Exploring Cell-The Unit Of Life

Demo Lecture

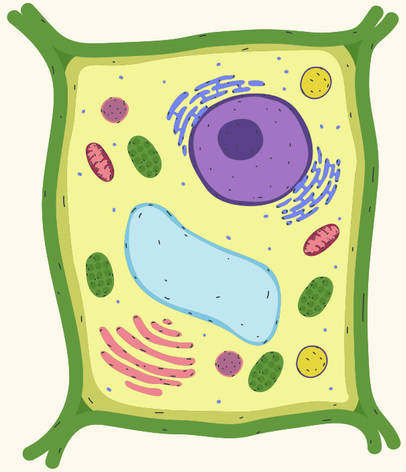
Today, you will study..

- Introduction of cell
- Cell Theory
- An overview of cell
- Prokaryotic cells

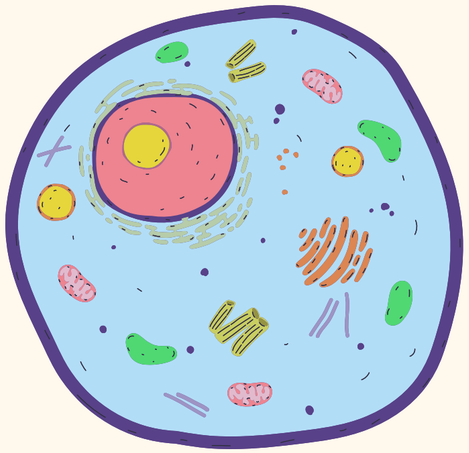
What is a cell?

A cell is the **fundamental, structural and functional unit** of all living organisms.

- ✓Independent existence
- ✓performing the essential functions of life
- ✓anything less than a complete structure of a cell does not ensure independent living.

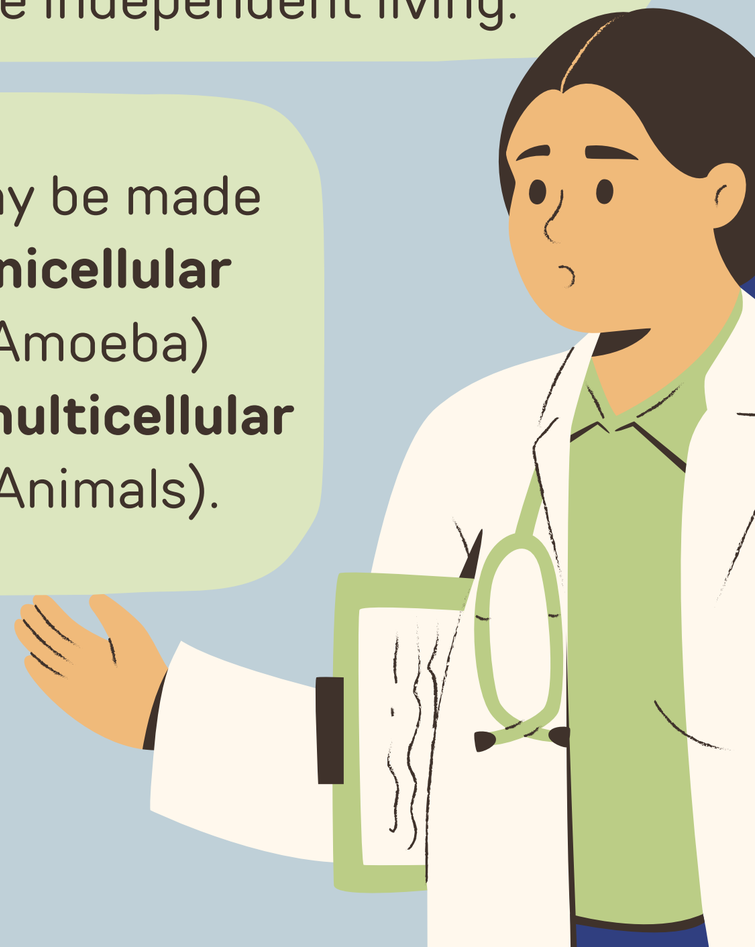


plant cell



animal cell

A living thing may be made of one cell (a **unicellular** organism, eg., Amoeba) or many cells (a **multicellular** organism, eg., Animals).



