Gram Positive Bacteria

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Course: Medical Microbiology (MA 212)

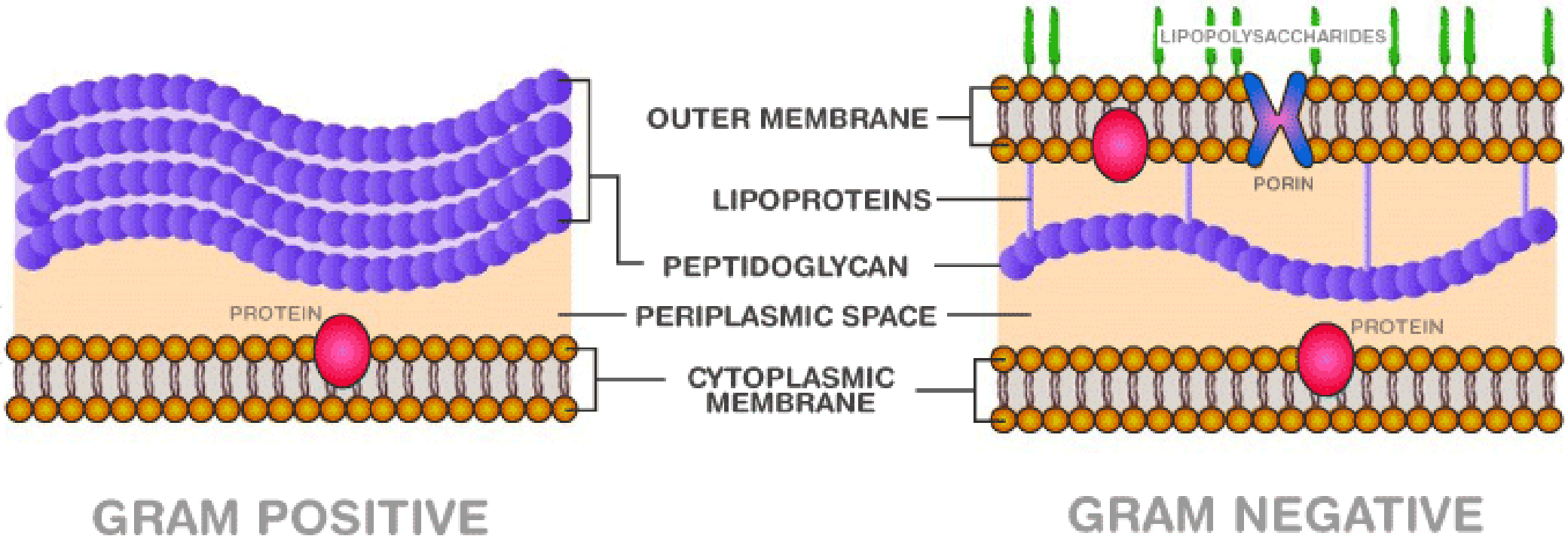
Summer School

