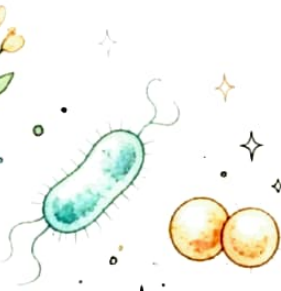
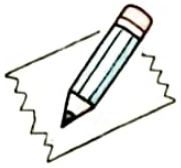
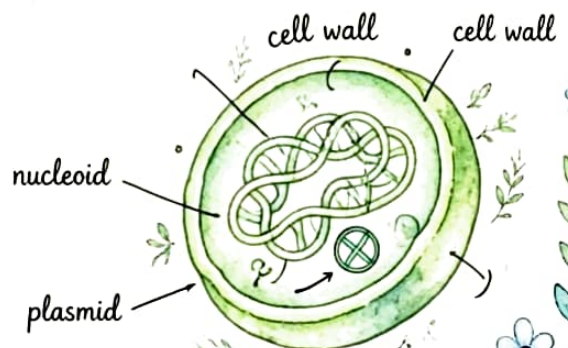


Prodigy Educlasses

Class - IX

CBSE

Topic: Prokaryotic Cell



Prokaryotic Cells

 No membrane bound nucleus and organelles

→ Include:

- Bacteria
- Blue-green algae / Cyanobacteria
- Mycoplasma & PPLO



(PPLO → Pleuro Pneumonia Like Organisms)



