



LECTURE 2

Bacterial structure

- Intracytoplasmic structure
- Cell wall
- Structures outside the cell wall

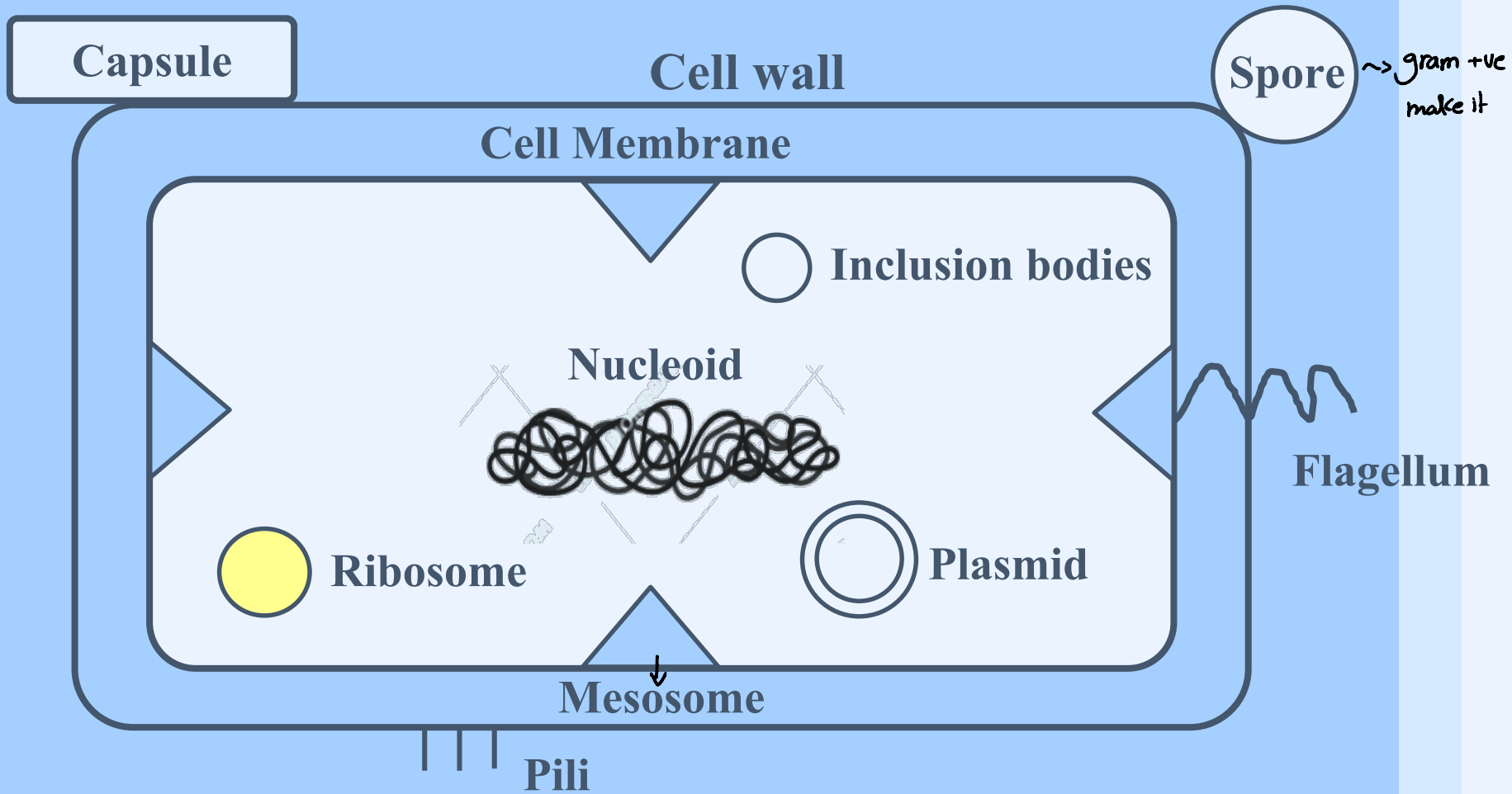


Objectives

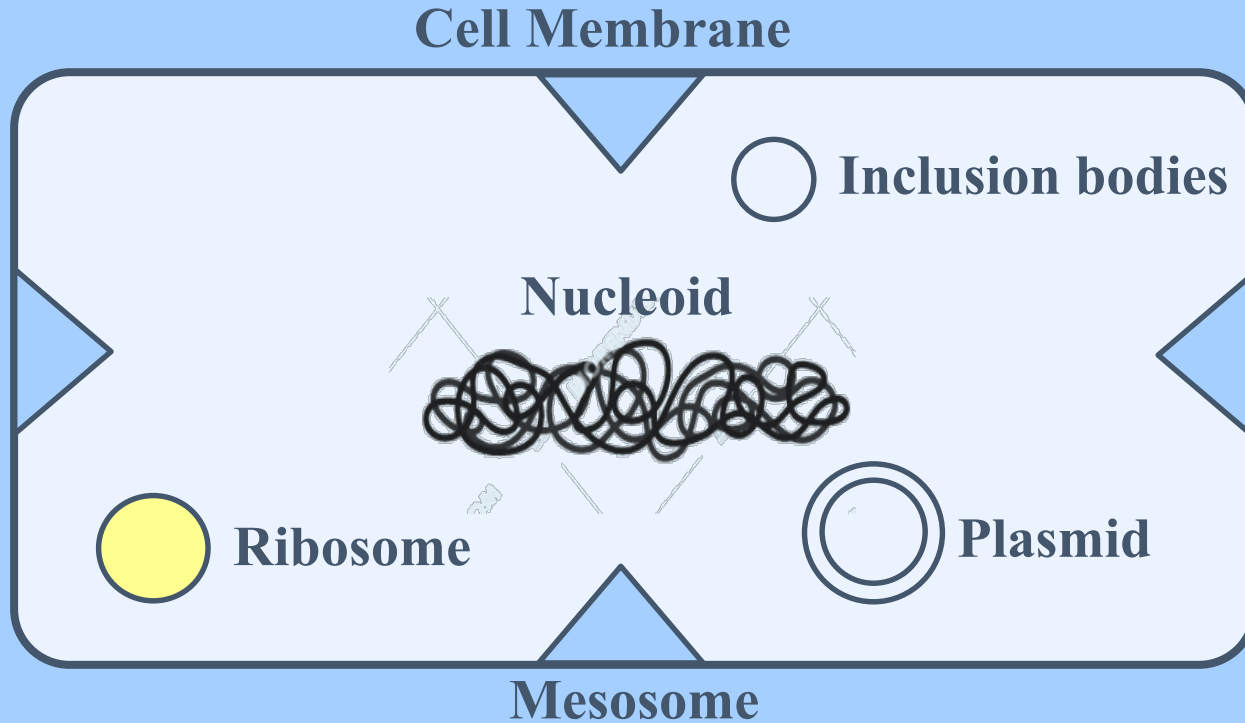
Intracytoplasmic structure

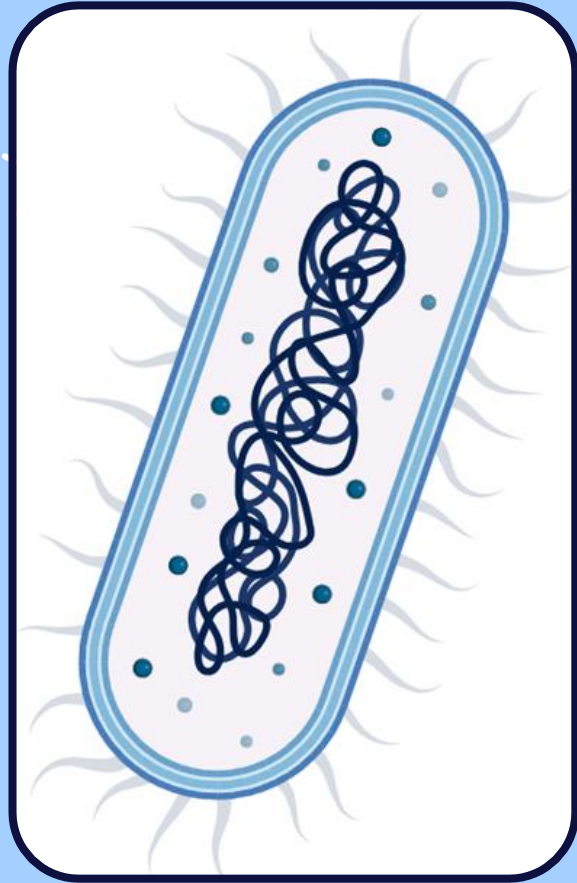
- 1) Nucleoid
- 2) Ribosome
- 3) Inclusion granules (*bodys*)
- 4) Cell membrane
- 5) Plasmid

Bacterial structure



Intracytoplasmic structure





1) Nucleoid

- 1 Single chromosome
- 2 Circular
- 3 dsDNA
- 4 1mm in length
- 5 supercoiled
- 6 Carry genetic information for growth
& survival

