TOPIC: PROKARYOTIC CELL STRUCTURE

Introduction to Bacterial Cell Walls

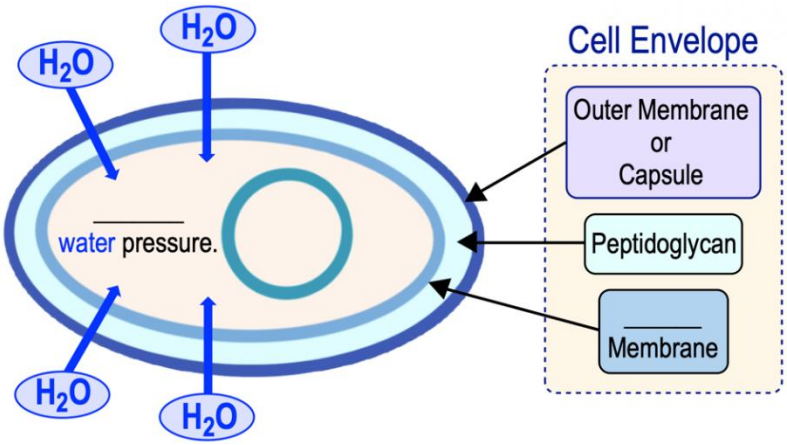
●Water pressure _____ a bacterial cell is typically *higher* than its surroundings.

□ Requires the cell to have a _____ layer around it.

●**Cell Wall:** semi-rigid structural layer located on the _____ of the *cell membrane* & is part of the *cell envelope.*

□ **Cell** _____**:** collection of the *cell wall, cell membrane* & *outer membrane* (if present).

EXAMPLE: The cell wall protects the cell from rupturing from high water pressure.



PRACTICE: Which is (are) true concerning the cell wall of prokaryotes?

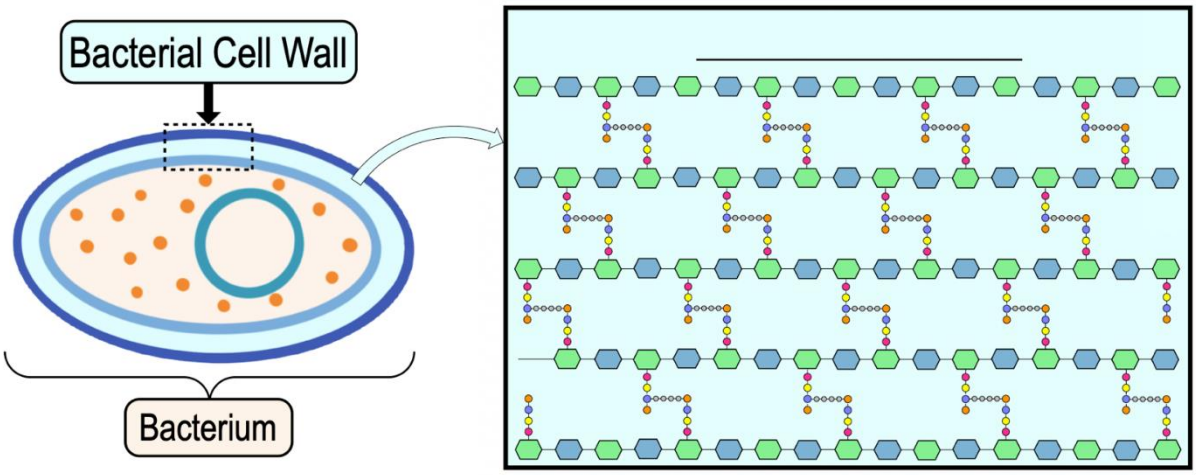
a) It determines the shape of the bacteria.
b) It is part of the cell envelope.
c) It prevents the bacteria from bursting.
d) All of the choices are true.

Peptidoglycan

●**Peptidoglycan:** a rigid, mesh-like *polysaccharide* & *protein* mix that is the main component of _____ cell walls.

□ Provides _____ support (or maintains *rigidity*) for the cell.

EXAMPLE: Peptidoglycan is the primary structural component of the cell wall.