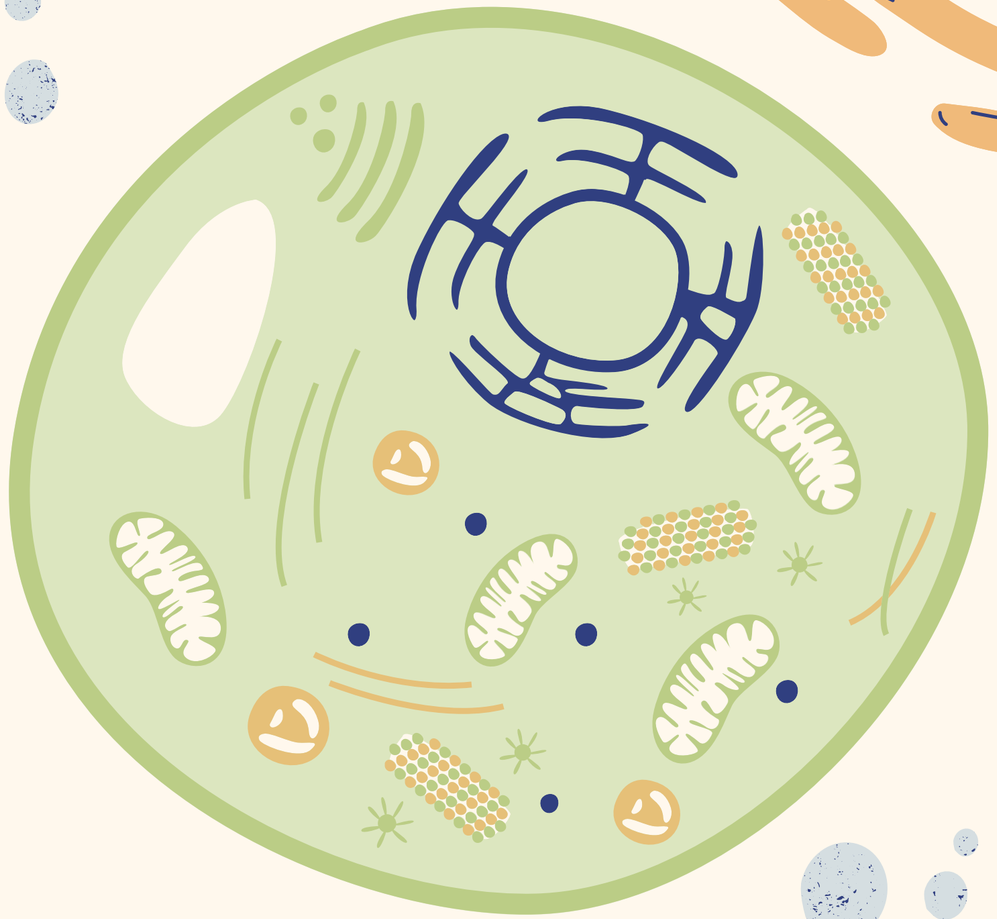
Discovering the Cell

Robert Hooke: Dead cell (cork cells)

Antonie Von Leeuwenhoek: Living cell

Robert Brown: Nucleus

Purkinje: Protoplasm



Cell Theory

Matthias Schleiden

✓1838
✓German Botanist
✓observed that all plants are made up of different types of cells which form tissues.

