

L-2\ BIOLOGY 1<sup>ST</sup> stage

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**PROKARYOTIC CELL**

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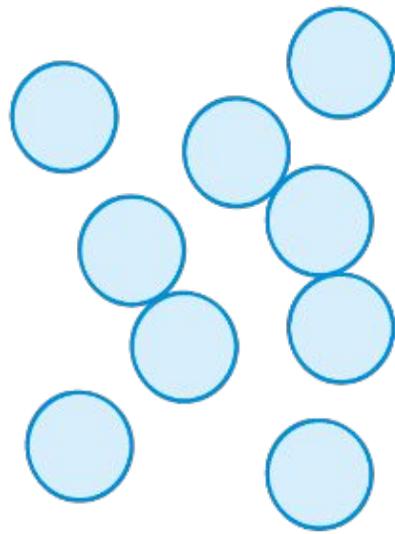
## Definition

- ▶ **“Prokaryotic cells are the cells that do not have a true nucleus and membrane-bound organelles.”**

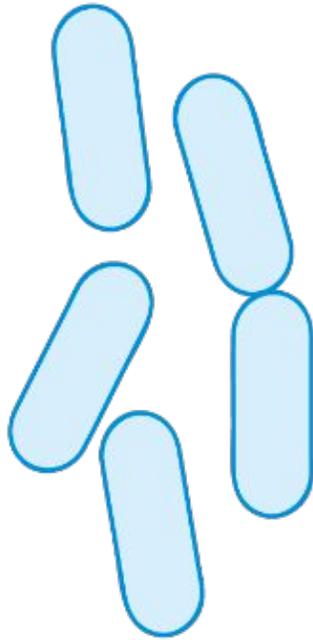
# ?What is a Prokaryotic Cell

- ▶ Prokaryotic cells are single-celled microorganisms known to be the earliest on earth. Prokaryotes include Bacteria and Archaea. The photosynthetic prokaryotes include cyanobacteria that perform photosynthesis.
- ▶ A prokaryotic cell consists of a single membrane and therefore, all the reactions occur within the cytoplasm. They can be free-living or parasites.

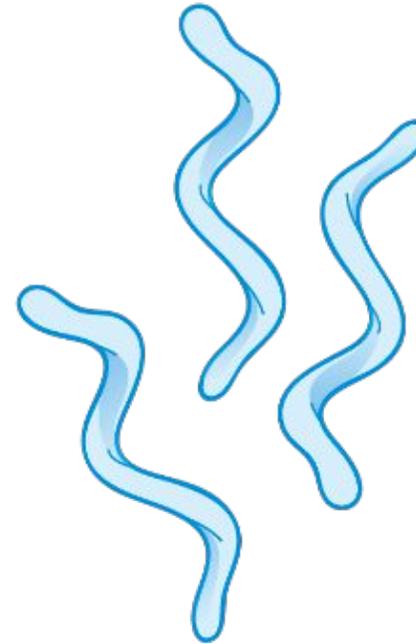
Prokaryotic cells are typically shaped as either spheres (called cocci), rods (called bacilli), or spirals.