→ Generally smaller & multiply more rapidly than eukaryotic cells

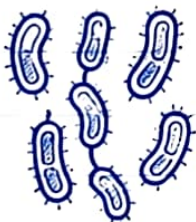
→ Vary in shape & size



Bacteria - 4 Basic Shapes

1. Bacillus

– rod like



2. Coccus

– spherical



3. Vibrio

– comma shaped



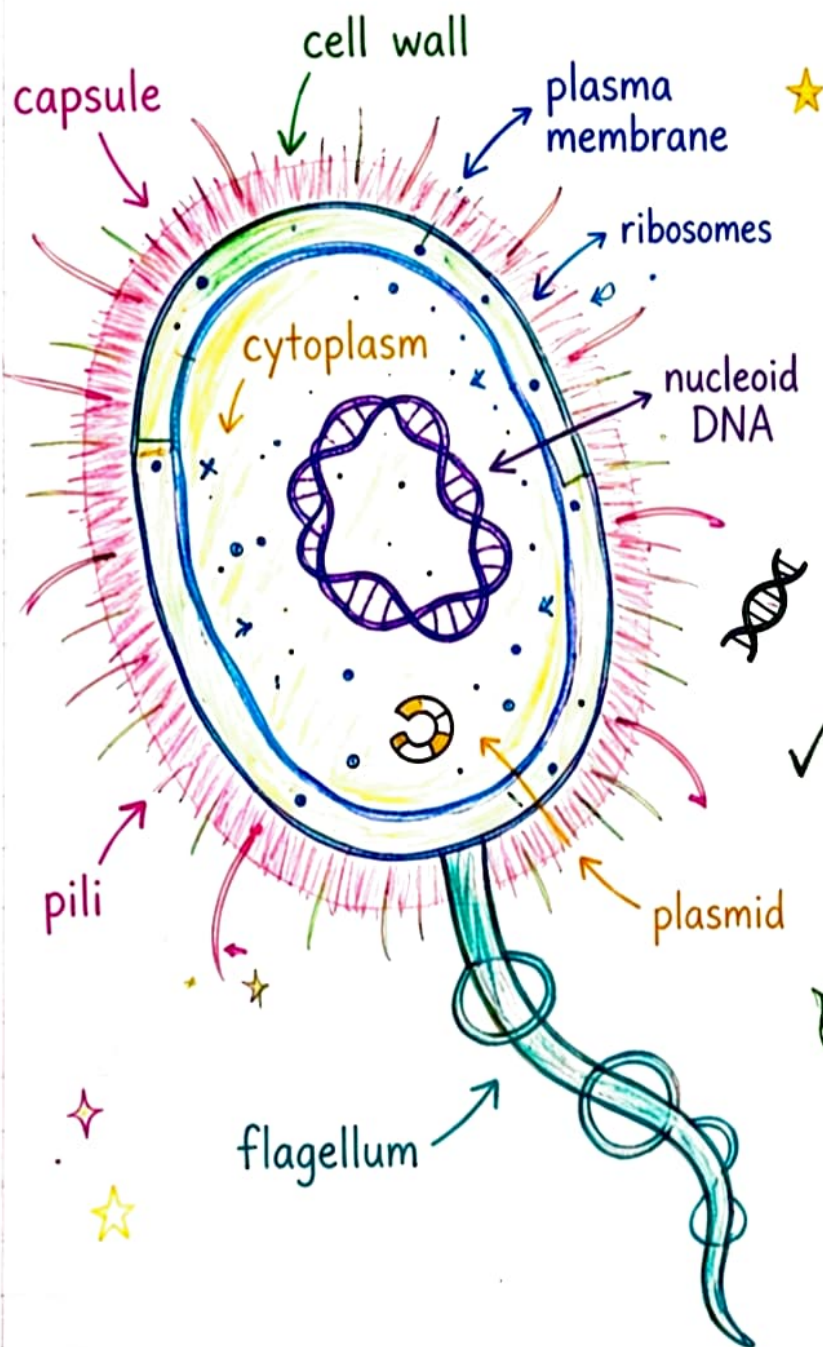
4. Spirillum

– spiral / helical



Note:

- Prokaryotes lack true nucleus →
- DNA is in nucleoid (no nuclear membrane)
- Cell wall present in most (except Mycoplasma)
- Example: E. coli, Lactobacillus are common prokaryotes



Key Notes —

7 Important Structures:

1. Cell envelope — the outer layer made of capsule + cell wall + plasma membrane; provides protection, shape & barrier
2. Mesosome & Chromatophores — folded membranes of the plasma membrane; involved in cellular respiration or photosynthesis in some bacteria (*now considered artifact in many species)
3. Nucleoid — region where the circular DNA is located; not enclosed in a nucleus; DNA is free in the cytoplasm
4. Flagella — long tail-like structure; enables movement of the cell
5. Pili and Fimbriae — small hair-like appendages; pili aid in attachment and genetic transfer between cells; fimbriae help cell adhere to surfaces
6. Ribosomes — tiny granules in the cytoplasm; site of protein synthesis
7. Inclusion Bodies — stored granules of nutrients/materials such as glycogen, lipids, sulfur, phosphate granules

* Key point: * Prokaryotes have no membrane-bound organelles • DNA is circular & free

- Typically much smaller than eukaryotic cells
- Examples: E. coli, Salmonella, Cyanobacteria

1. Cell Envelope —

It is chemically complex protective covering, made of 3 tightly bound layers:

a) Glycocalyx — outer layer

- Composition & thickness vary in different bacteria
- May be slime layer (loose sheath) or capsule (thick & tough)

b) Cell wall — middle layer

- Present in all prokaryotes 
- Gives shape & provides structural support
- Prevents bacterium from bursting or collapsing 

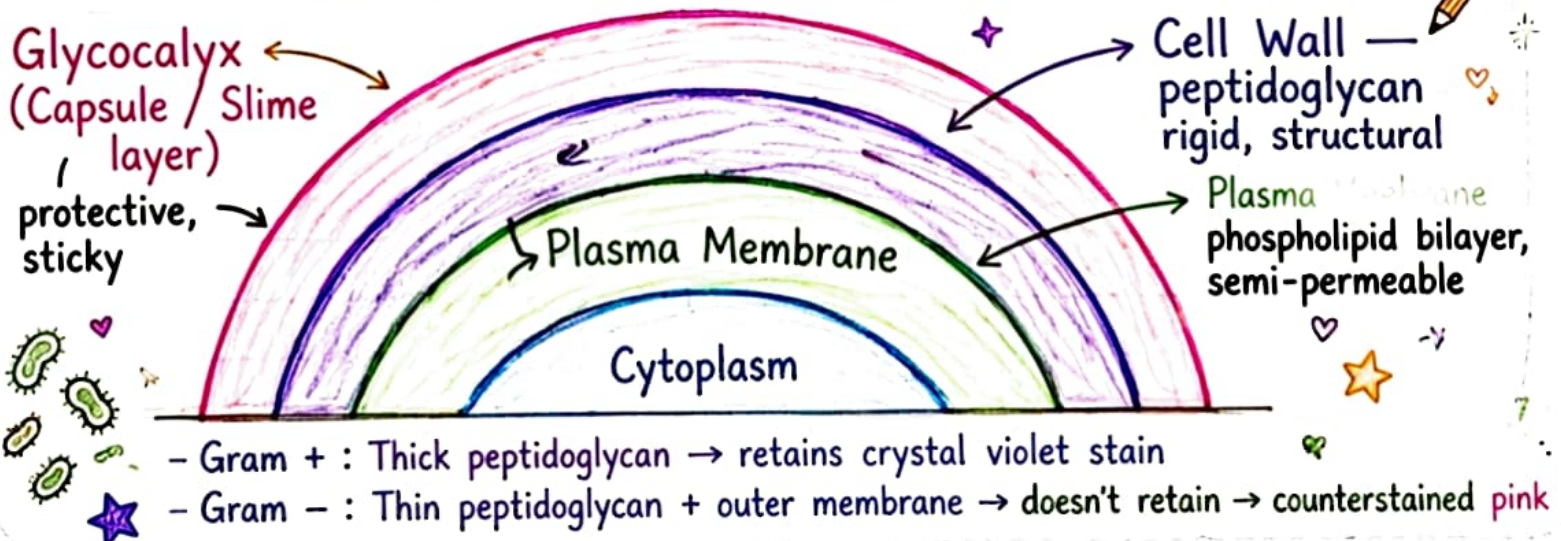
c) Plasma membrane — inner layer

- Semi-permeable nature; controls what enters/exits
- Interacts with outside environment
- Structurally similar to eukaryotes 