Schwann

✓1839
✓German Zoologist
✓proposed hypothesis that plants and animals are made up of cells and product of cells.
✓Animal cell: Plasma membrane
✓Plant cell: Cell Wall (unique feature)

Rudolf Virchow

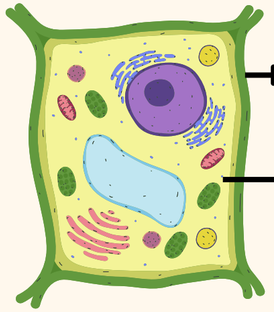
✓1855
✓modified hypothesis given by Schwann and Schleiden
✓all living organisms are composed of cells and products of cells.
✓All cells arise from pre-existing cells(Omnis cellula-e cellula)

Schwan's and Schleiden together formulated cell theory. But this didn't explain,how new cells were formed.

An overview of cell

✓Plant cell:

eg., Cell in an onion cell

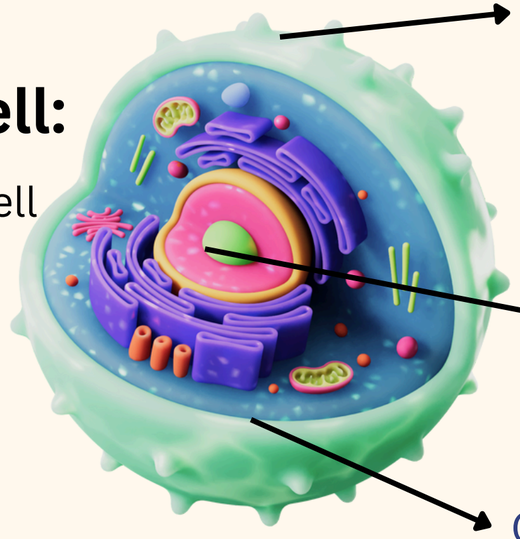


Cell Wall (outer boundary)

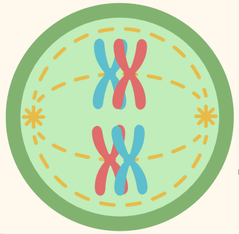
Cell Membrane

✓Animal cell:

eg., Human cheek cell



Cell Membrane (delimiting structure)

Nucleus →  → Genetic material (DNA)