Spheres



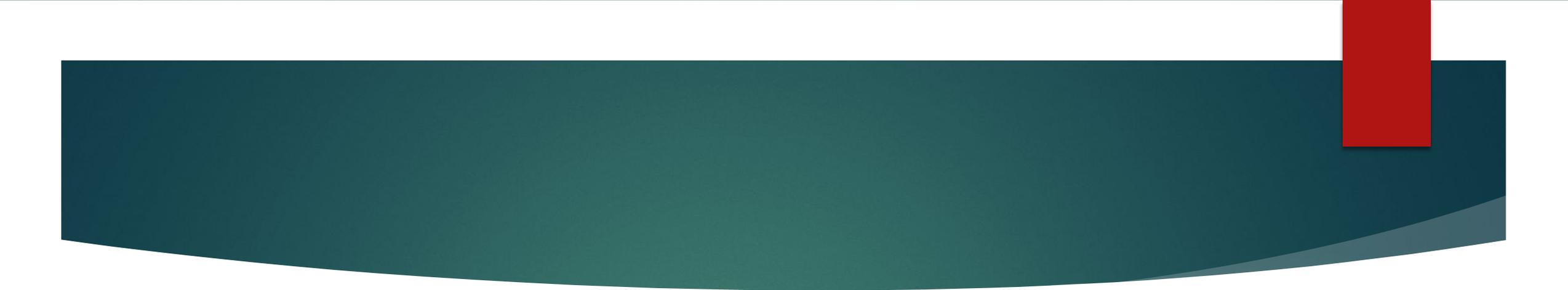
Rods



Spirals

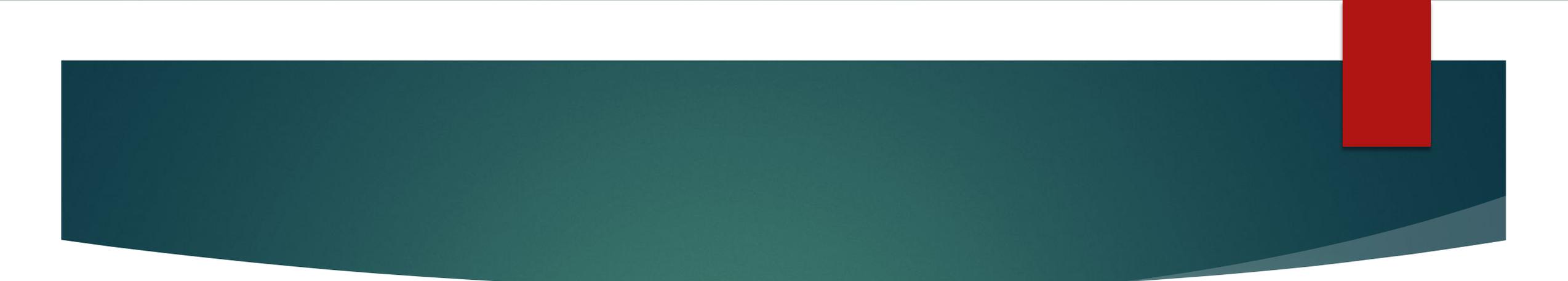
# Characteristics of Prokaryotic Cell

- ▶ Prokaryotic cells have different characteristic features. The characteristics of the prokaryotic cells are mentioned below.
- ▶ They lack a nuclear membrane.
- ▶ Mitochondria, Golgi bodies, chloroplast, and lysosomes are absent.
- ▶ The genetic material is present on a single chromosome.

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- ▶ The histone proteins, the important constituents of eukaryotic chromosomes, are lacking in them.
  - ▶ The cell wall is made up of carbohydrates and amino acids.
  - ▶ The plasma membrane acts as the mitochondrial membrane carrying respiratory enzymes.
  - ▶ They divide asexually by binary fission. The sexual mode of reproduction involves conjugation.

# Prokaryotic Cell Structure

- ▶ A prokaryotic cell does not have a nuclear membrane. However, the genetic material is present in a region in the cytoplasm known as the **nucleoid**. They may be spherical, rod-shaped, or spiral. A prokaryotic cell structure is as follows:

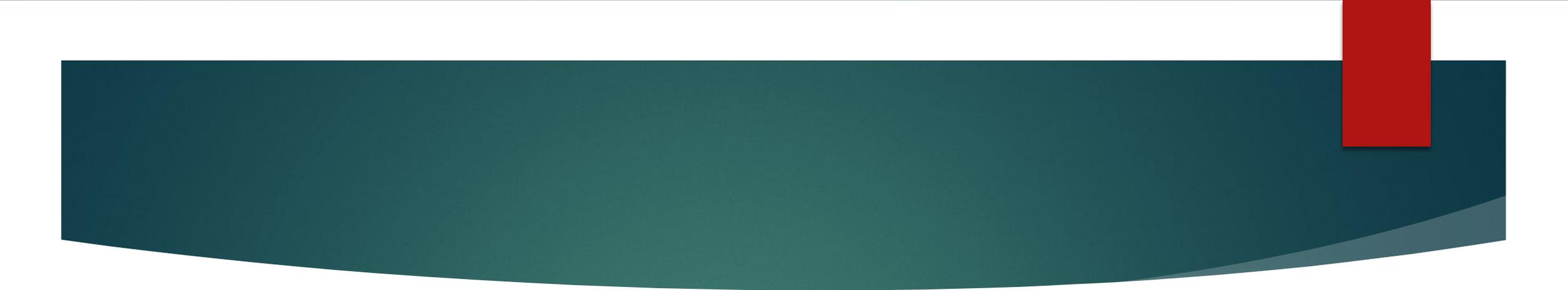


## **Extracellular (external) structures**

**Pili**– These are hair-like outgrowths that attach to the surface of other bacterial cells.

**Flagella**– These are long structures in the form of a whip, that help in the locomotion of a cell.

**Capsule**– It is an outer protective covering found in the bacterial cells, in addition to the cell wall. It helps in moisture retention, protects the cell when engulfed, and helps in the attachment of cells to nutrients and surfaces.