Essential

2) Ribosome

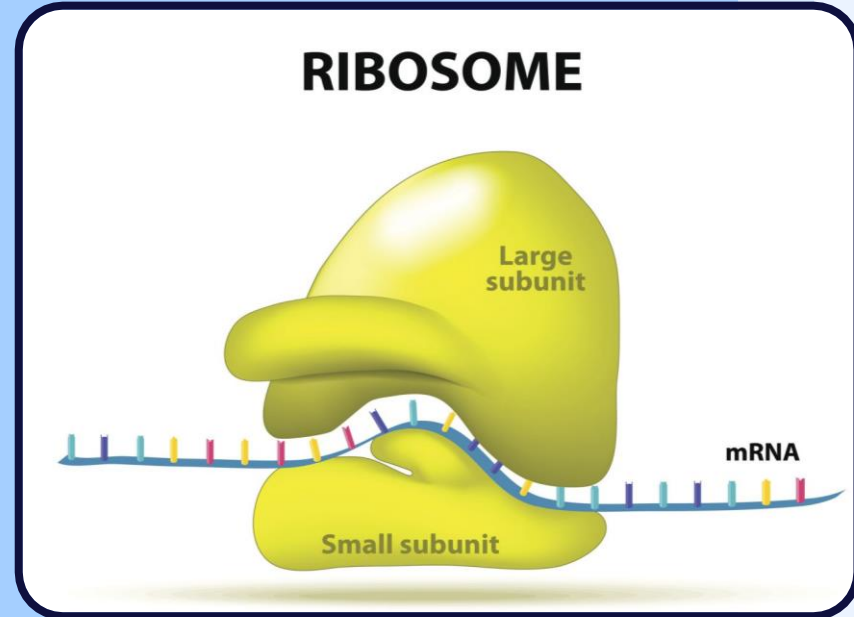
1 Ribo=RNA

2 Some=body

3 Site of Protein synthesis

Essential

→ all bacteria
have it



2) Ribosome

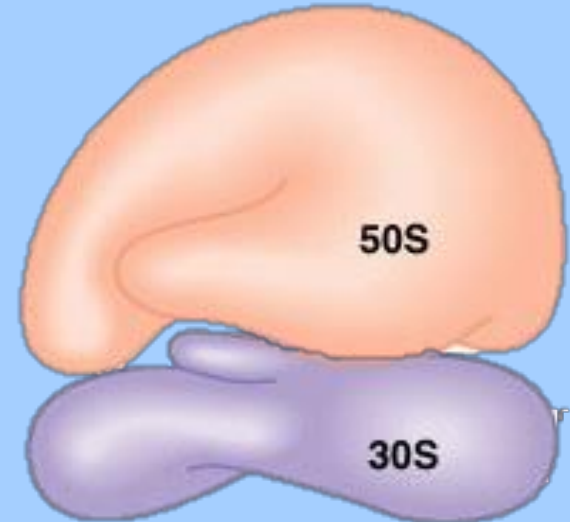
Bacterial ribosomes

(70S)

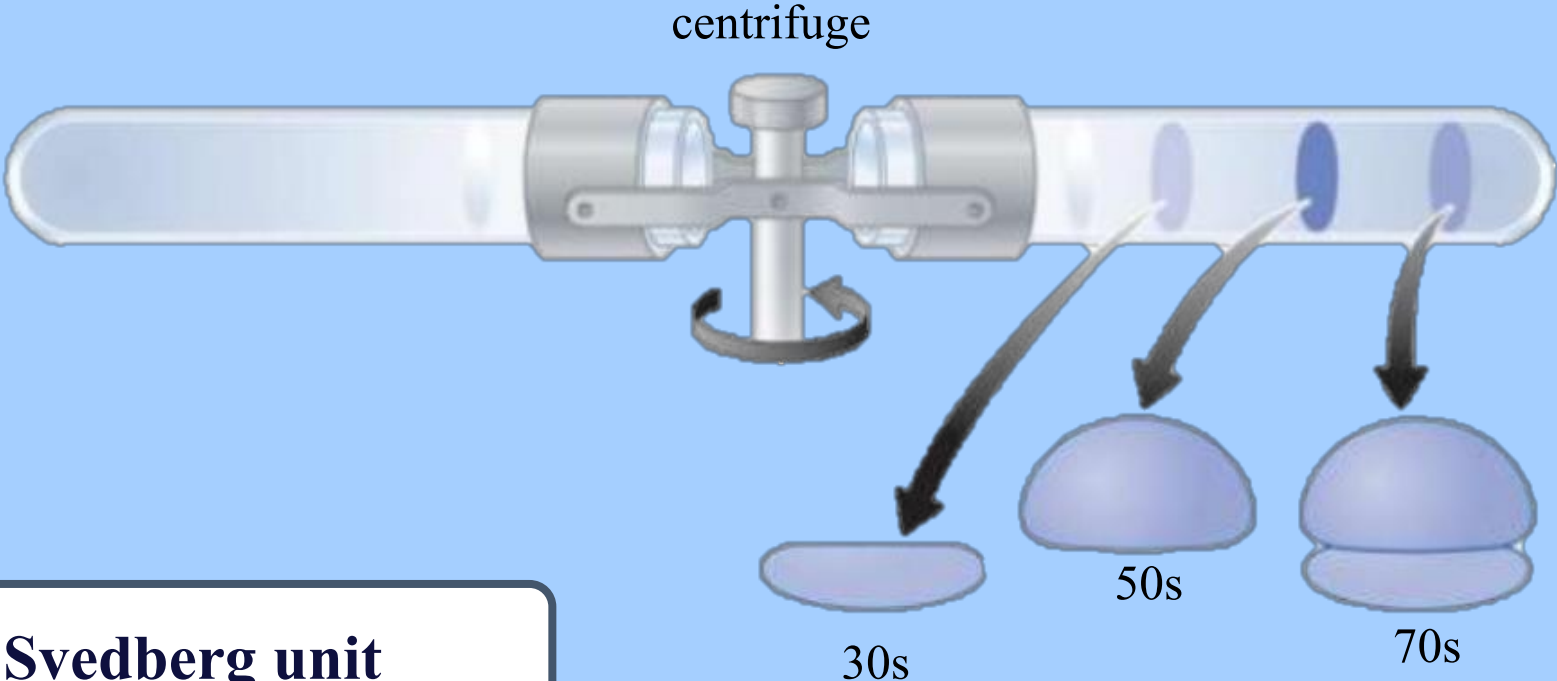
Svedberg unit

50s large subunit
30s small subunit

50s, 30s, 70s
↳ acc to densities when
centrifugated.



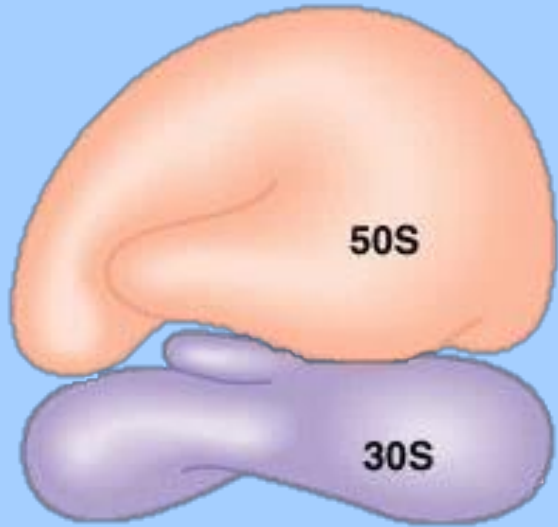
2) Ribosome



Svedberg unit

Ribosomal subunits

2) Ribosome



2) Ribosome



50S

60S

Target of antibiotics

Human

cuz diff from human ribosome



30S

40S

3) Inclusion granules

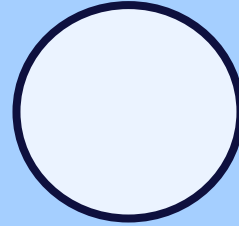
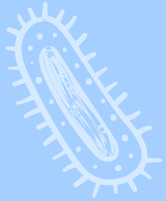
Store of nutrient

Glycogen

Starch

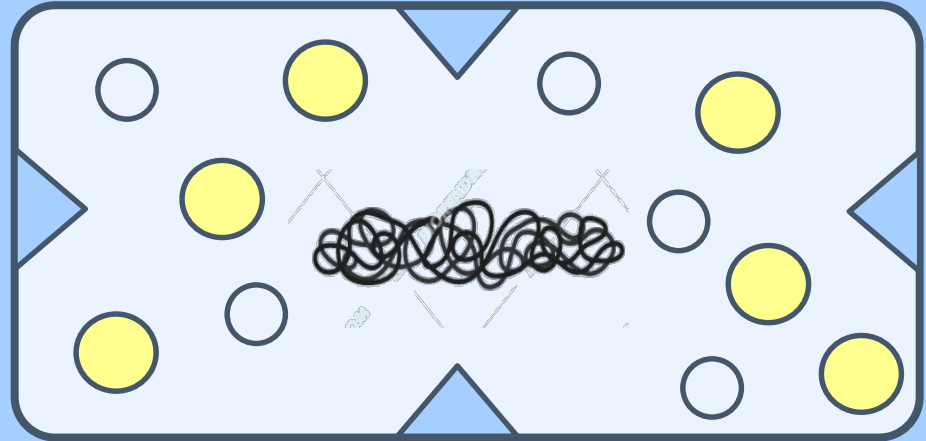
Phosphate

Volutin granule (granule for a bacteria called *Corynebacterium diphtheriae* & it mainly stores phosphate)
(Metachromatic granules)



Definition of the cell membrane

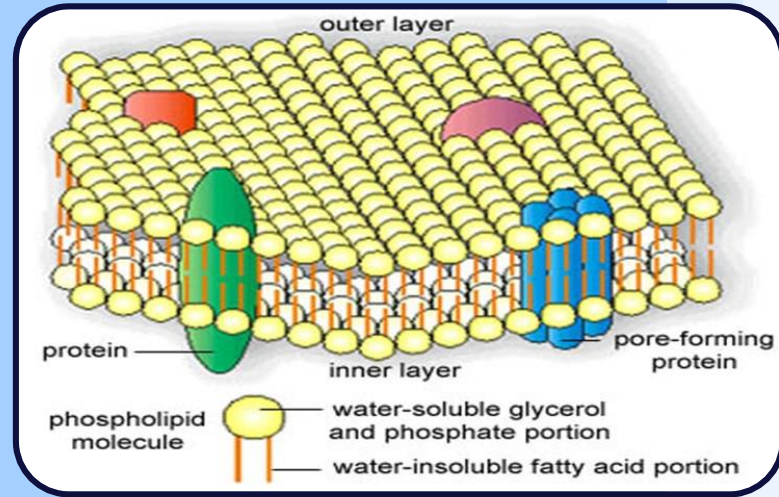
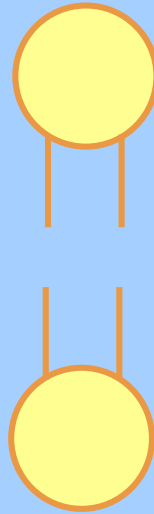
Thin, fragile membrane
located just
inside the cell wall
(under the Cell wall)