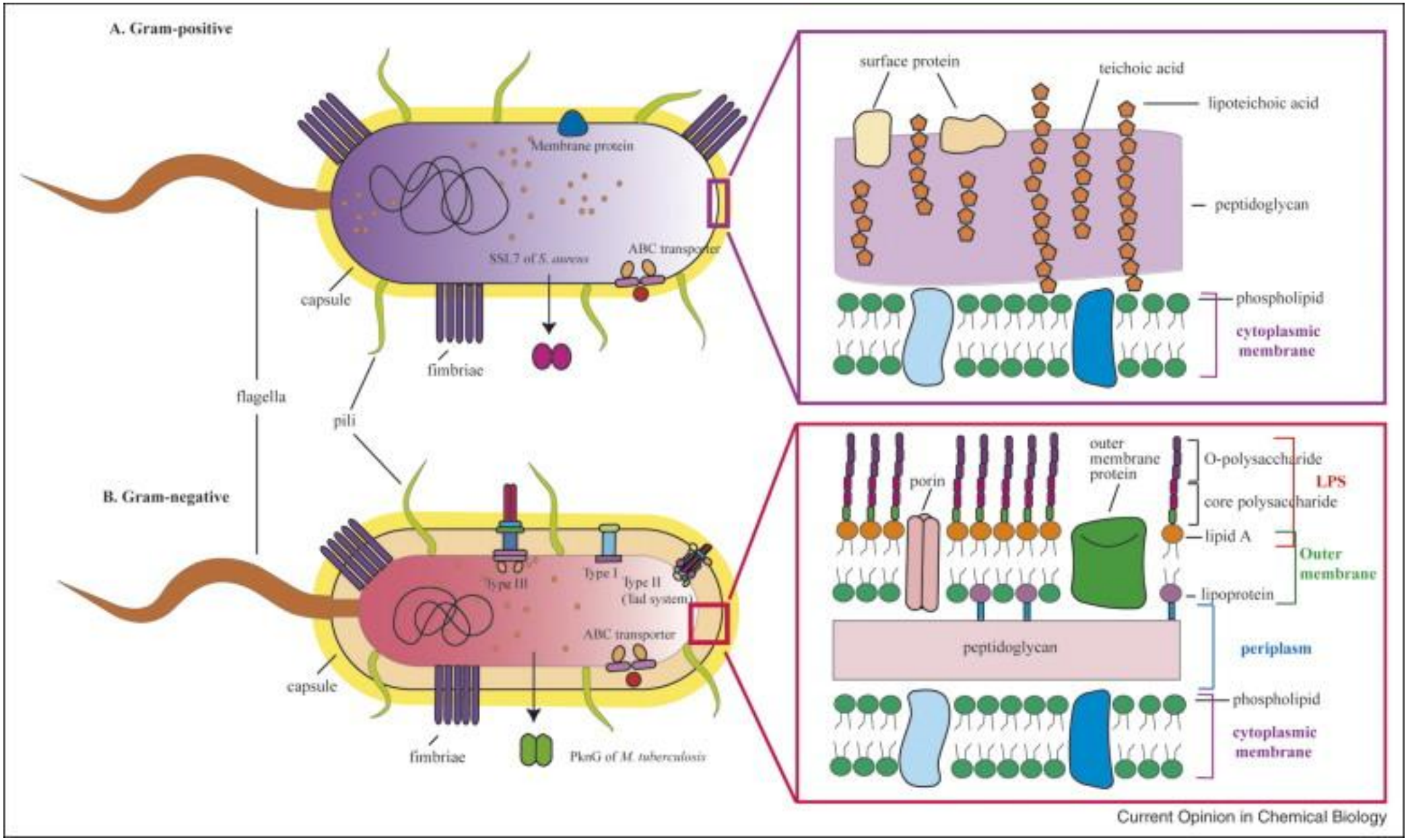
Week 2

Outline

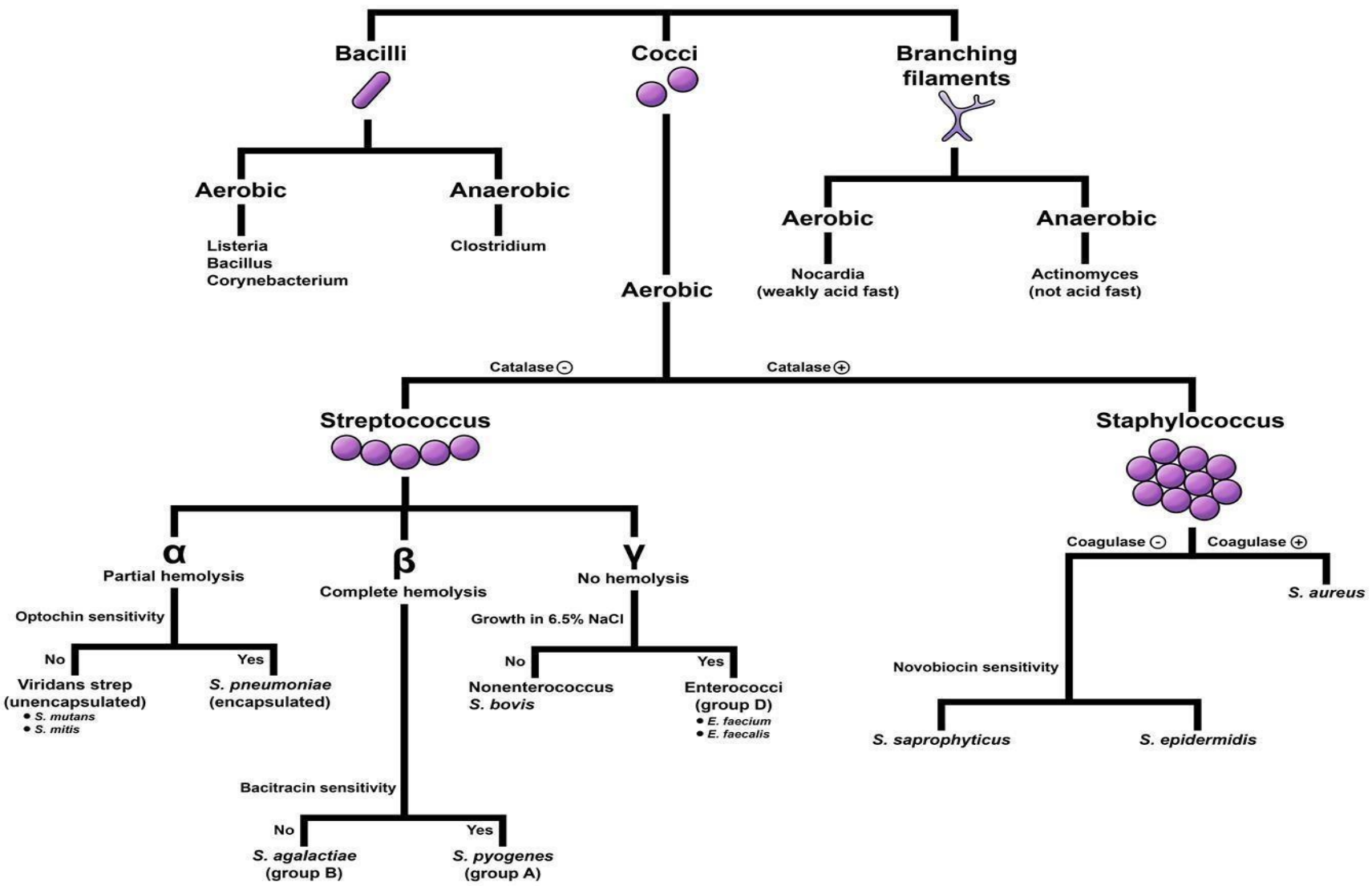
- Gram Positive Bacteria
- Gram Positive Bacteria Virulence Factors