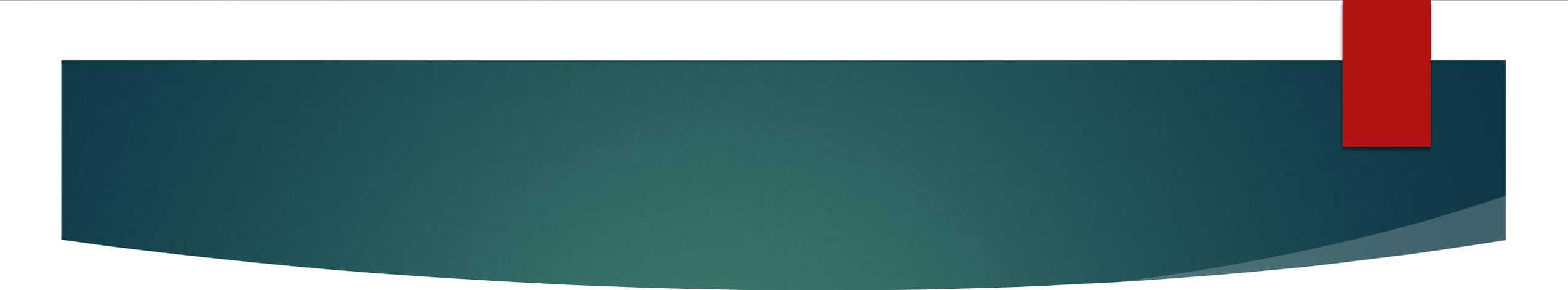


**S-layers** is a cell surface protein layer found in some [bacteria](#) and common in [archaea](#), function ( a partial permeability barrier for large substrates and protection against host defence mechanisms

**Cell Wall**– It is the outermost layer of the cell which gives shape to the cell.

**Cell Membrane**– This layer surrounds the cytoplasm and regulates the entry and exit of substances in the cells.

**Cytoplasm**– The cytoplasm is mainly composed of enzymes, salts, cell organelles and is a gel-like component.

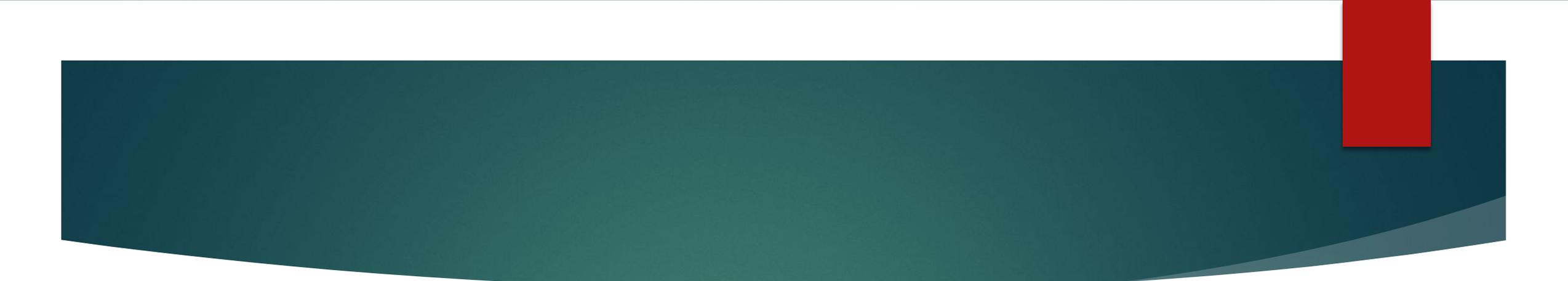


▶ **Intracellular (internal) structure**

**Ribosomes**– These are involved in protein synthesis.

**Plasmids**– Plasmids are non-chromosomal DNA structures. These are not involved in reproduction.

**Nucleoid Region**– It is the region in the cytoplasm where the genetic material is present.



## **Intracellular membranes.**

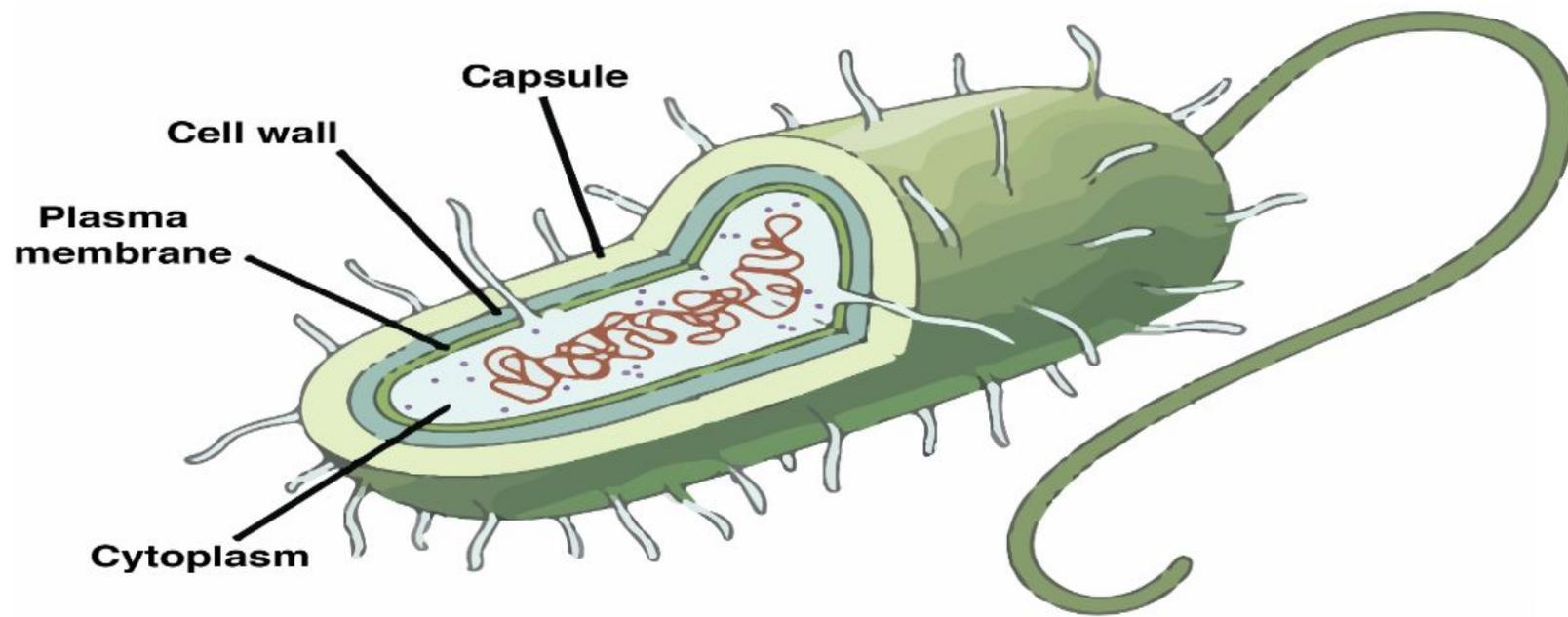
**Nutrient storage structures:** Most bacteria do not live in environments that contain large amounts of nutrients at all times. To accommodate these transient levels of nutrients bacteria contain several different methods of nutrient storage in times of plenty for use in times of want.