Essential

Composition of cell membrane

Phospholipid bilayer + Protein
(heads+tails) for transport
(No sterols)
except mycoplasma

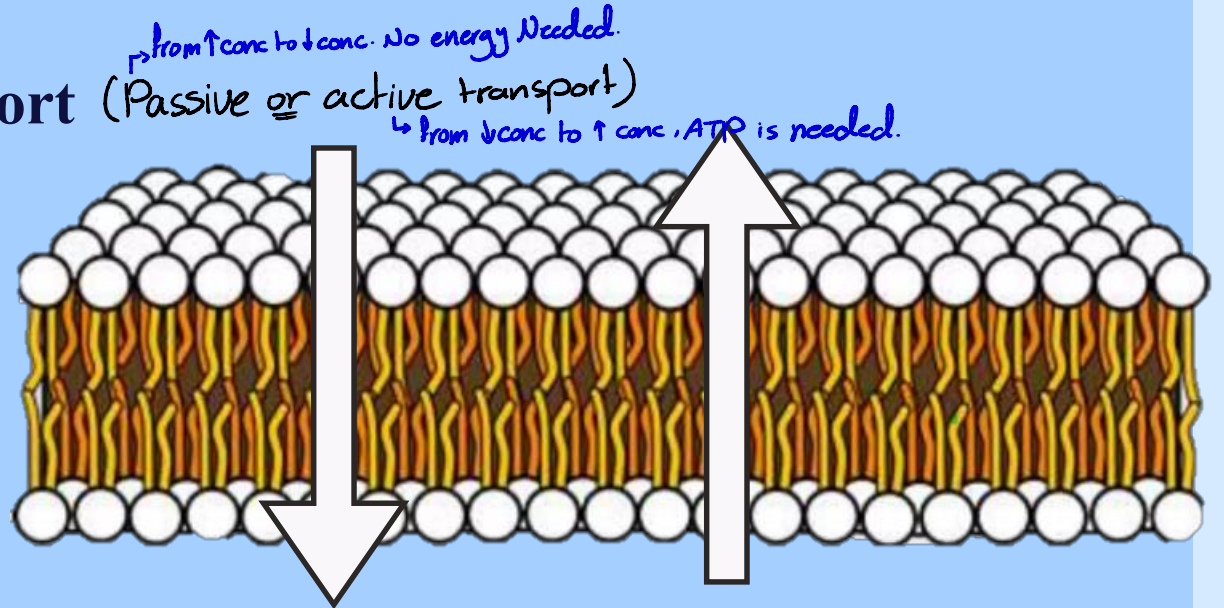


Function of the cell membrane

1

Selective transport (Passive or active transport)

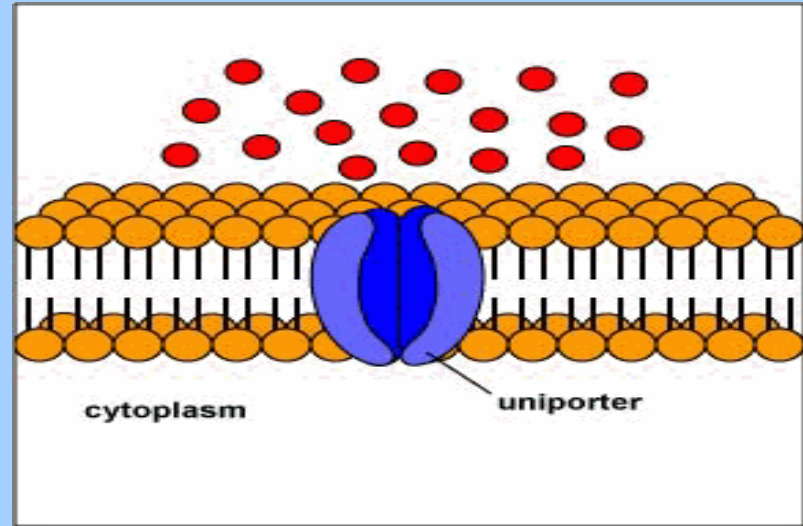
(Passive)



Function of the cell membrane

1

Selective transport (Active)



Function of the cell membrane

2

Mesosomes

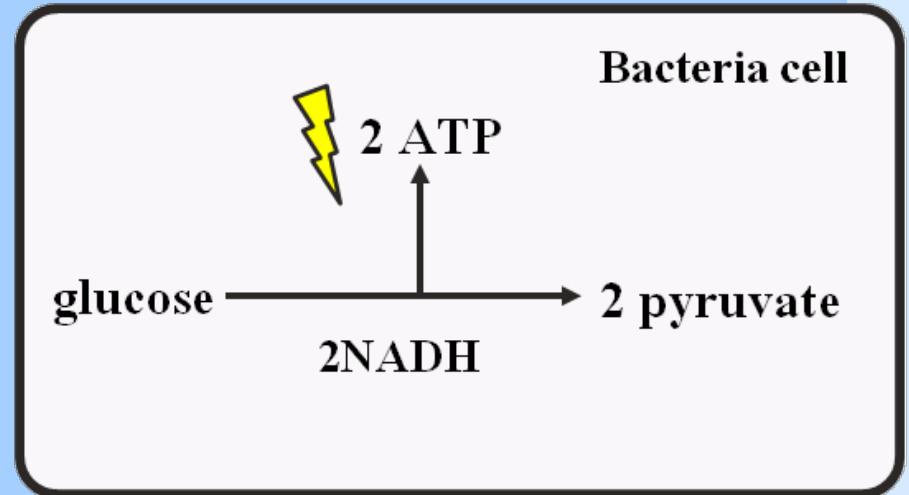
↓ contain

Respiration enzyme

↓ responsible for

(Making energy) → ATP

(Like Mitochondria)