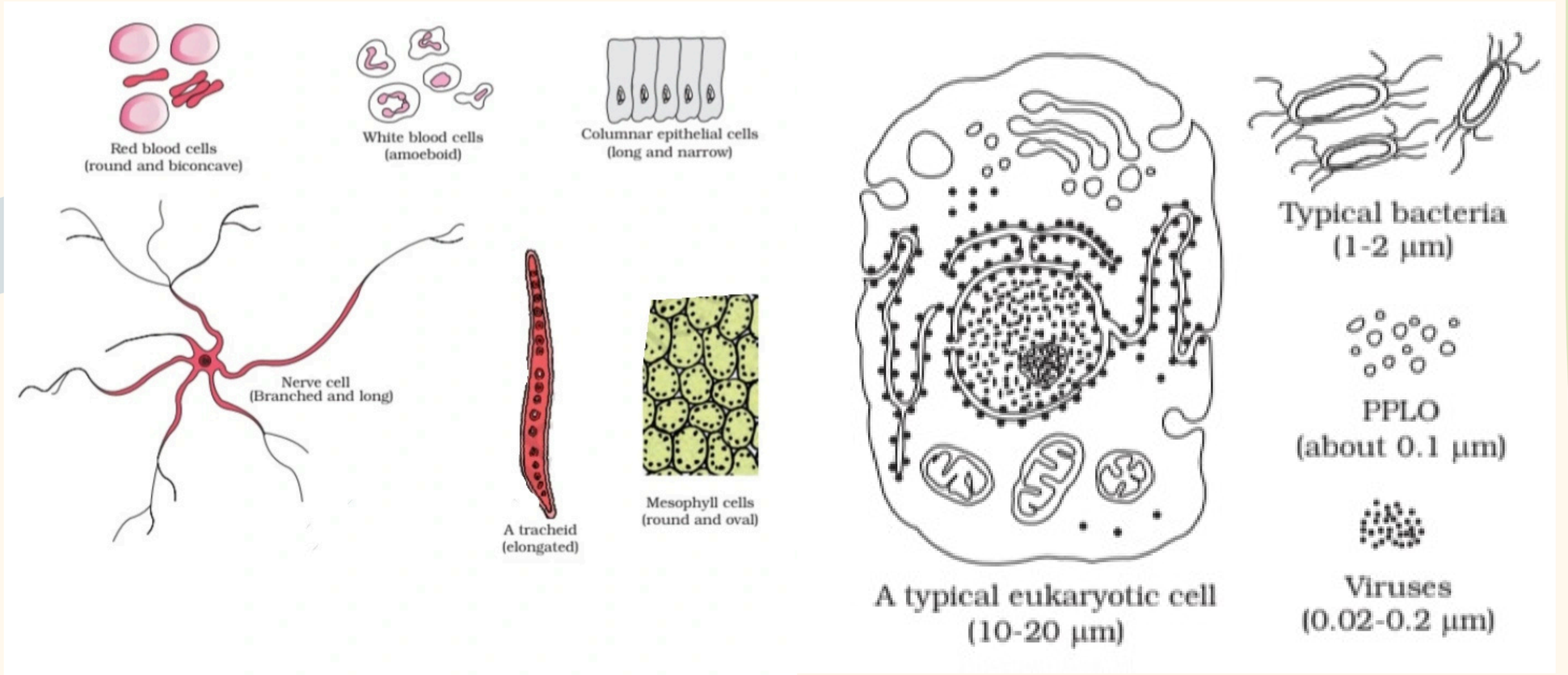
Chromosome

Cytoplasm → Semi fluid matrix, Main arena of cellular activity, chemical reaction-------keep the cell in a living state

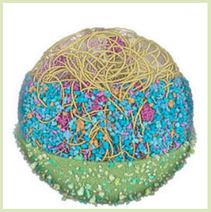
✓**Eukaryotic cell:** membrane bound nuclei is present.

✓**Prokaryotic cell:** Lack membrane bound nuclei

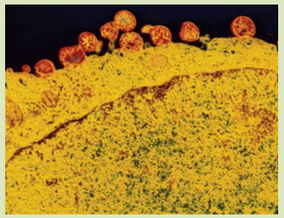
✓Based on the **functions**, shape of cells may be disc-like, polygonal, columnar, cuboid, thread-like, or irregular.



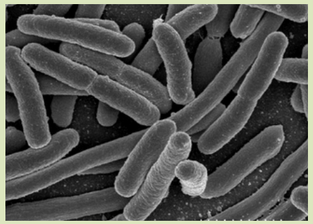
✓ Cell **Size:**



Mycoplasma
(Smallest cell)
0.3 um

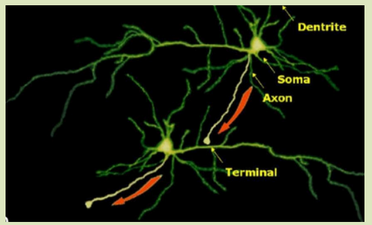


PPLO
(0.1um)



Bacteria
(3 to 5 um)

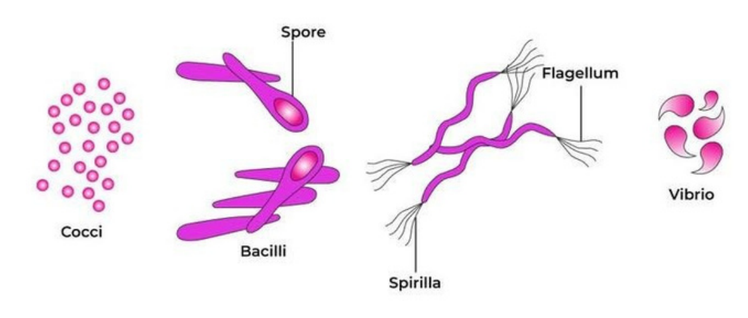
Ostrich Egg
(Largest cell)



Neuron
(Longest cell)

RBC
(7um)

Prokaryotic cell



•have no membrane bound nucleus and organelles.