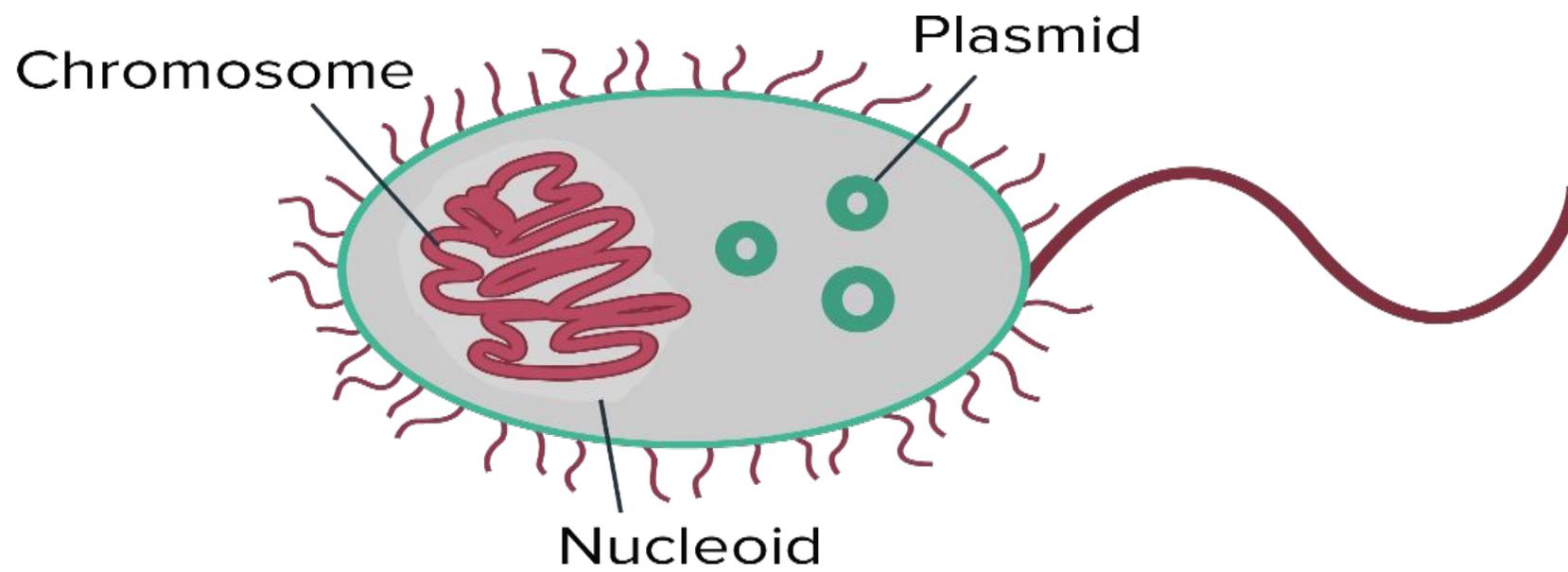
**Inclusions:** Inclusions are considered to be nonliving components of the cell that do not possess metabolic activity and are not bounded by membranes. The most common inclusions are glycogen, lipid droplets, crystals, and pigments.