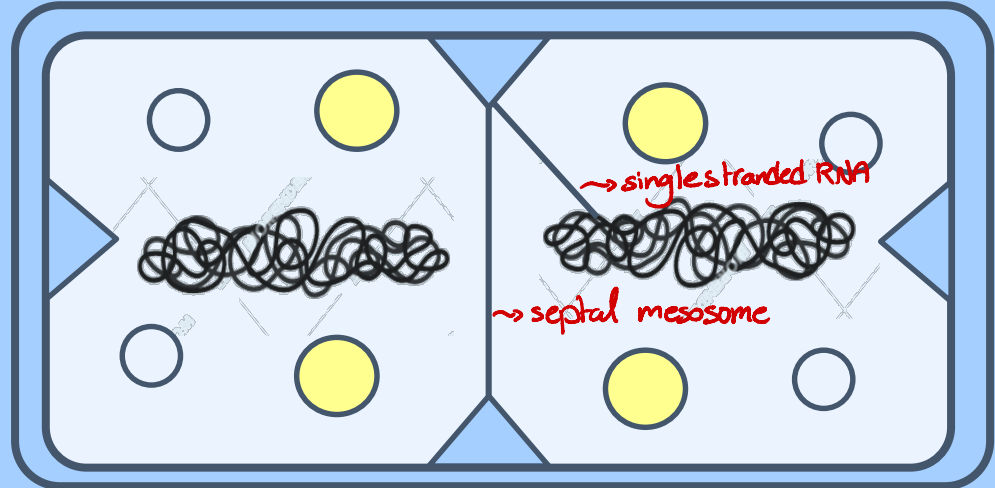
Function of the cell membrane

2

Cell division

Separate DNA *into 2 parts*

Septal mesosome

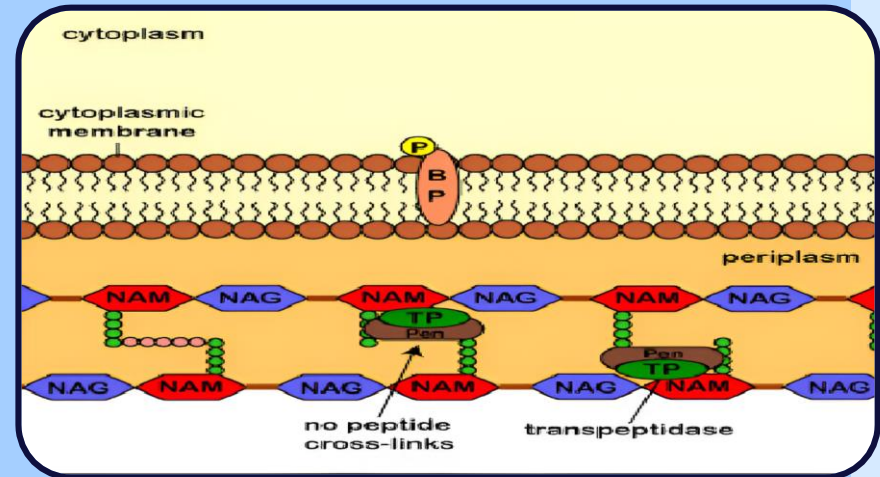


Function of the cell membrane

3

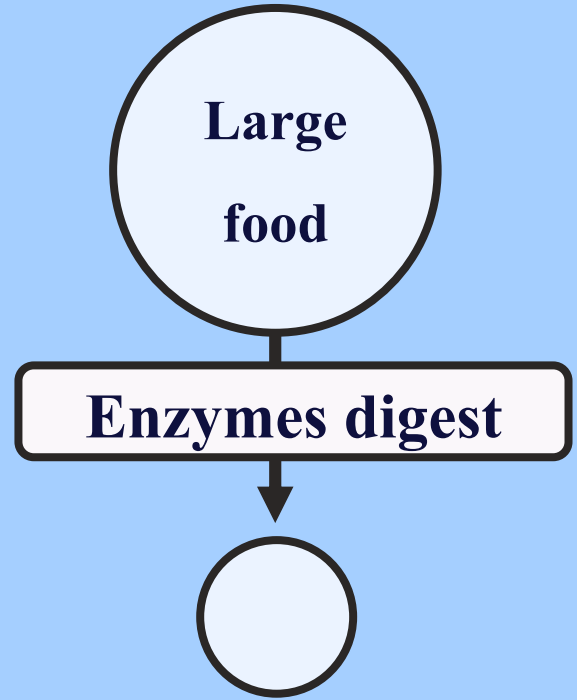
Biosynthesis of cell wall

↳ synthesize the precursors that make the cell wall



4

**Excretion of extracellular enzymes
(Hydrolytic enzymes)**



Penetrate cell membrane

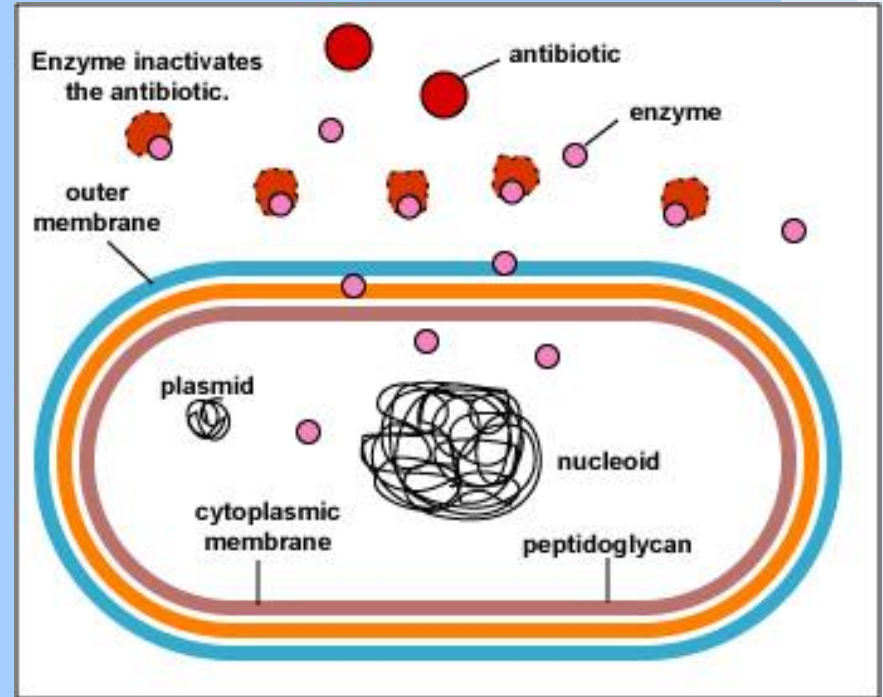
Function of the cell membrane

5

Excretion of extracellular enzymes

(Penicillinase)

↳ destroy Antibiotics that work on cell membrane protecting her self.



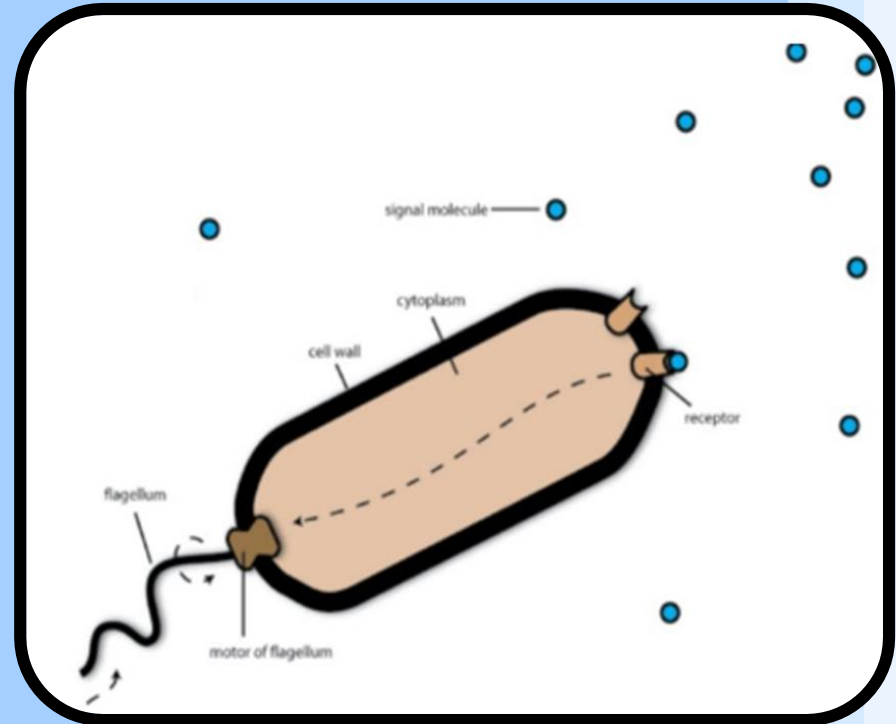
Function of the cell membrane

6

Chemotactic system

↳ for the Bacteria that has flagella

Chemotactic ⇒ Bacteria has receptors on the cell membrane
certain material come & attach to these receptors
if the material was good, the cell membrane send
signal to the flagella to go toward it
& if it was bad it send signal to the flagella
to go away from it.



Plasmid

EXTRA chromosomal dsDNA (Circular)

1 Replicate autonomously (Independent of bacterial chromosome)

2 Toxin production Drug resistance

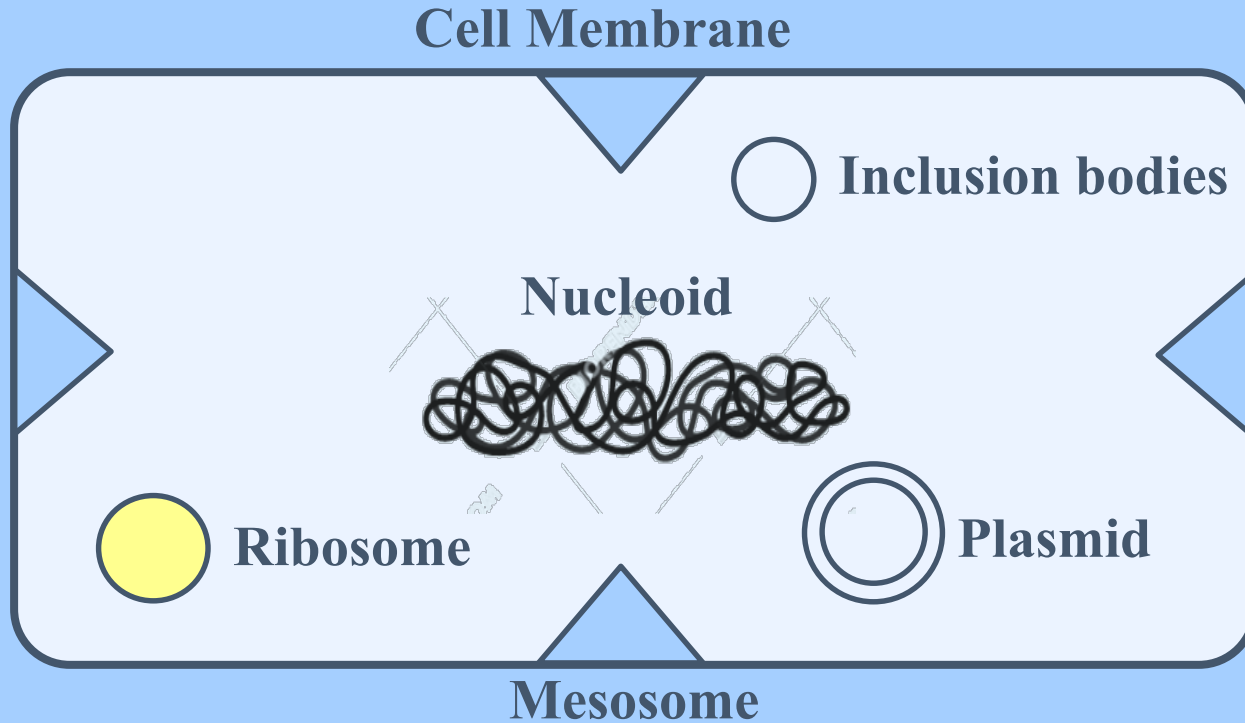
* Plasmid carries genetic material to give property to the Bacteria (toxin production & drug resistance) while the Bacterial Chromosome carries genetic material for growth & survival

Not essential



Plasmid

Intracytoplasmic structure



Objectives

Cell wall

- 1) Definition
- 2) Composition
- 3) Synthesis
- 4) Function
- 5) Cell wall Deficient

Definition of cell wall

Outermost layer!!!

*Not accurate!
cuz some types of Bacteria
have Capsules so it's not always
the outermost*

Surrounds the cell membrane

Rigid *from the peptidoglycans*

(GAGs + oligopeptides)

*repeated disacc
(NAM+NA6)*

*connected by
glycosidic bonds*

*made by transglycosidase
enzyme.*

*↳ bound to NAM sugar
the bond made by
transpeptidase enzyme*



The diagram shows a cross-section of a cell wall and membrane. It consists of three concentric layers: an outermost thick layer (the cell wall), a middle layer (the cell membrane), and an innermost thin layer (the cytoplasmic membrane). The text 'Cell membrane' is written in the middle layer.