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PRACTICE: The peptidoglycan molecule is responsible for the:

a) Entry and exit of molecules into and from the cell.
b) Flexibility of the cytoplasmic membrane.
c) Motility of the bacterial cell.
d) Genetic characteristics of the bacterial cell.
e) Semi-rigid cell wall structure of prokaryotes.

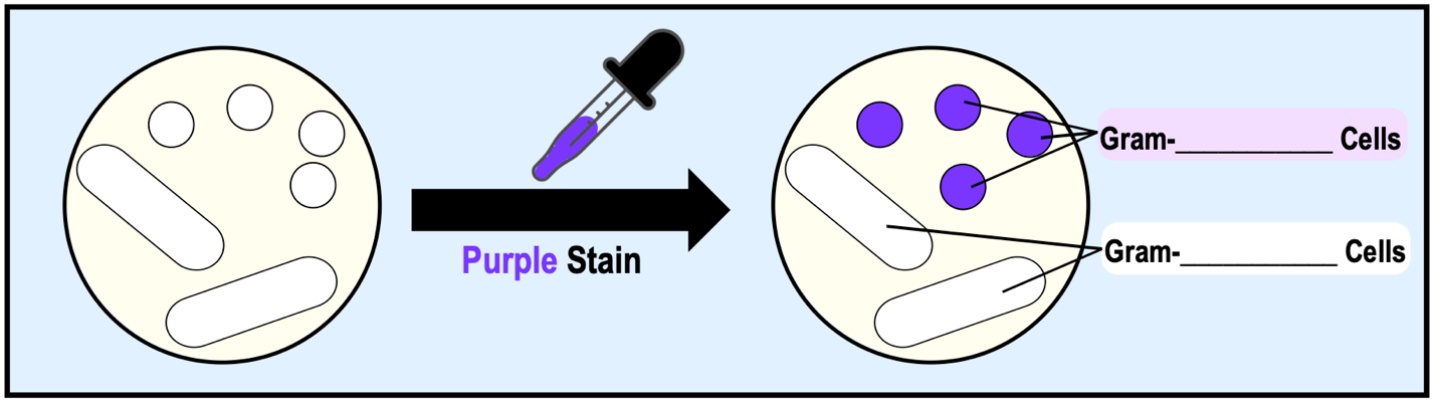
Gram-Positive & Gram-Negative Bacteria

●Bacterial cells are categorized based on whether or not they take up the _____ stain.

□ **Gram Stain** *differentiates* bacteria based on differences in their *cell* _____.

●*Gram-positive* bacteria _____ the stain; HOWEVER, *gram-negative* bacteria do _____ absorb the stain.

EXAMPLE: The Gram Stain differentiates Gram Positive & Gram-Negative bacteria.



PRACTICE: The Gram stain works because of differences in the _____ of bacteria.

a) Genetic characteristics.
b) Cell membranes.
c) Cell walls.
d) Capsules.

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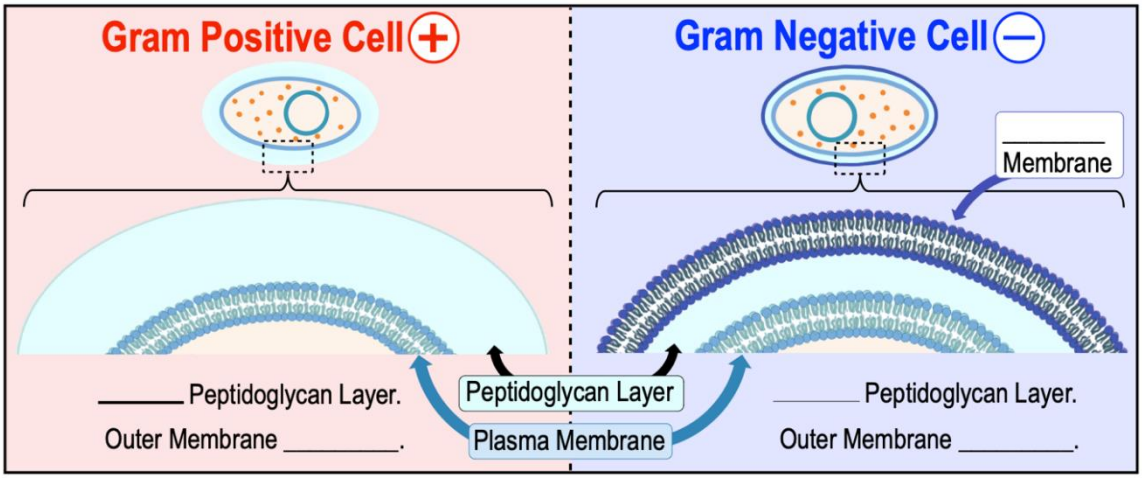
Types of Bacterial Cell Walls