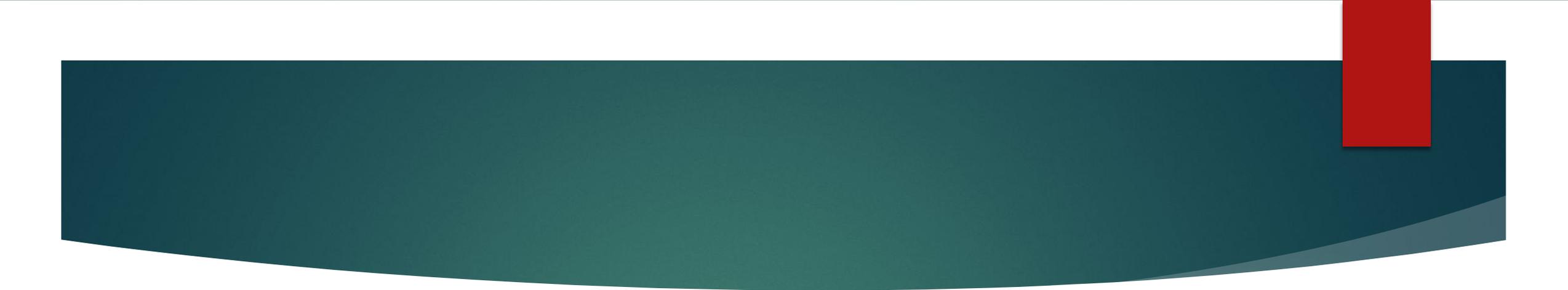
**Gas vacuoles** Gas vesicle ,Gas vacuoles are membrane-bound, spindle-shaped vesicles, found in some planktonic bacteria and Cyanobacteria, that provides buoyancy to these cells by decreasing their overall cell density.

**Endospores** Endospore Perhaps the best known bacterial adaptation to stress is the formation of endospores. Endospores are bacterial survival structures that are highly resistant to many different types of chemical and environmental stresses and therefore enable the survival of bacteria in environments that would be lethal for these cells in their normal vegetative form

- ▶ A prokaryotic cell lacks certain organelles like mitochondria, endoplasmic reticulum, and Golgi bodies.



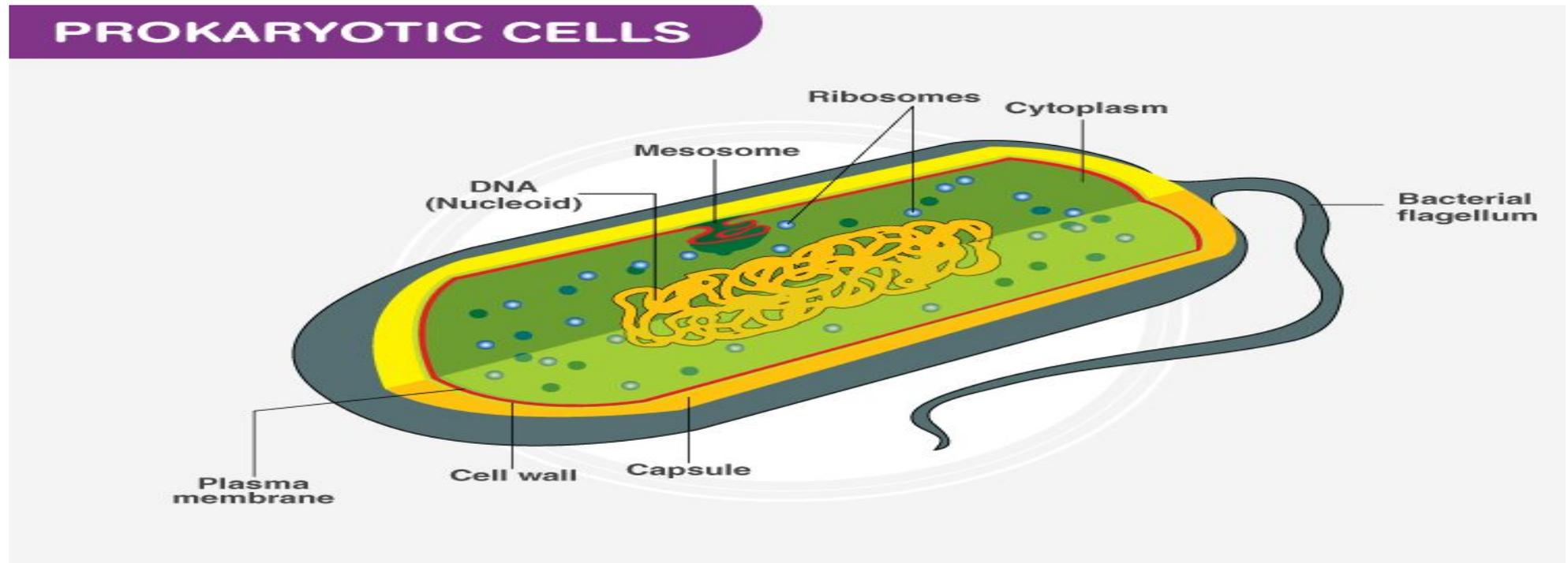




▶ **Prokaryotic Cell Diagram**

The prokaryotic cell diagram given below ▶ represents a bacterial cell. It depicts the absence of a true nucleus and the presence of a flagellum that differentiates it from a .eukaryotic cell