Cell membrane

Composition of cell wall

Rigidity
(Peptidoglycan)

Cell membrane

Composition

N-acetylmuramic acid

Glycans

NAM

NAG

N-acetylglucosamine

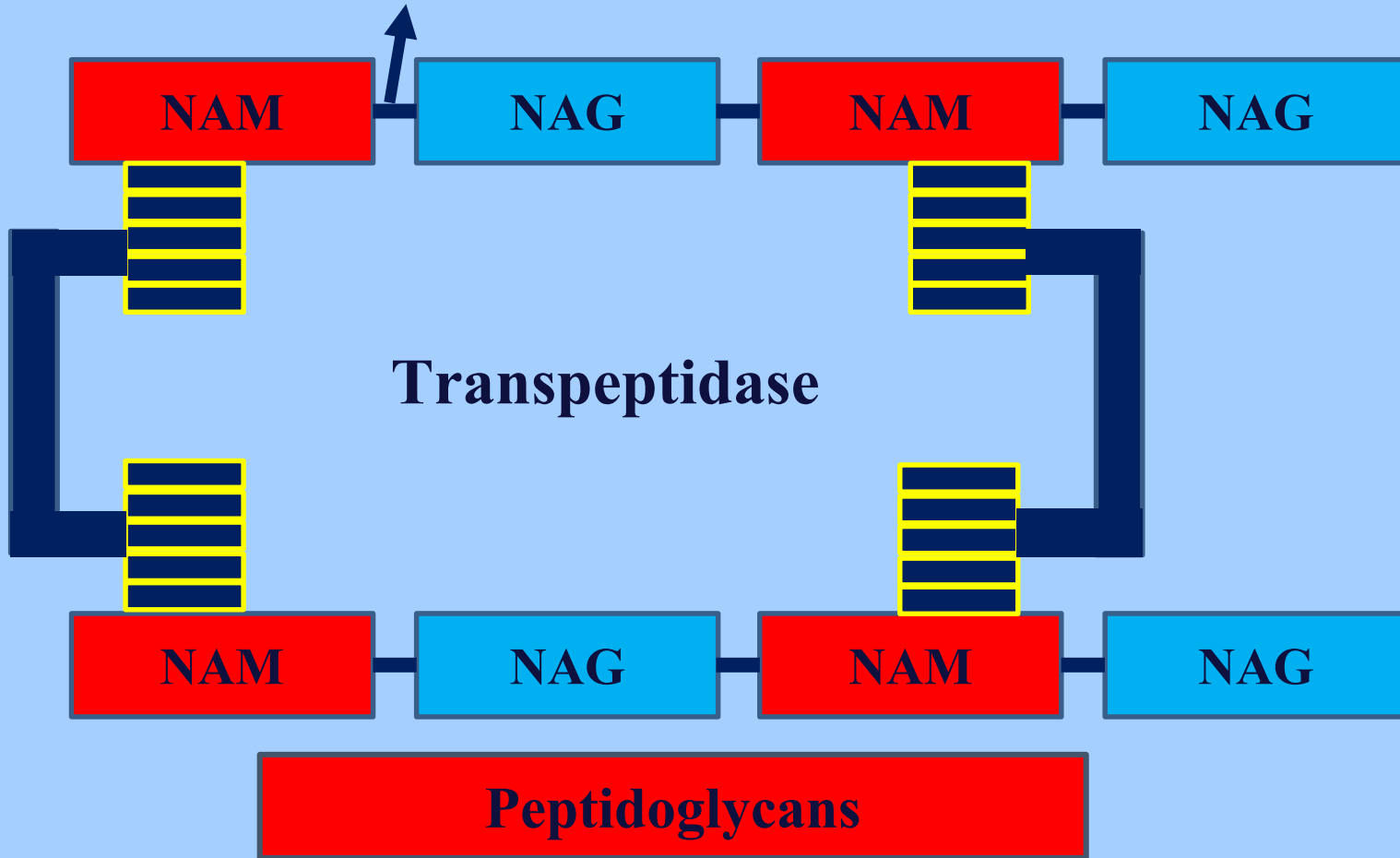
Peptido

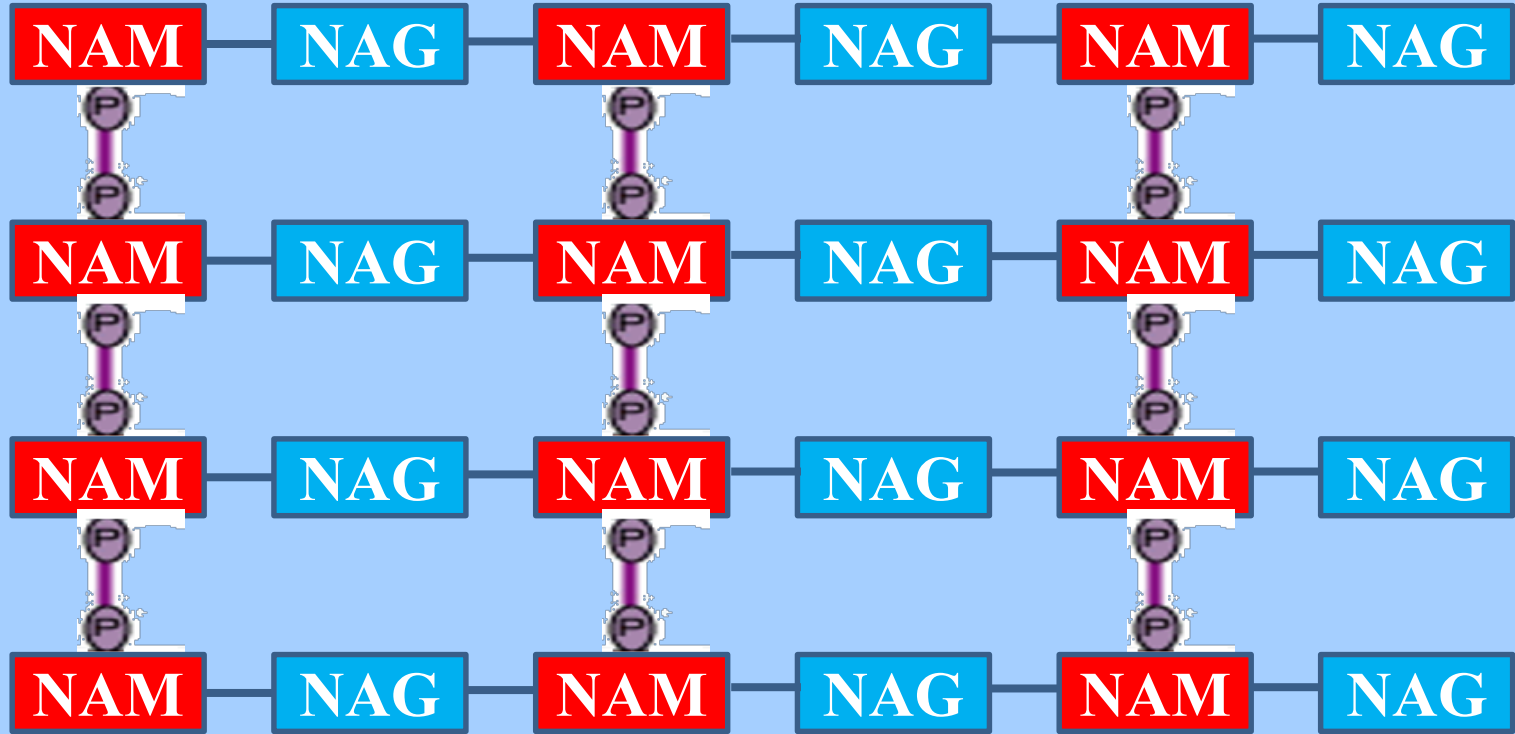
Peptide chain

→ tetra, penta

Peptidoglycans

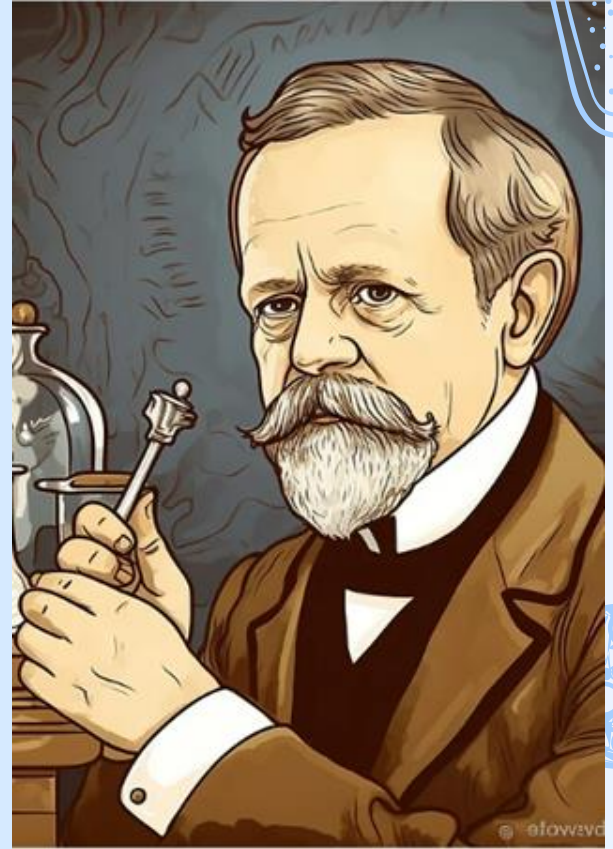
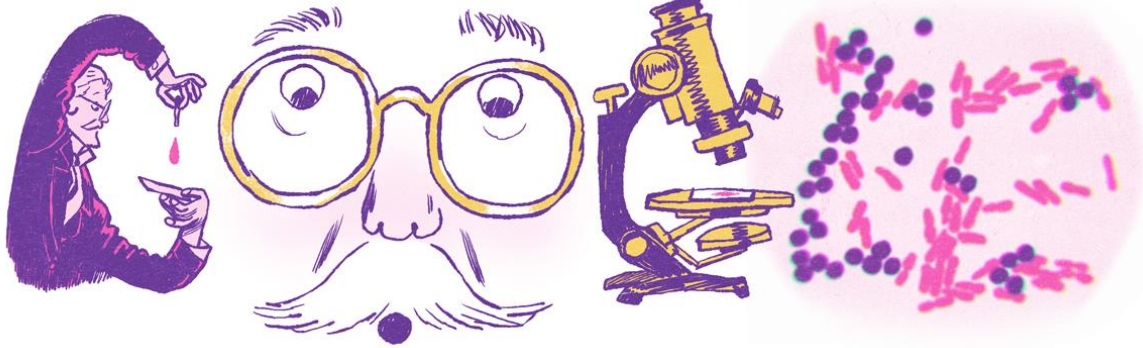
Glycosidic bond (Transglycosidase) Alternating repeating unit