●The two types of bacterial cells are grouped by the structure of their cell walls:

1) **Gram-Positive Bacteria:** have a _____ peptidoglycan layer.

2) **Gram-Negative Bacteria:** only have a _____ peptidoglycan layer & a complex *outer membrane*.

EXAMPLE: Gram positive vs. Gram negative cell walls.



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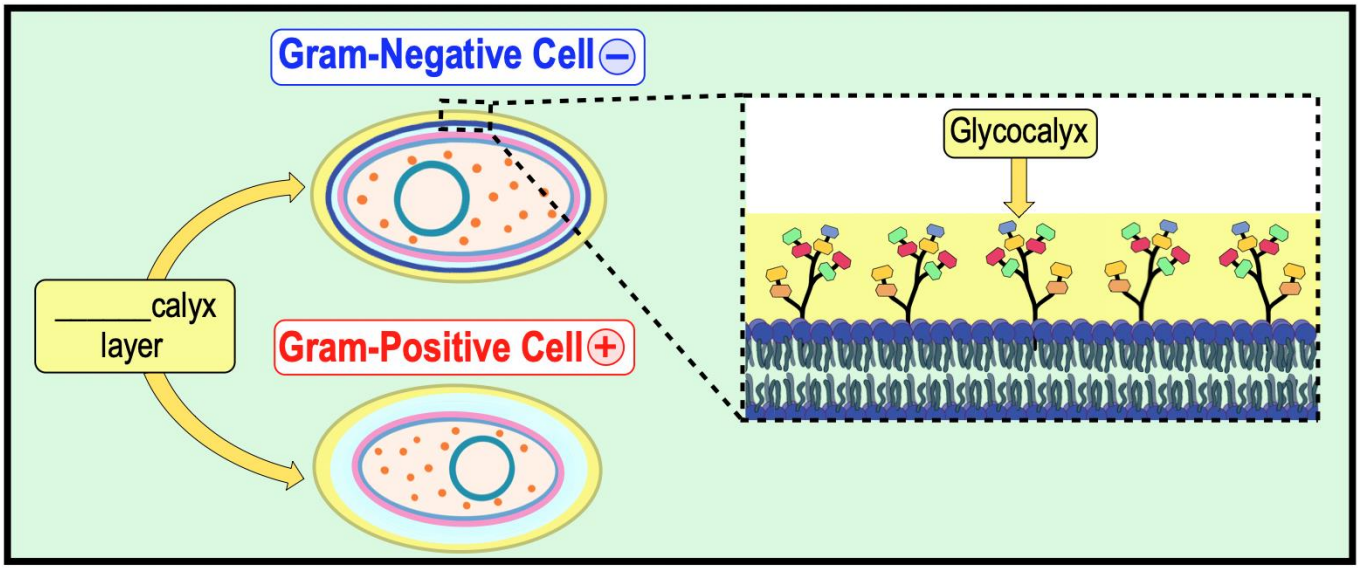
The Glycocalyx: Capsules & Slime Layers

●Most bacteria are surrounded by a layer of a *sticky gel-like* substance called the _____.

Glycocalyx: a complex poly_____ layer surrounding the outside of a cell.

□ Promotes _____ of cells to solid surfaces & to other cells.

□ _____ the cell from dehydration & can collect nutrients from the environment for energy.



●There are different categories of the glycocalyx based on the _____ of its structure.