•include bacteria, blue-green algae, mycoplasma & PPLO (Pleuro Pneumonia Like Organisms).

•generally smaller and multiply more rapidly than the eukaryotic cells.

• vary in shape & size.

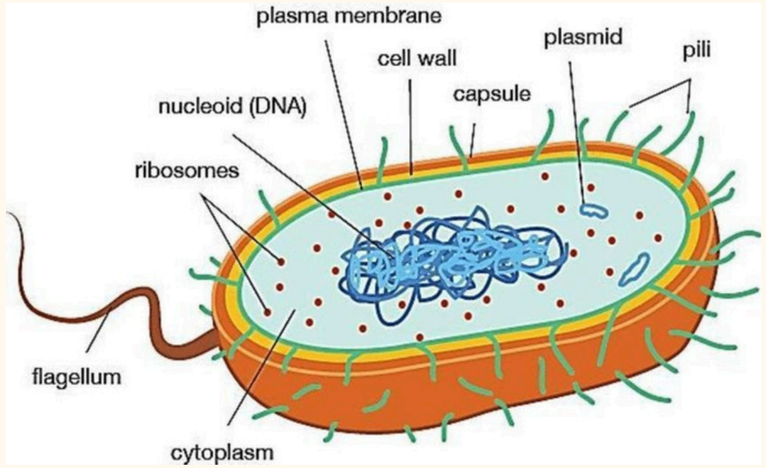
•Bacteria have 4 basic shapes:

✓Bacillus (rod like)

✓Coccus (spherical)

✓Vibrio (comma shaped)

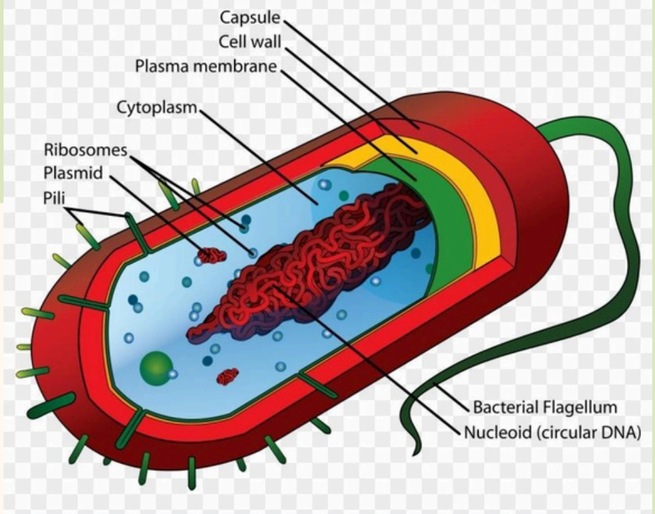
✓Spirillum (spiral)



Cell organelles in Prokaryotic cell:

1. Cell envelope
2. Mesosome & Chromatophores
3. Nucleoid
4. Flagella
5. Pili and Fimbriae
6. Ribosomes
7. Inclusion Bodies

1.Cell Envelope:



•It is a chemically complex protective covering.

•It is made of 3 tightly bound layers:

✓Glycocalyx

✓Cell wall

✓Plasma membrane

A. GLYCOCALYX

✓Outer layer

✓ composition and thickness vary in different bacteria.

✓ may be a slime layer (loose sheath) or capsule (thick & tough).

B. CELL WALL

✓Middle layer.

✓Seen in all prokaryotes.

✓gives shape to the cell

✓provides a structural support to prevent the bacterium from bursting or collapsing.

C. PLASMA MEMBRANE

✓Inner layer

✓semi-permeable in nature and interacts with the outside.

