	Prokaryotic	Eukaryotic
Size	Small (0.2–2 µm diameter)	Large (10–100 µm)
Nucleus	Nuclear membrane absent Nucleoli absent	True nucleus consisting of nuclear membrane and nucleoli present
Cell organelles	Membrane Bound Cell Organelles are absent.	Present
Flagella	Simple	Complex microtubules show (9+2) array
Cell wall	Usually present, chemically complex (typical bacterial cell wall is made up of Peptidoglycan)	Present in plant cells. But absent in human and protozoan cells
Plasma Membrane	No carbohydrate and generally lacks sterols High proportion of protein is present	Carbohydrate & sterols are Present comparatively less proportion of protein.
Cytoplasm	Cytoskeleton Absent	Cytoskeleton present
Ribosome	70 S ribosome present	80S ribosome present in the cytoplasm, 70S present in mitochondria and chloroplasts.
Chromosome	Single circular DNA, histone proteins absent	Multiple linear chromosomes with histones proteins
Cell Division	Binary fission (Amitosis)	Mitosis
Reproduction	Meiosis absent	Meiosis present
Example	Bacteria	Algae, fungi, protozoa, plants and animals

Prokaryotic Cells

- Prokaryotic cells multiply rapidly and vary in size and are represented by Bacteria, Blue-green algae, Mycoplasma (0.3 micron) (Smallest Cell) and PPLO (0.1 micron) (Smallest Cell).
- Bacterial cells may be Bacillus (rod-shaped), Coccus (spherical), Vibrio (comma- shaped) and Spirillum (spiral).
- All prokaryotic cells have cell wall except in Mycoplasma.
- Nuclear membrane absent, Genetic material is naked.
- In addition to genomic DNA (Single chromosome/circular DNA) the bacteria have plasmid/ circular DNA (provides resistance to antibiotics & to monitor bacterial transformation with foreign DNA).

A specialized differentiated cell membrane formed by extension of plasma membrane into the cell is called Mesosome.

- Cell envelope act as protective unit consist of three layers. The outermost is Glycocalyx, middle one cell wall and innermost is the cell membrane.
- **Glycocalyax** may be as loose sheath in some bacteria called slime layer. In some other bacteria, Glycocalyx may be thick and tough called capsule.
- **Cell Wall**- determine shape, and prevent from bursting. Made up of Peptidoglycans (polysaccharides & amino Acids)

Gram Positive vs. Gram Negative Bacteria

Gram staining is a widely used technique in microbiology to differentiate bacteria based on the structure of their cell walls. The primary difference between Gram-positive and Gram-negative bacteria lies in the thickness and composition of their cell walls.

Gram-Positive Bacteria

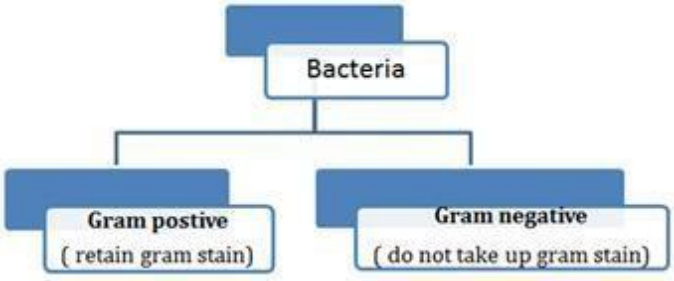
- **Cell Wall:** Gram-positive bacteria have a thick cell wall composed primarily of peptidoglycan.
- **Gram Stain:** These bacteria retain the crystal violet stain during the Gram staining process

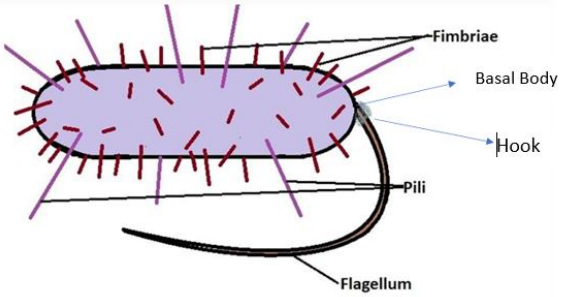
and appear purple under a microscope.

- **Examples:** Staphylococcus aureus, Streptococcus pneumoniae, Bacillus subtilis.

Gram-Negative Bacteria

- **Cell Wall:** Gram-negative bacteria have a thinner cell wall consisting of a few layers of peptidoglycan surrounded by an outer membrane.
- **Gram Stain:** These bacteria lose the crystal violet stain during the decolorization step of the Gram staining process and are counterstained with safranin, appearing pink or red under a microscope.
- **Examples:** Escherichia coli, Salmonella enterica, Pseudomonas aeruginosa.





Plasma membrane is semi-permeable having mesosome in the form of vesicles,tubules, and lamellae. They help in cell wall formation, DNA replication and distribution to daughter cells.

- **Pili** and **fimbriae** are the other surface structures that help the bacteria to attach with host and other substances.
- **Chromatophores –** Membranous structure containing pigment ex: Cyanobacteria.
- In prokaryotes, ribosome are attached with cell membrane having two sub-units – 50S and 30S to form together 70S prokaryotic ribosomes.

Ribosomes – 15nm-20nm in size. Site of protein synthesis. Made up of two sub units 50S and 30S together forms 70S.
Ribosomes attached with single mRNA to form a chain are called **polyribosomes**.

Inclusion Body: Reserved materials in prokaryotic cells are present in cytoplasm which may contain phosphate, granules, glycogen granules etc.

Motile bacterial cell contains **flagella**, which is composed of filament, hook andbasal body.

Gas vacuoles are found in blue-green algae and purple and green photosynthetic bacteria