# Prokaryotic Cell Diagram illustrates the absence of a true nucleus

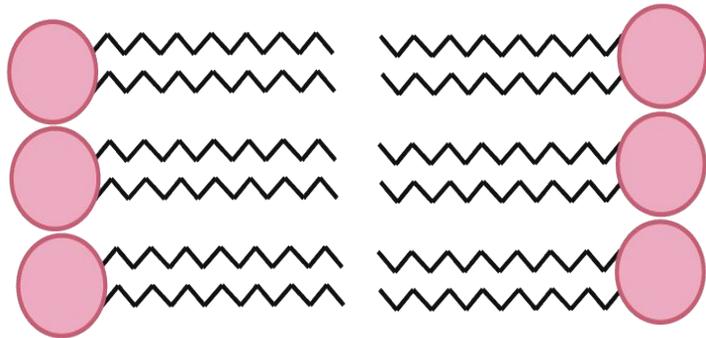


# Components of Prokaryotic Cells

- ▶ The prokaryotic cells have **four** main components:
  1. **Plasma Membrane-** It is an outer protective covering of phospholipid molecules which separates the cell from the surrounding environment.

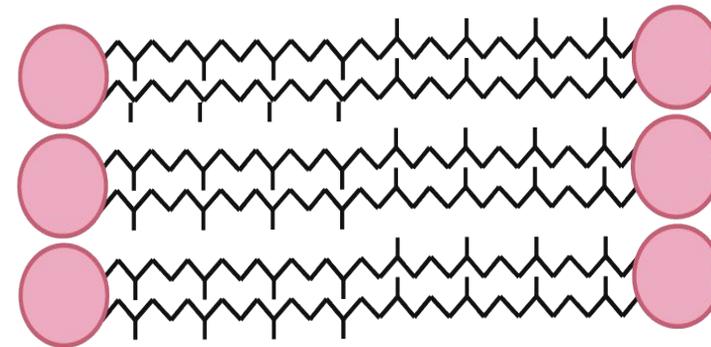
# Plasma Membrane

## Lipid bilayer

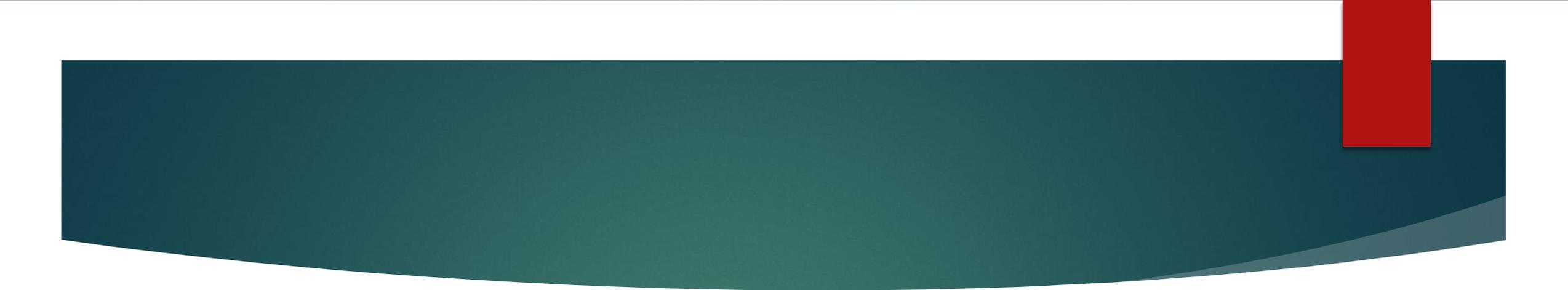


Bacteria and eukaryotes

## Lipid monolayer



Some archaea



**2- Cytoplasm-** It is a jelly-like substance present inside the cell. All the cell organelles are suspended in it.

**3- DNA-** It is the genetic material of the cell. All the prokaryotes possess a circular DNA. It directs what proteins the cell creates. It also regulates the actions of the cell.