✓ structurally similar to that of the eukaryotes.

✓Based on the types of the cell envelopes and response to Gram staining, bacteria are 2 types:

•**Gram positive**: They take up and retain the gram stain.

•**Gram negative**: They do not retain the gram stain

2.MESOSOMES & CHROMATOPHORES (MEMBRANOUS STRUCTURES)

A. Mesosome:

- formed by the ***infolding of plasma membrane.***
- includes vesicles, tubules & lamellae

B. Chromatophores:

✓***membranous infoldings*** in some prokaryotes. E.g. cyanobacteria.

✓contain pigments.

Functions:

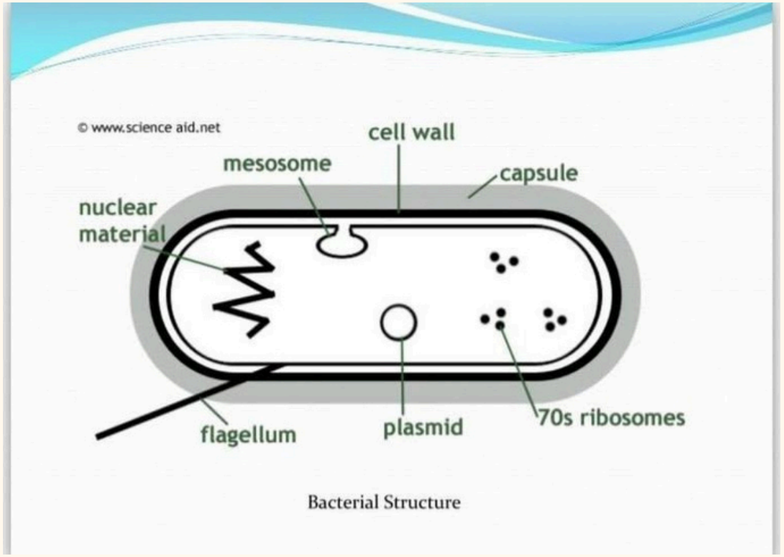
✓For cell wall formation.

✓For DNA replication.

✓For distribution of chromosomes to daughter cell

✓For respiration and secretion processes

✓To increase the surface area of plasma membrane and enzymatic content

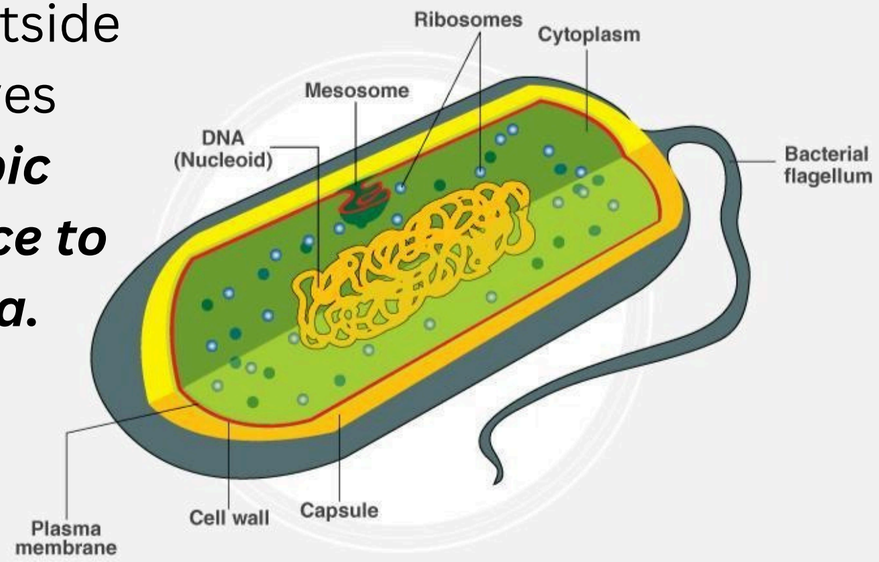


Bacterial Structure

3. NUCLEOID :

✓formed of non-membranous (naked) circular genomic DNA (single chromosome/Genetic material).