PRACTICE: What is the function of the glycocalyx in bacterial cells?

a) Attachment of cells to surfaces and other cells.
b) Protein synthesis.
c) Phagocytosis of other cells.
d) DNA replication.

PRACTICE: _____ is the slime-like layer of polysaccharides on the outer surface of bacterial cells.

a) The outer membrane.
b) The cytoplasm.
c) The glycocalyx.
d) The periplasm.
e) The S-layer.

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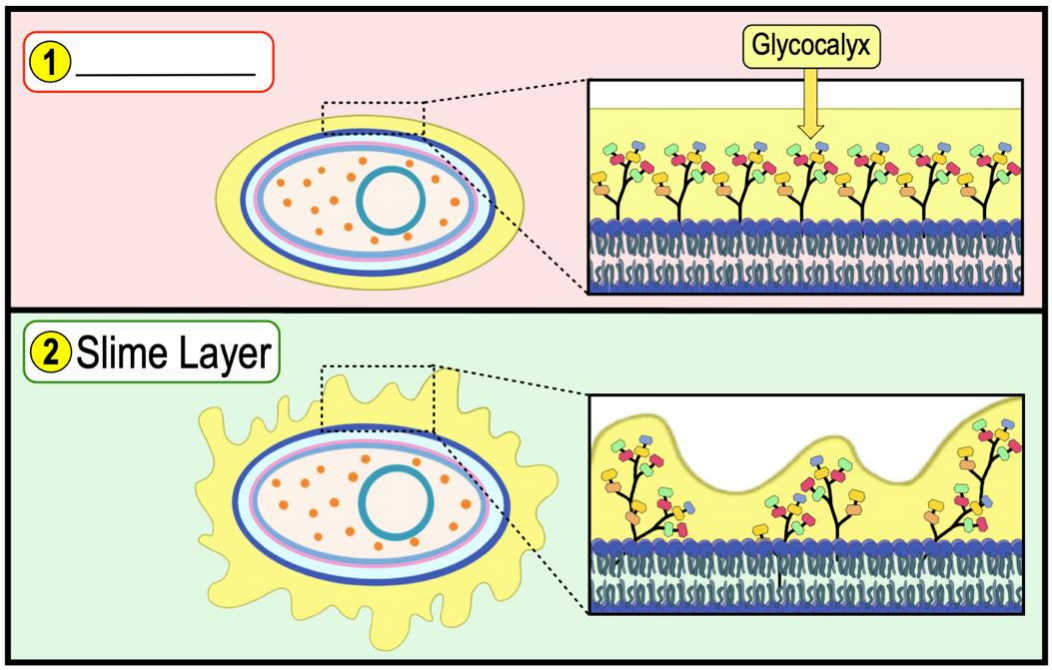
Capsules vs. Slime Layers

●There are ____ categories of the *glycocalyx*:

1) Capsules: highly organized & dense layer of polysaccharides _____ anchored to the cell.

2) _____ **Layers:** *unorganized* layer of polysaccharides easily removable from the cell.



●The *glycocalyx* is important for the formation of _____.

PRACTICE: _____ are an organized layer of polysaccharides tightly anchored to the cell wall.

a) Capsules.
b) Periplasms.
c) Slime-layers.
d) Teichoic acids.
e) Lipopolysaccharides.

PRACTICE: Which of the following is not a function of slime layers and capsules:

a) Protection against dehydration.
b) Collect nutrients from its surroundings.
c) Attachment to other cells & solid surfaces.
d) Anchors the outer membrane to peptidoglycan.