Gram scientist

↳ made The Gram Stain



Types \leadsto Gram positive/negative bacteria

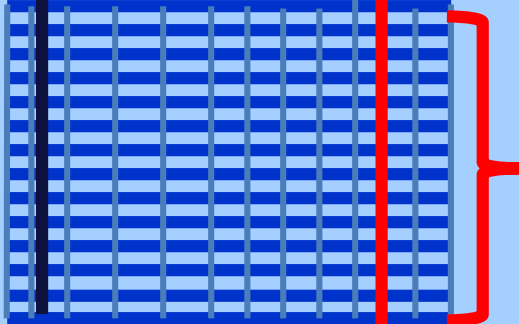
depending on differences in components of cell wall

Protein
Teichoic acid

linked with peptidoglycans

Lipoteichoic acid

linked with cell membrane lipid

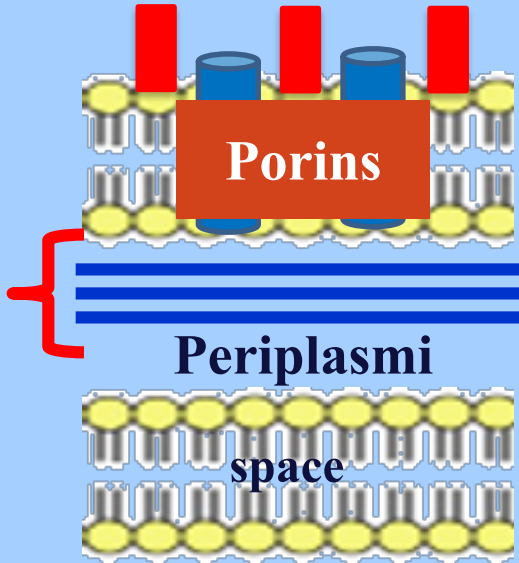


Peptidoglycan

G+ve

Outer membrane *Above peptidoglycans*

(Lipopolysaccharides)



Periplasmic space

G-ve

Gram positive bacteria

1) Peptidoglycan

(50%)

NAM-NAG

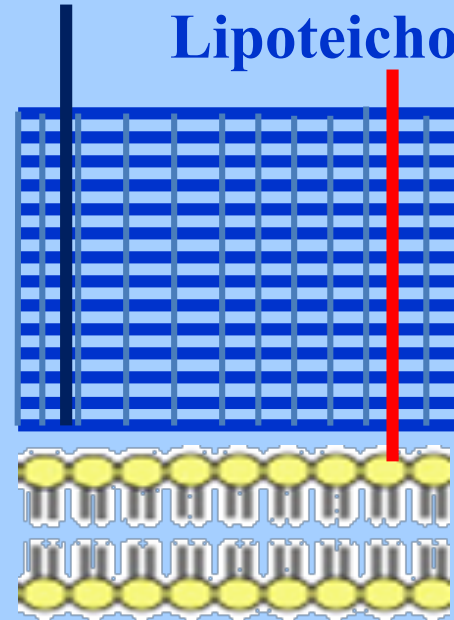


Peptide

Porous

Teichoic acid

Lipoteichoic acid



G+ve

Composition of Gram positive

Polymers of glycerol or

Rbitol

2) Teichoic acid

Lipoteichoic acid

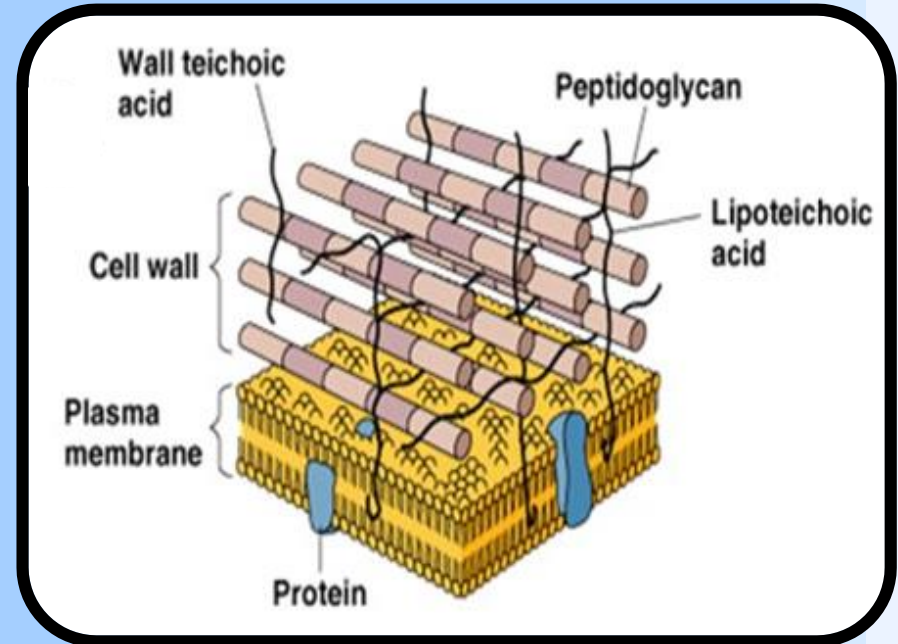
linked with

(Cell membrane)

Teichoic acid

linked with

(Cell wall)



Composition of Gram positive

Major surface Ag of G+ve (teichoic acid)
antigen

2) Teichoic acid

Highly

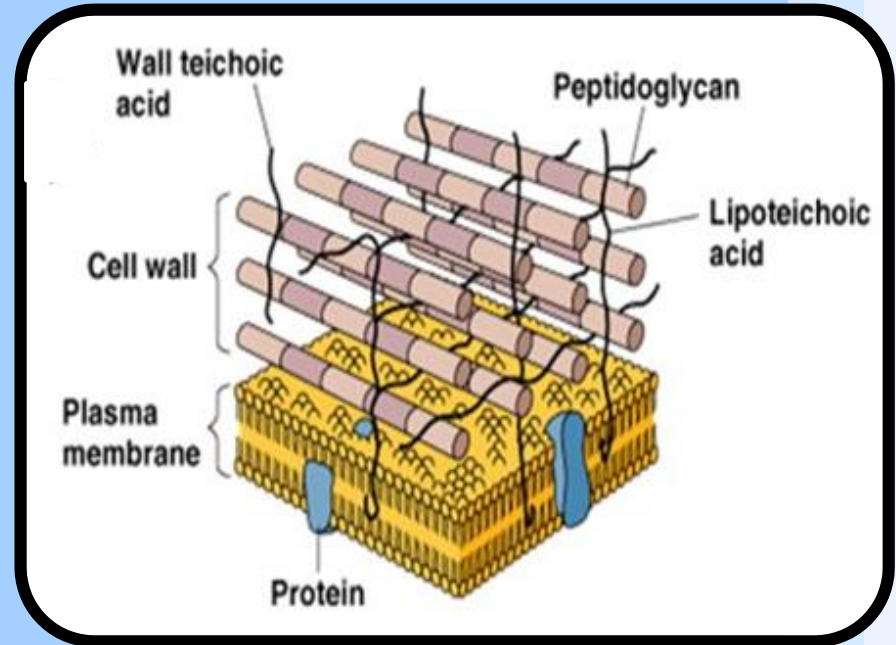
immunogenic (causes immune response if entered Body causes the Body to release cytokines)

TNF- α Tumor Necrosis Factor- α

IL-1
IL-6

IL-1 interlukin-1

responsible for Toxic Shock



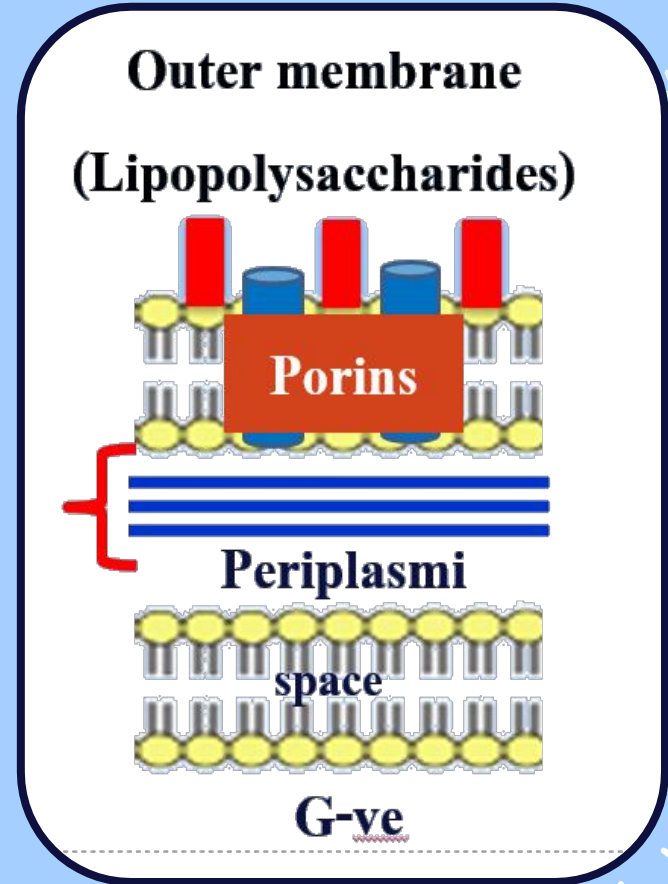
Composition of Gram Negative

1) Peptidoglycan

A thin layer (5%)

2 sheets of
(NAM & NAG)