What are the differences between gram +ve and gram –ve?




A. Gram-positive
Membrane protein
SSL7 of S. aureus
ABC transporter
capsule
fimbriae
flagella
pili
B. Gram-negative
Type III
Type I
Type II
(Tad system)
ABC transporter
capsule
fimbriae
PknG of M. tuberculosis
surface protein
teichoic acid
lipoteichoic acid
peptidoglycan
phospholipid
cytoplasmic membrane
porin
outer membrane protein
O-polysaccharide
core polysaccharide
LPS
lipid A
Outer membrane
lipoprotein
peptidoglycan
periplasm
phospholipid
cytoplasmic membrane
Current Opinion in Chemical Biology

Gram-Positive Bacteria



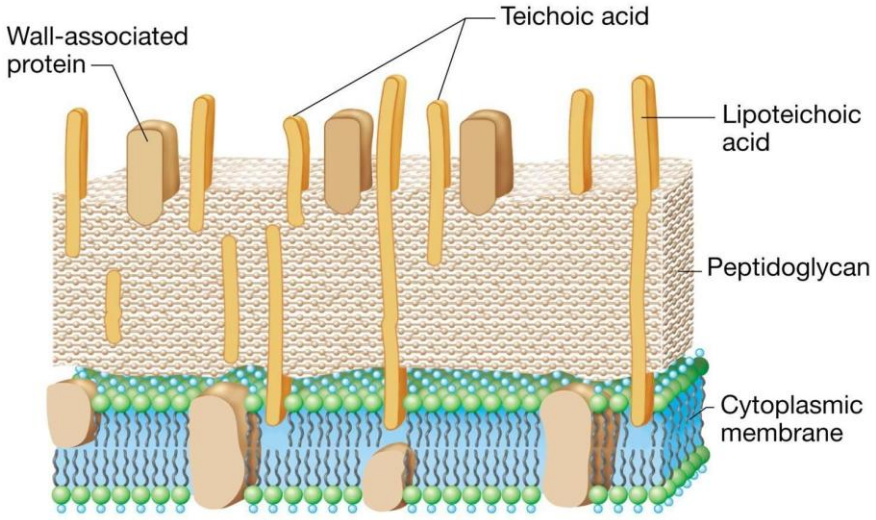
Gram Positive Virulence Factors

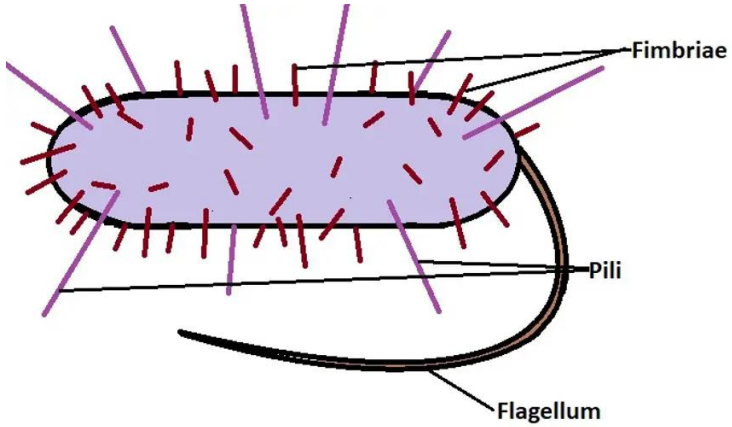
1. Adhesion Factors (Aid in attachment to host cells)