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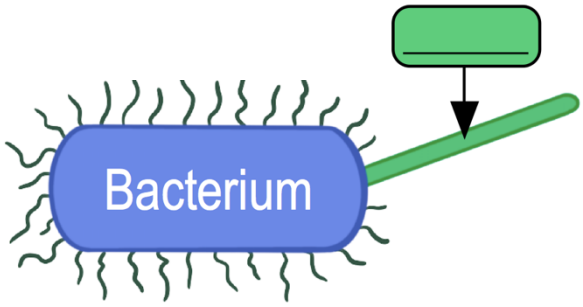
Pili

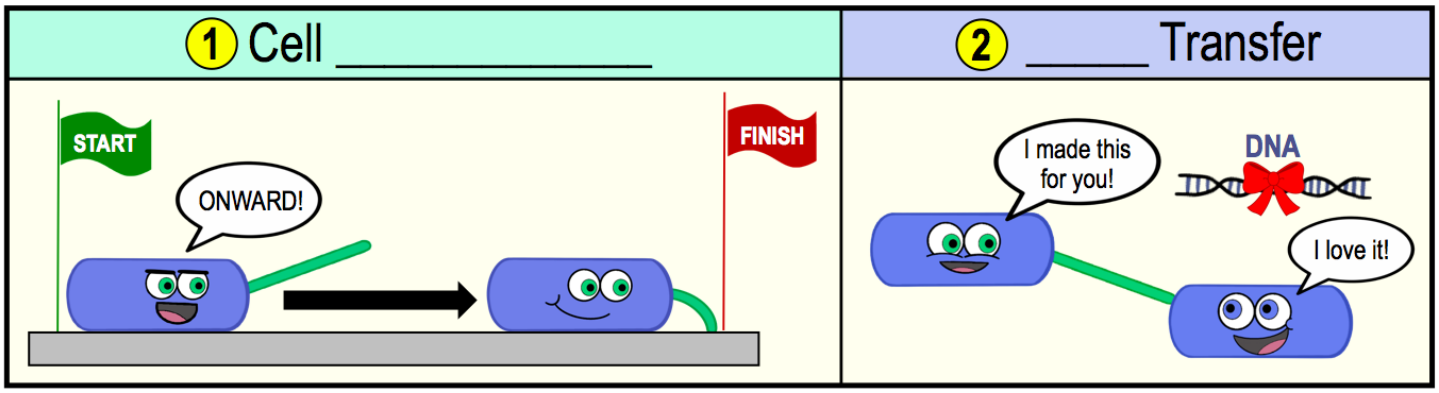
●The surface of bacterial cells can have relatively _____, *filamentous* protein structures called *pili.*

□ **Pili (***singular* **Pilus):** protein filaments that _____ from the cell surface & can have varied functions.



Functions of Pili

●Pili typically number in only 1-2 per cell & generally have _____ primary functions:



●**Motility:** the ability of an organism to _____.

PRACTICE: Which of these are true about pili?

a) Pili are short filaments of pilin on the surface of bacterial cells that allow neighboring cells to adhere to one another.
b) Pili allow cells to "crawl" across a surface.
c) Pili are short filaments on the surface of archaea cells that allow neighboring cells to adhere to one another.
d) Pili allow cells to share genetic information through a process called DNA transfer or conjugation.
e) A and B.
f) B and C.
g) A and C.
h) B and D.

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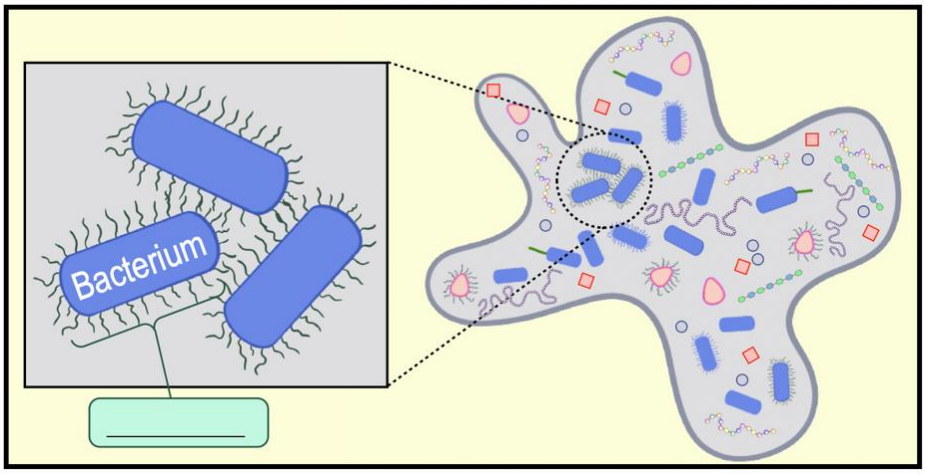
Fimbriae

●**Fimbriae:** filaments of *pilin* protein that are _____ than pili & extend from the cell surface.