Gram Staining Classification:

- * **Gram-positive:** Retain gram stain → appear **PURPLE** 
 - Thicker peptidoglycan cell wall 
- * **Gram-negative:** Do NOT retain gram stain → appear **PINK/RED** 
 - Thinner peptidoglycan + outer membrane
- * Christian Gram developed the staining technique (1884) 

Diagram: Prokaryotic Cell Envelope Layers



→ Key: 3 layers work together to protect & maintain cell shape.

Mesosome



- Mesosome formed by infolding of plasma membrane → includes vesicles, tubules & lamellae



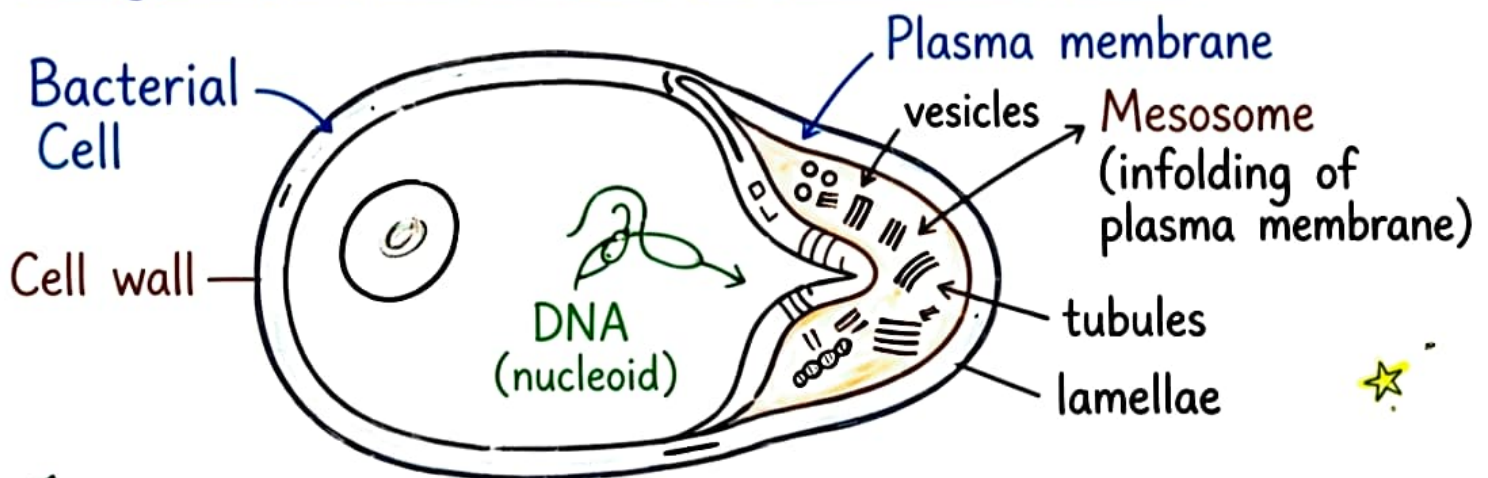
Functions of Mesosome: ☆

1. For cell wall formation - helps build the cell wall
2. For DNA replication
3. For distribution of chromosomes to daughter cells
4. For respiration and secretion
5. To increase surface area of plasma membrane and enzymatic content ↑

Chromatophores

- pigment-containing membranous infoldings in some prokaryotes
- e.g. cyanobacteria

Diagram of Mesosome in Bacterial Cell: ☆



- ✱ Mesosome aids respiration by holding respiratory enzymes in the folded membrane

Chromatophores → hold pigments like chlorophyll, phycocyanin for photosynthesis in cyanobacteria

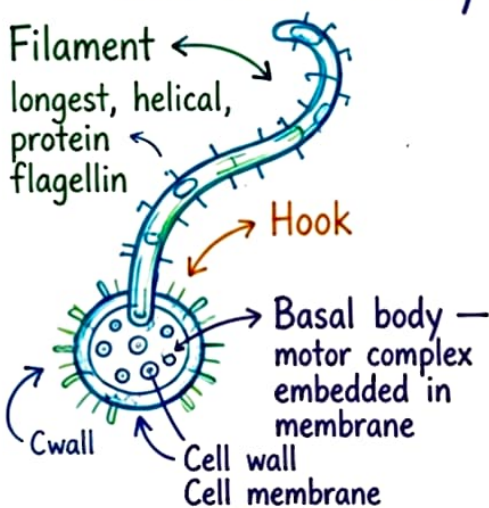
Note: Mesosomes are debated but traditionally taught as infoldings for respiration & DNA segregation