**4- Ribosomes-** Protein synthesis occurs here.

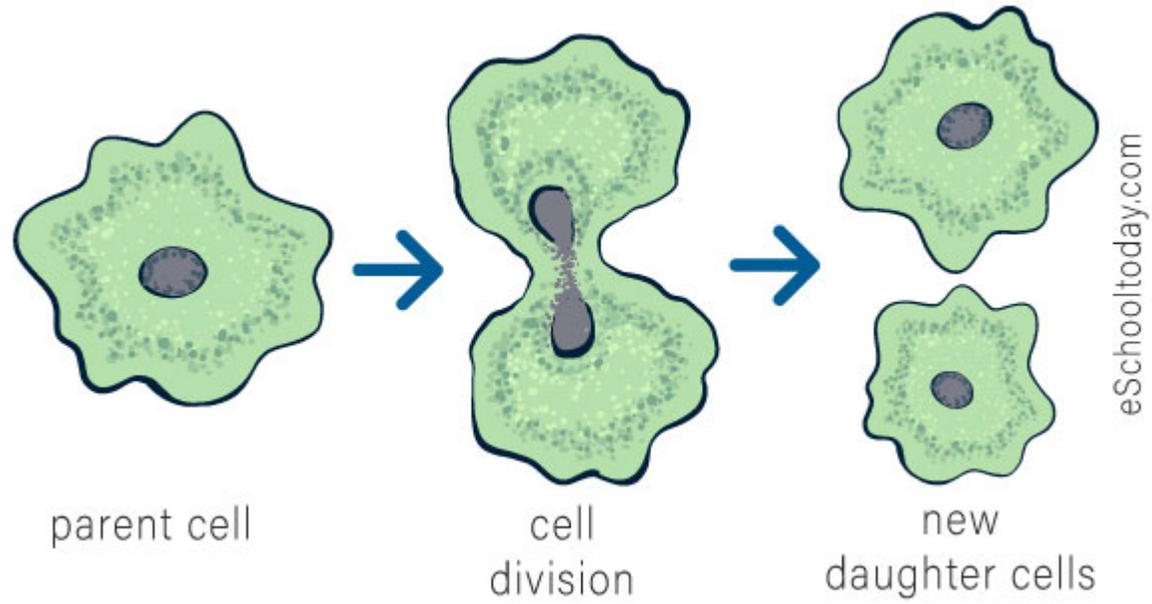
Some prokaryotic cells possess cilia and flagella which helps in locomotion ▶

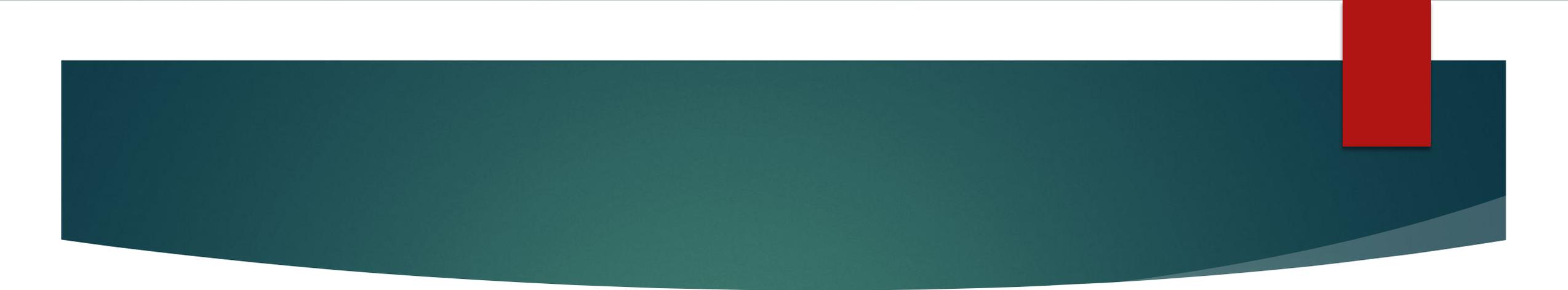
# Reproduction in Prokaryotes

- ▶ A prokaryote reproduces in two ways:
  - Asexually by **binary fission**
  - Sexually by **conjugation**

# Binary Fission

- ▶ The DNA of an organism replicates and the new copies attach to the cell membrane.
- ▶ The cell wall starts increasing in size and starts moving inwards.
- ▶ A cell wall is then formed between each DNA, dividing the cell into two daughter cells.