✓Many bacteria have small circular DNA **(plasmid)** outside the genomic DNA. It gives some unique ***phenotypic characters (e.g. resistance to antibiotics) to bacteria.***



4. FLAGELLA:

✓thin filamentous ***extensions from the cell wall*** of motile bacteria.

✓Their number and arrangement are varied in different bacteria.

✓Bacterial flagellum has 3 parts: filament, hook & basal body.

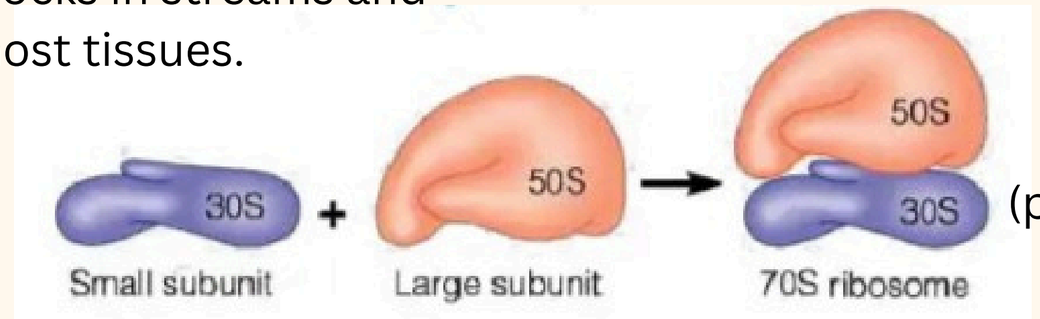
✓The filament is the longest portion and extends from the cell surface to the outside.

5. PILLI & FIMBRIAE:

✓These are surface structures that **have no role in motility.**

✓Pili (sing. Pilus) are elongated tubular structures made of a special protein (pilin).

✓Fimbriae are small bristle like fibres sprouting out of the cell. In some bacteria, they help to attach the bacteria to rocks in streams and to the host tissues.



6. RIBOSOMES:

✓associated with plasma membrane of prokaryotes.

✓about 15 nm by 20 nm in size.

✓made of two subunits - 50S and 305 units. They together form 70S prokaryotic ribosomes. (S= sedimentation coefficient; a measure of density & size.)

Function of Ribosomes:

•Ribosomes are the site of translation (protein synthesis).