•**Lipoteichoic Acid (LTA)** – Binds to host cell receptors and promotes adherence (e.g.,

Staphylococcus aureus, *Streptococcus pyogenes*).

•**Fimbriae (Pili)** – Help bacteria adhere to host tissues (e.g., *Enterococcus spp.*).





Gram Positive Virulence Factors

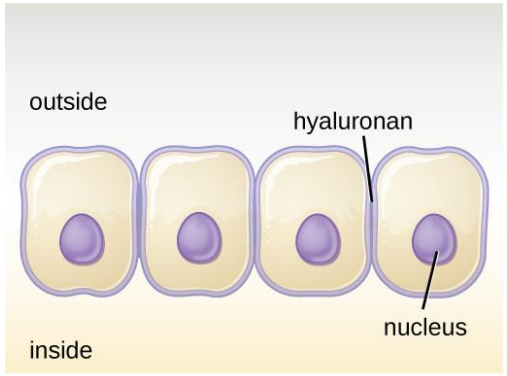
2. Enzymes (Invasion and Tissue Damage)

•**Hyaluronidase** – Breaks down hyaluronic acid in connective tissue, aiding in bacterial spread (*S. aureus*, *S. pyogenes*).

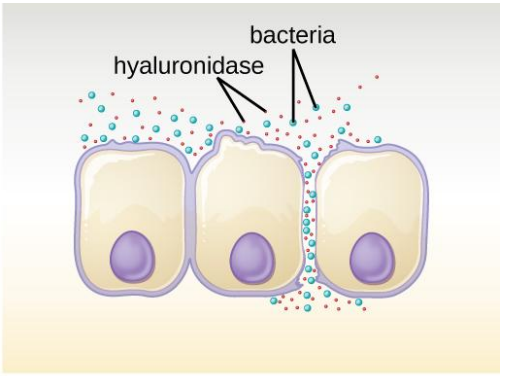
•**Collagenase** – Degrades collagen in host tissues (*Clostridium perfringens*).

•**Coagulase** – Induces fibrin clot formation to protect bacteria from the immune system (*S. aureus*).

•**DNase (Deoxyribonuclease)** – Degrades DNA in neutrophil extracellular traps (NETs), helping bacteria escape immune defenses (*S. aureus*, *S. pyogenes*).



(a)



(b)

Gram Positive Virulence Factors

3. Toxins

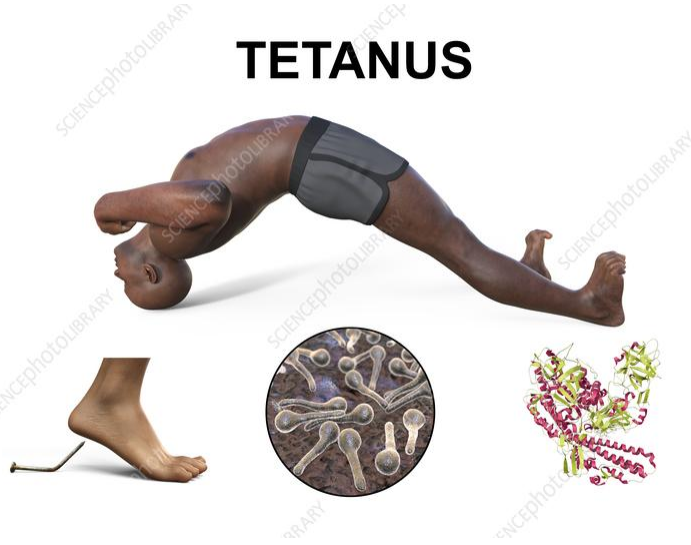
Example 1: Alpha-toxin from Staphylococcus aureus, which creates pores in host cell membranes, causing tissue damage.

Example 2: Streptolysin O and Streptolysin S from Streptococcus pyogenes, which lyse red blood cells and white blood cells (leukocytes) and are key virulence factors for this bacterium.).

