to surfaces** and **movement**.
- **Flagella** are whip-like *filament structures* protruding from the bacterial cell wall; responsible for **movement**.