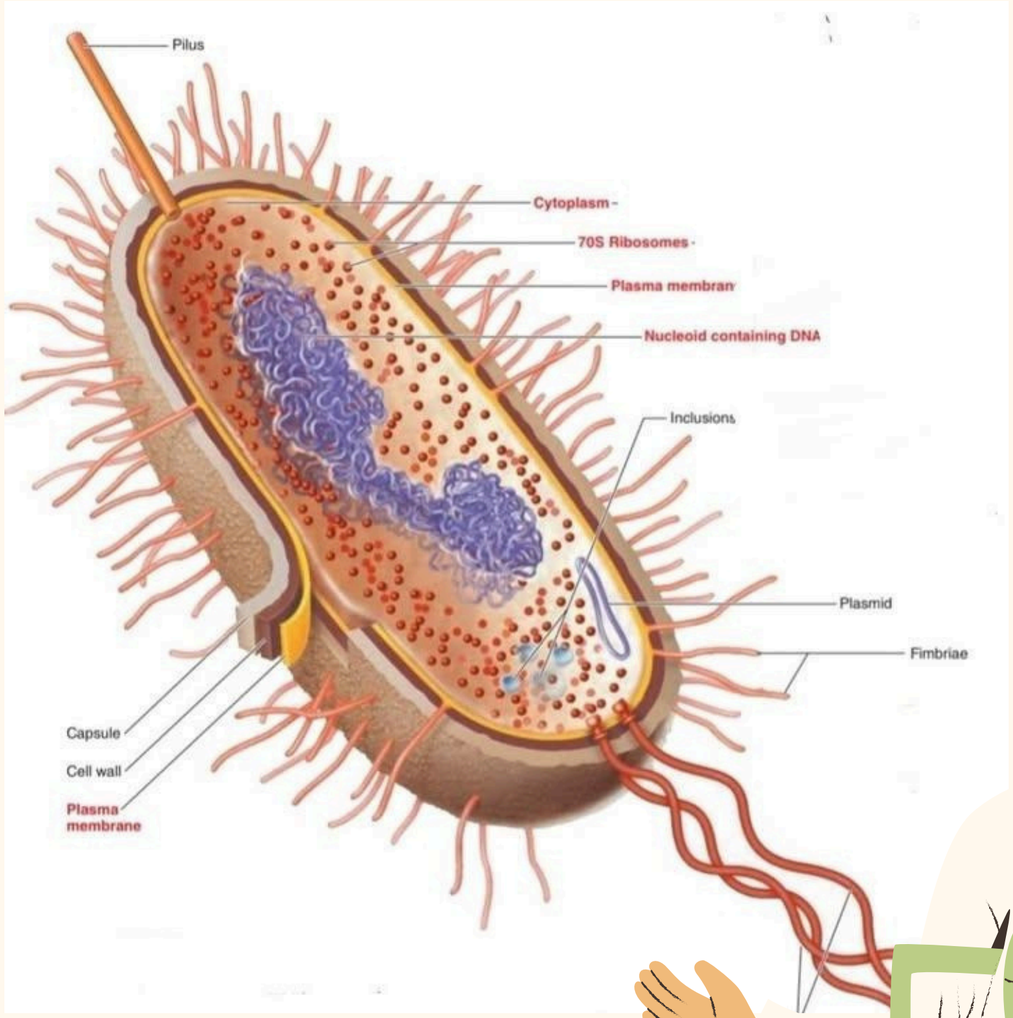
•Several ribosomes may attach to a single mRNA to form a chain called polyribosomes (polysome). Ribosomes of a polysome translate the mRNA into proteins.

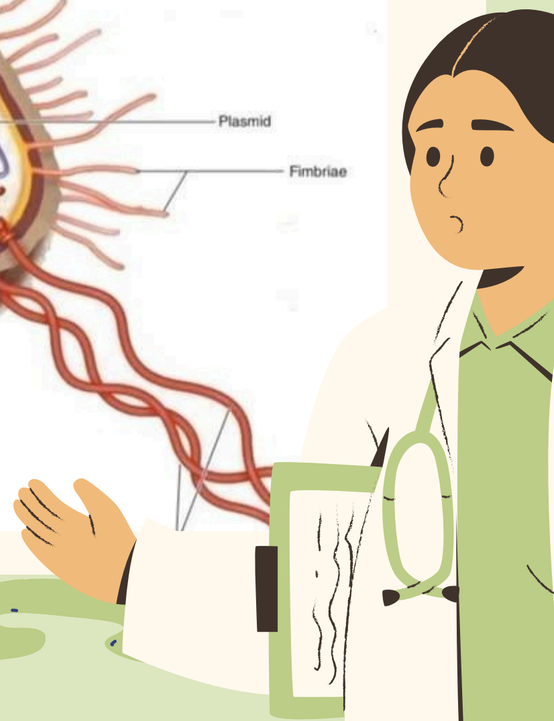
7. INCLUSION BODIES:

✓These are **non-membranous**, stored reserve material seen freely in the cytoplasm of prokaryotic cells.

✓E.g. phosphate granules, cyanophycean granules and glycogen granules, gas vacuoles etc.

✓Gas vacuoles are found in blue green and purple and green photosynthetic bacteria.





THANK YOU