Gram Positive Virulence Factors

An exotoxin is a potent, soluble protein toxin secreted by a living bacterium into its surroundings. Unlike endotoxins, which are part of the bacterial cell structure and released upon cell death

- Tetanus Toxin – Blocks inhibitory neurotransmitters, leading to spastic paralysis (Clostridium tetani).



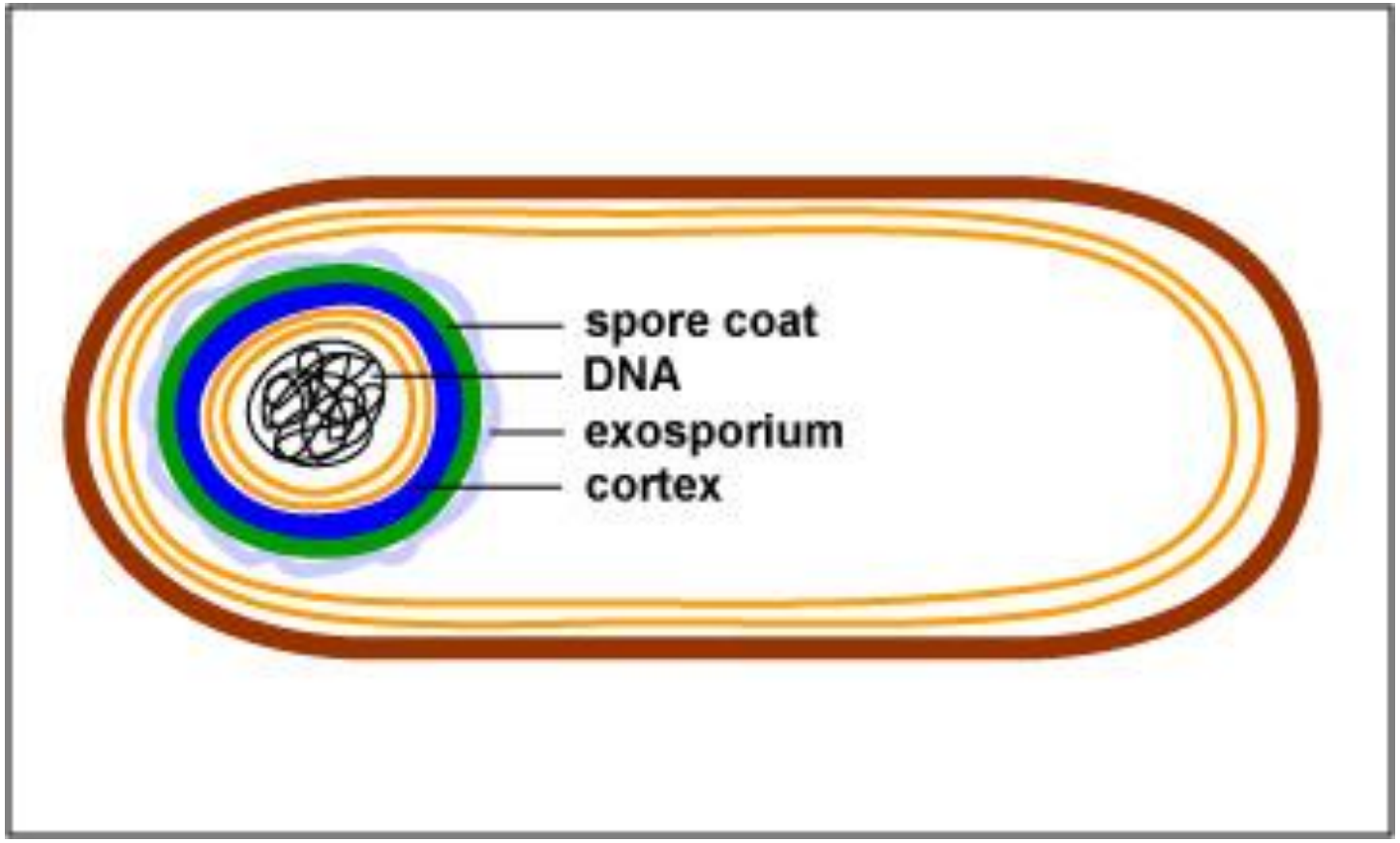
Gram Positive Virulence Factors

4. Immune Evasion Factors

•**Capsule** – Prevents phagocytosis and enhances survival in host tissues (*S. pneumoniae*, *Bacillus anthracis*).

5. Spore Formation (Survival in harsh conditions)

•**Endospores** – Is resistant structure made by bacteria that enable bacteria to withstand extreme environments (*Bacillus anthracis*, *Clostridium spp.*).



Endospores