Peptides



Outer membrane

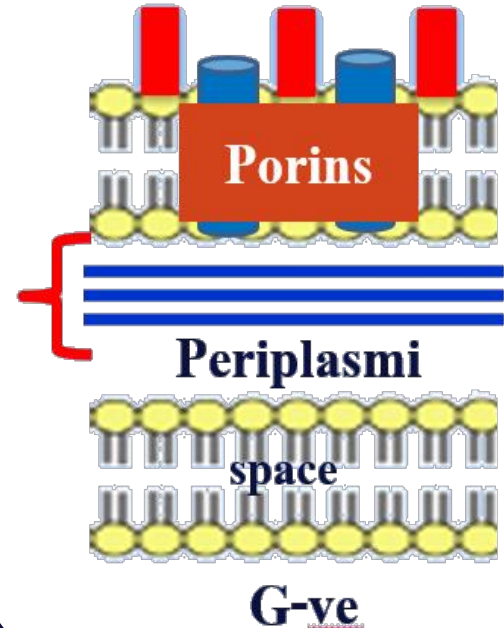
A) Bilayer phospholipids

B) Lipopolysaccharides

Lipid A
(Endotoxin)

Polysaccharides
(somatic O Ag)

Outer membrane
(Lipopolysaccharides)



Outer membrane

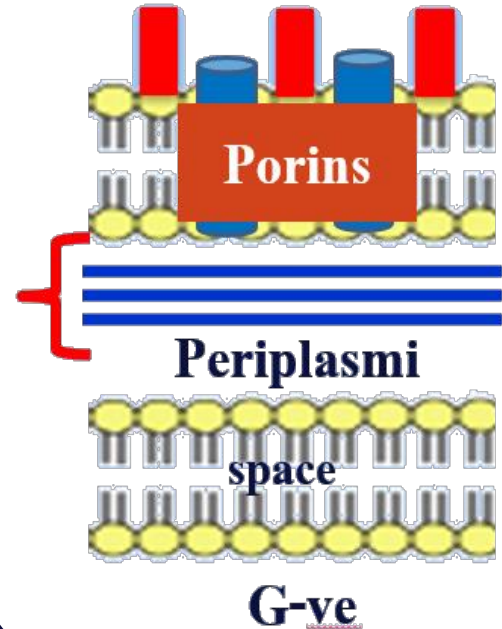
C) Porins

(hydrophilic Protein)

in the outer membrane

used for (Transportation)

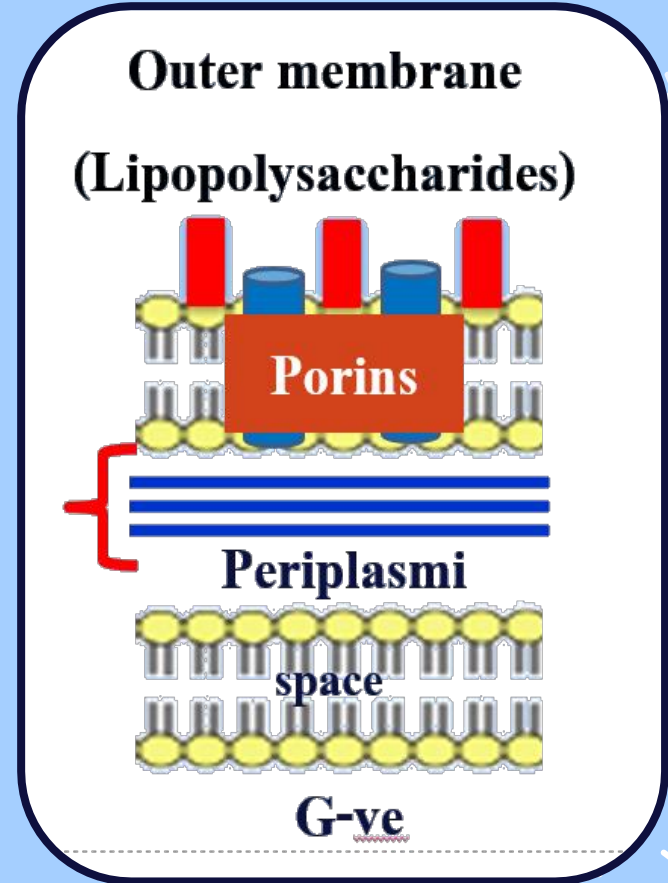
Outer membrane
(Lipopolysaccharides)



Periplasmic space

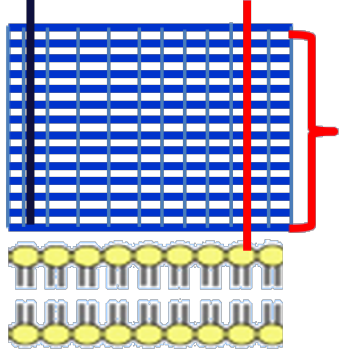
Space between cytoplasmic &
outer membrane

composed of → ¹Peptidoglycan layer &
²gel-like protein



Gram positive/Negative bacteria

Teichoic acid
Lipoteichoic acid



G+ve

1) Peptidoglycan

Thick

2) Teichoic acid/

Lipoteichoic acid

Yes

3) Outer membrane

No

1) Peptidoglycan

Thin

2) Teichoic acid/

Lipoteichoic acid

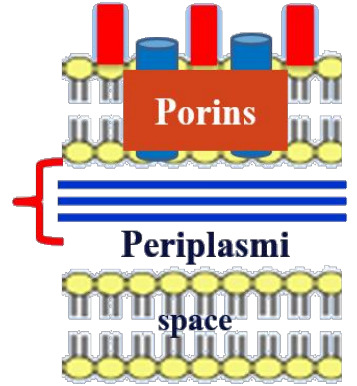
No

3) Outer membrane

Yes

Outer membrane

(Lipopolysaccharides)

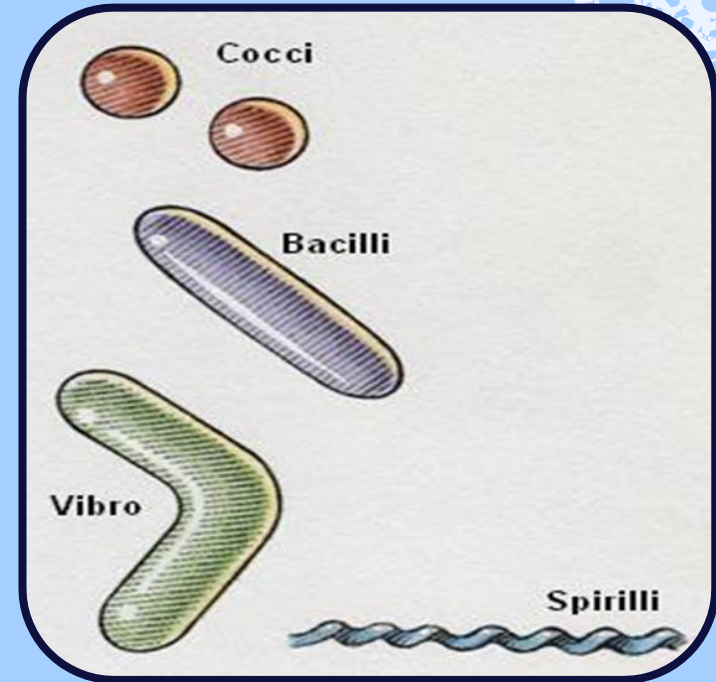


G-ve

Function of cell wall

1

**Maintenance of the
shape (Rigid)**



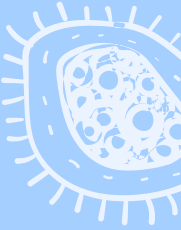
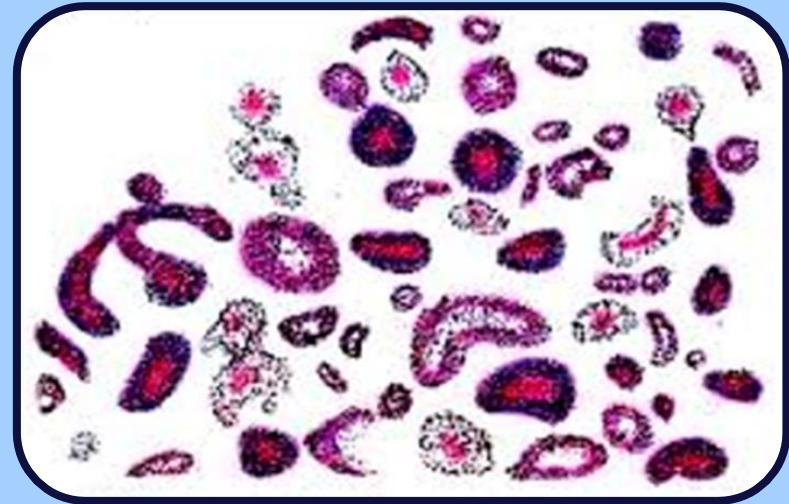
Function of cell wall

1

Deficient of cell wall

ex mycoplasma

(more than one shape)
Polymorphic



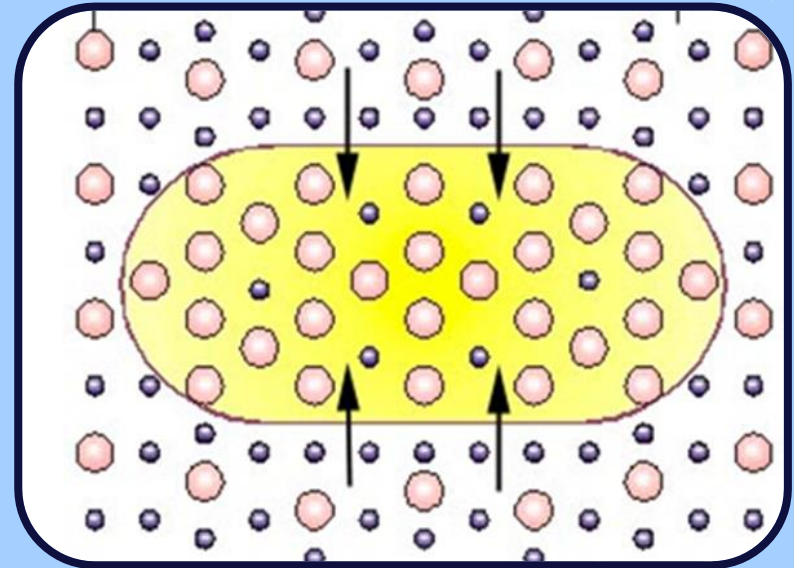
Function of cell wall

2

Protection

(Osmosis insensitive)