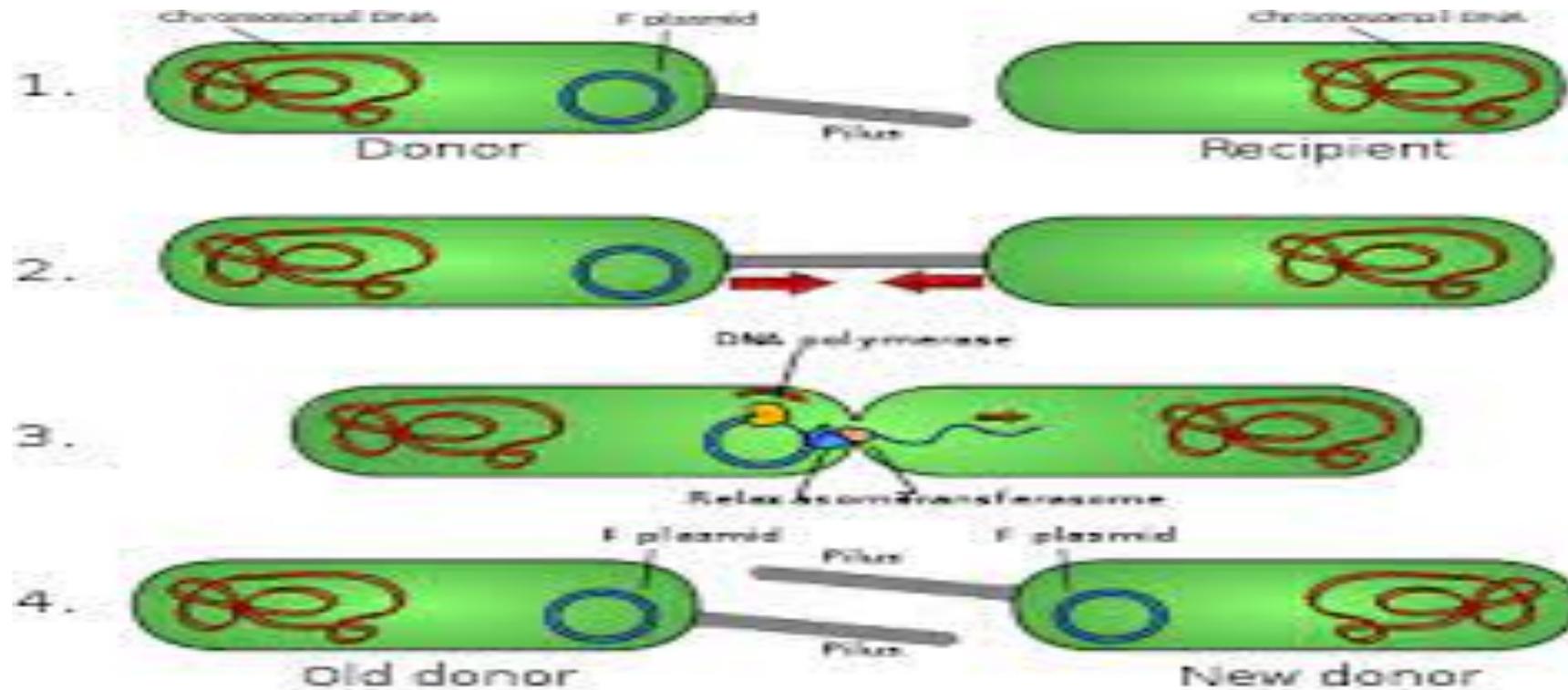




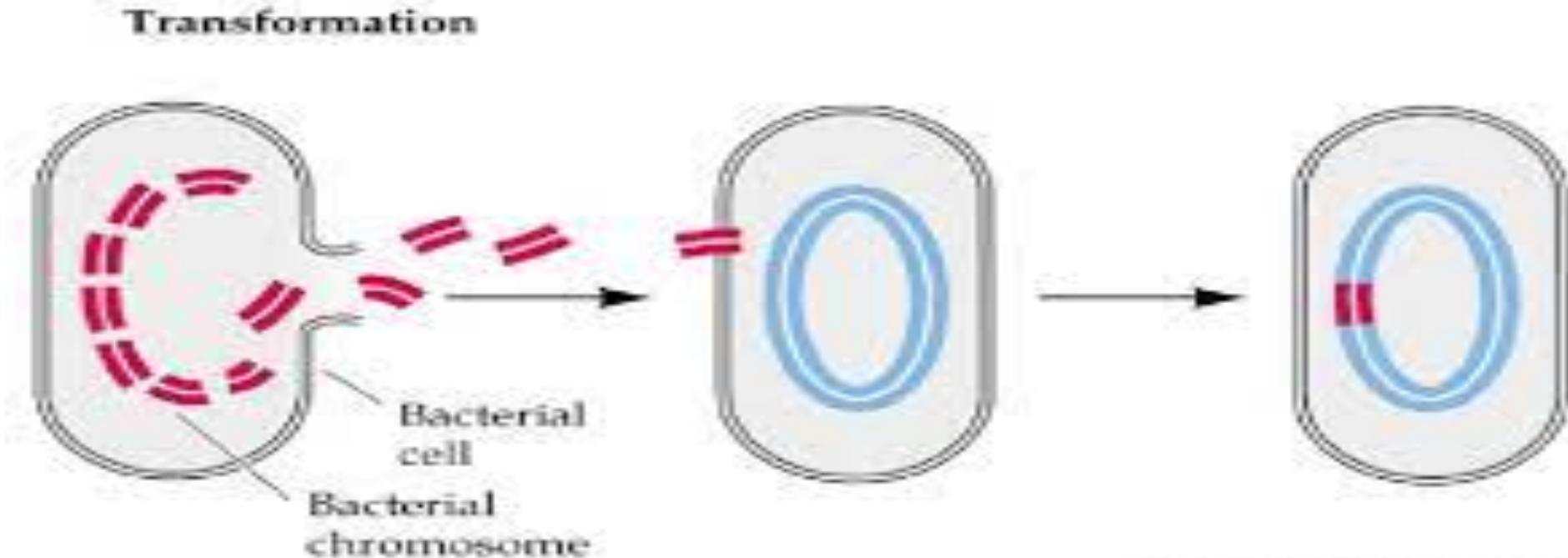
▶ **Recombination**

- ▶ In this process, genes from one bacteria are transferred to the genome of other bacteria. It takes place in three ways-conjugation, transformation, transduction.

**Conjugation** is the process in which genes are transferred between two bacteria through a protein tube structure called a pilus.



**Transformation** is the mode of sexual reproduction in which the DNA from the surroundings is taken by the bacterial cell and incorporated in its DNA.



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**Transduction** is the process in which the genetic material is transferred into the bacterial cell with the help of viruses. Bacteriophages are the virus that initiates the process.