□ Function to adhere cells to one another or to surfaces & are involved in formation of _____.

EXAMPLE: Fimbriae adhere to each other connecting cells in a biofilm.



PRACTICE: The presence of fimbriae on a bacterial cell is most likely to have a critical role in

a) Conjugation. b) Chemotaxis. c) Biofilm formation. d) DNA replication.

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Endospores

●*Recall:* John Tyndall discovered a heat-resistant form of bacterial cells which were later termed *endospores*.

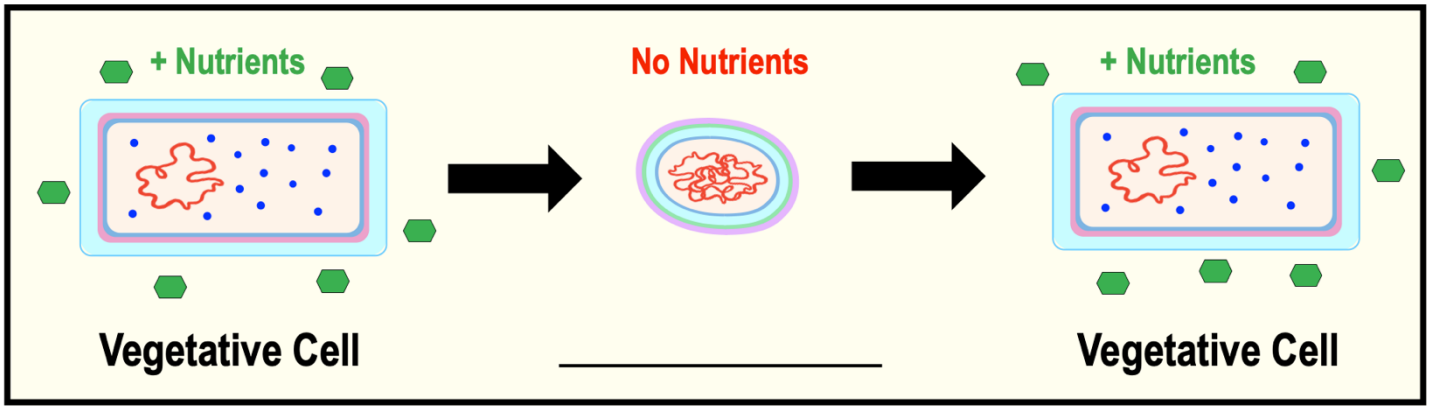
●**Endospores:** a _____ cell produced by some bacteria that are resistant to damaging conditions.

□ Resistant to conditions like extreme _____, *toxic* chemicals & _____ depletion.

□ Endospores are _____ a form replication, they are a form of *survival,* it starts & ends with a *single* cell.

●_____ **Cell:** a normal, replicating cell that is not dormant.

EXAMPLE: Vegetative cell forms endospores when nutrients are depleted.



●*Endospores* are usually only produced by the gram-_____ bacteria *Bacillus* & *Clostridium.*

●Endospores are *dormant* like winter clothes in the summer in the **Back** of your **Closet** (when temp. is **positive** Celsius).

PRACTIC: Endospores are:

a) A dormant cell-type.

b) A type of vegetative cell.

c) A form of reproduction.

d) Sensitive to damaging environmental conditions.

PRACTICE: Formation of endospores _____.

a) Allows bacterial reproduction.

b) Occurs when the cell is in thriving environmental conditions.

c) Is called germination.

d) Can be triggered by adverse environmental conditions.

e) Occurs in all bacterial cells.

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PRACTICE: What 2 bacterial genera produce endospores?

a) *Escherichia* and *Bacillus*.

b) *Staphylococcus* and *Streptococcus*.

c) *Clostridium* and *Bacillus*.

d) *Enterobactor* and *Clostridium*.

e) *Citrobacter* and *Staphylococcus*.