*Cell won't rupture in ↑ water
got inside cuz of the availability
of cell wall*



Function of cell wall

3

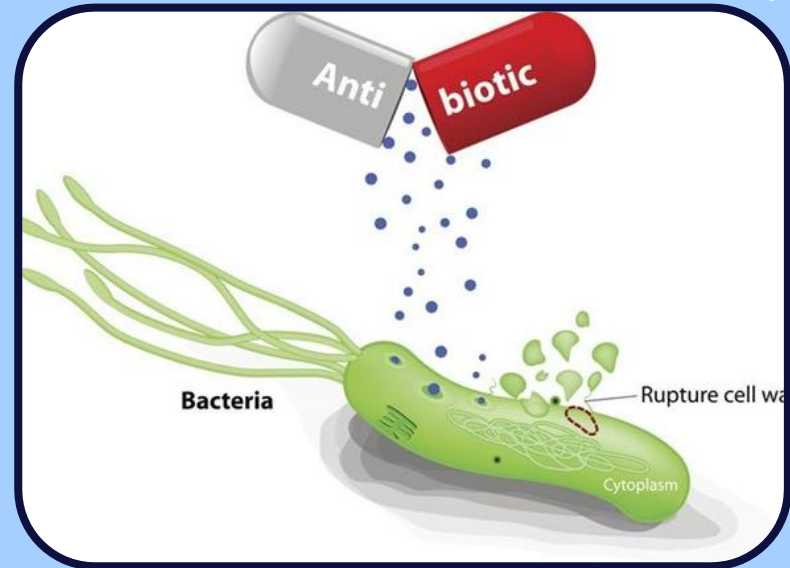
Target site for antibiotics

ex of Antibiotics:

-Penicillin

-Cephalosporines

work on Cell wall

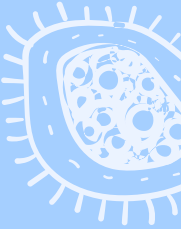
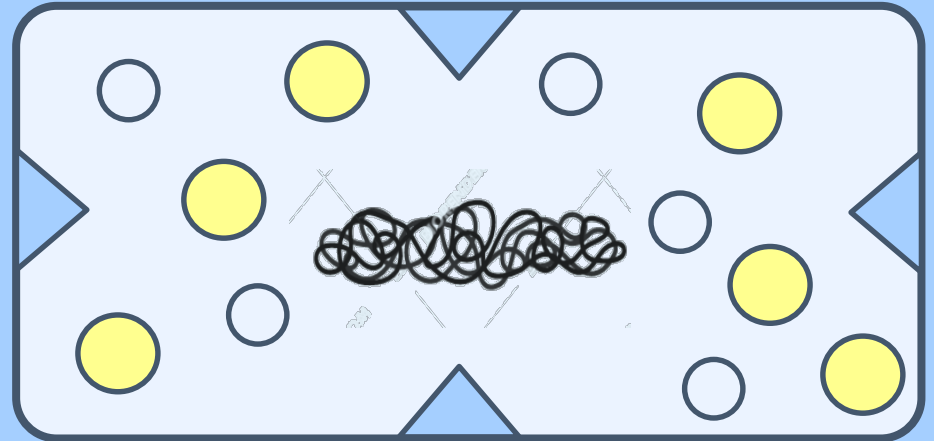


Function of cell wall

4

Role in cell division

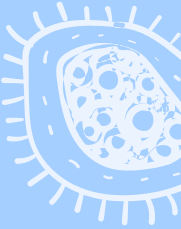
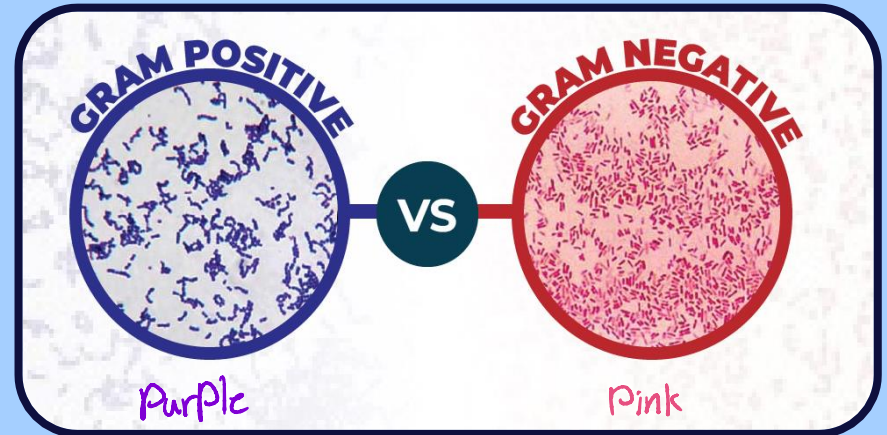
will be explained with growth lec



Function of cell wall

5

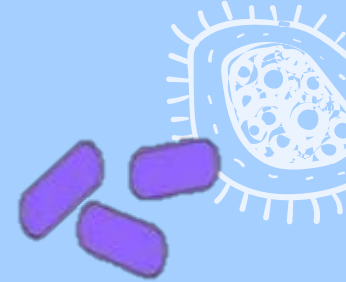
Responsible
for staining



Function of cell wall

Responsible for staining using 4 stains

G+ve



Fixation

Crystal

Iodine

Acetone

Counter

violet

for color fixation

for decolorisation

stain

Purple color

↳ make crystal violet-iodine complex

Safranin stain → will stain the G-ve Pink.

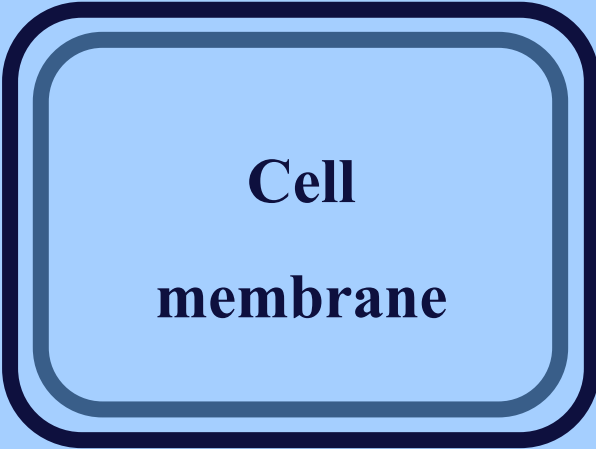


G-ve

↳ at this point
G+ will be purple cuz it has thick cell wall so it can't be decolorized
G- will be colorless.

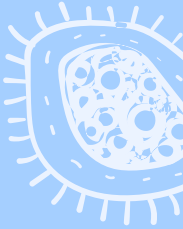
Cell wall Deficient

**Bacteria without cell
wall**



**Cell
membrane**

The diagram shows a rounded rectangular shape with a double-line border, representing a cell membrane. The text 'Cell membrane' is centered within this shape.



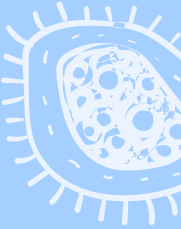
Cell wall Deficient

1) Naturally

**Mycoplasma
(Sterol)**

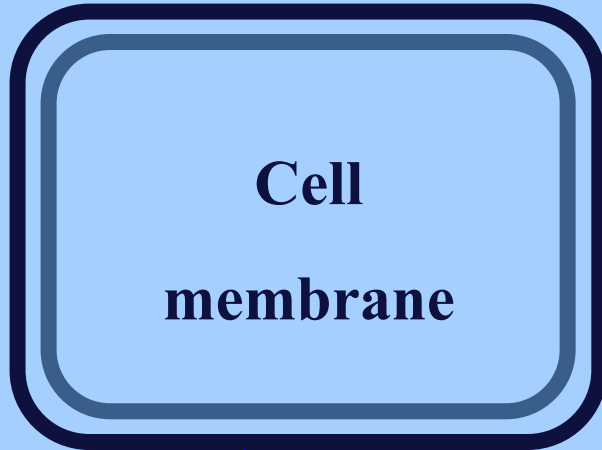
2) Induced

**-Cell wall inhibitors
-Lysozyme**



2) Induced

Completely

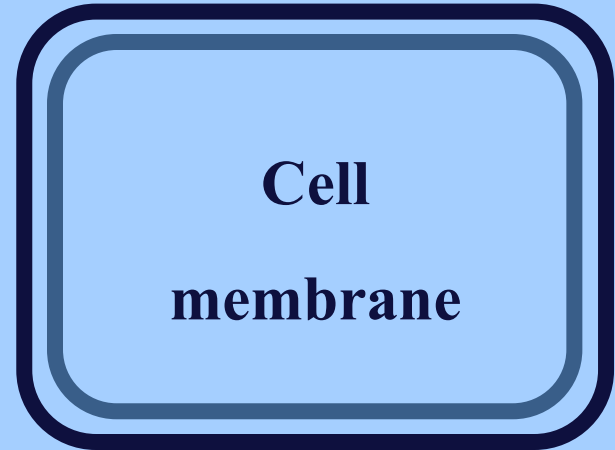


**Cell
membrane**

↳ named if it were gram +ve
Protoplast (+ve)

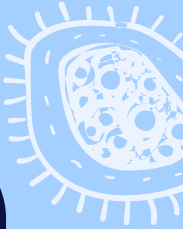
↳ named if it were gram -ve
Spheroplast (-ve)

Partially



**Cell
membrane**

L-form bacteria



L-form & Mycoplasma

Resist to Penicillin & Cephalosporines

*cuz they don't have cell wall
& these Antibiotics work on cell
wall so they resist.*