— Flagella —

- Flagella: thin filamentous extensions from cell wall of motile bacteria
- Number & arrangement varied:
- Monotrichous — single flagellum (at one pole)
- Lophotrichous — tuft of flagella at one pole
- **Amphitrichous** — flagella at both poles
- Peritrichous — flagella around entire cell surface

Bacterial flagellum = 3 parts:

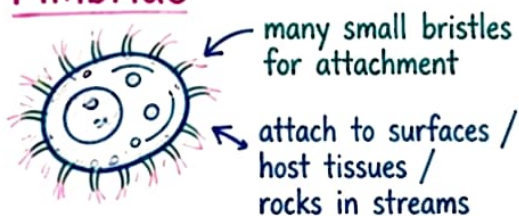
1. Filament → longest portion, extends from cell surface to outside ←
2. Hook — curved connector section
3. Basal body — embedded in cell wall & membrane, acts like rotary motor



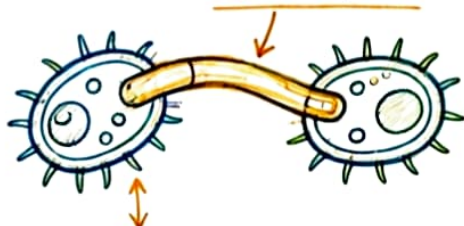
→ Pili & Fimbriae —

- Pili & Fimbriae = surface structures
→ have NO role in motility
- Pili: elongated tubular structures made of special protein pilin
- Fimbriae: small bristle-like fibres out of cell, help attach bacteria to rocks in streams & to host tissues

Fimbriae



Sex Pilus



Sex pilus — for conjugation / DNA transfer between cells

Capsule



Capsule —

slimy polysaccharide layer, protects cell, helps prevent phagocytosis

Key Point: Flagella = MOTILITY ✓ • Pili/Fimbriae = ATTACHMENT & CONJUGATION × no motility ☆

* Topic: Ribosomes in Prokaryotes *

What are Ribosomes?

- Small organelles made of RNA + protein – responsible for protein synthesis
- Found free in cytoplasm, or *attached to the plasma membrane* of prokaryotes
→ plasma membrane (no ER in prokaryotes!)
- Size: ~**15 nm × 20 nm**

Structure:

- Made of **two subunits**:
 - 30S subunit (small subunit)
 - 50S subunit (large subunit)

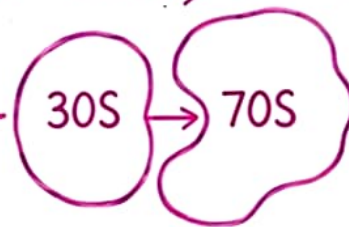
30S

RNA + proteins

50S

RNA + proteins

30S + 50S → 70S ribosome**



(S = sedimentation coefficient → measures density & size, NOT weight)

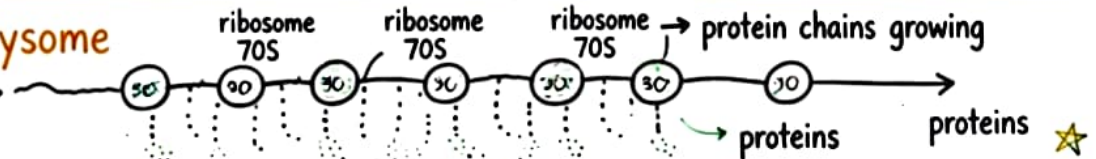
Function:

- Site of **translation**: mRNA is translated into protein
- Several ribosomes can bind to one mRNA strand → forms a **polyribosome/polysome**



Polyribosome / Polysome

mRNA strand →



Prokaryotic vs Eukaryotic Ribosomes

Prokaryotic

- **70S ribosome**
- Made of 50S + 30S subunits
- Size: ~15-20 nm
- Found: cytoplasm & plasma membrane
- Example: bacteria

Eukaryotic

- **80S ribosome**
- Made of 60S + 40S subunits
- Size: ~22-25 nm
- Found: cytoplasm, ER, mitochondria, chloroplasts
- Example: plants, animals, fungi

* Key to remember: *

- Prokaryotes = 70S (smaller) vs Eukaryotes = 80S (larger)
- Ribosomes NOT membrane-bound in prokaryotes — just attach to plasma membrane

* Why it matters: *

- Allows bacteria to quickly synthesize proteins for growth & survival