

Gram
positive &
Gram
negative
bacteria

Lecture 6



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Objectives:

1. To know about the gram stain used for gram positive and gram negative bacteria.
2. To differentiate between the cell wall in gram positive and gram negative bacteria.
3. Species fall under gram positive and their properties.
4. Species fall under gram negative and their properties.

GRAM STAIN

Developed in 1884 by the Danish physician Hans Christian Gram

An important tool in bacterial taxonomy, distinguishing so-called **Gram-positive bacteria**, which remain coloured after the staining procedure, from **Gram-negative bacteria**, which do not retain dye and need to be counter-stained.

Can be applied to **pure cultures** of bacteria or to **clinical specimens**

CELL WALL

Gram +tive cell wall

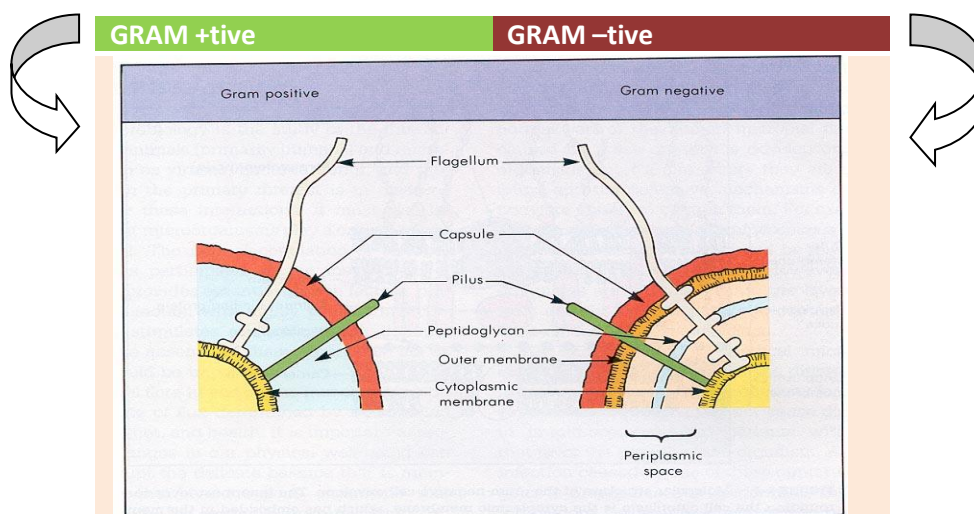
Consists of :

- ✓ a thick, homogenous sheath of peptidoglycan 20-80 nm thick .
- ✓ tightly bound acidic polysaccharides, including teichoic acid and lipoteichoic acid .
- ✓ cell membrane .
- ✓ **Retain crystal violet and stain purple .**

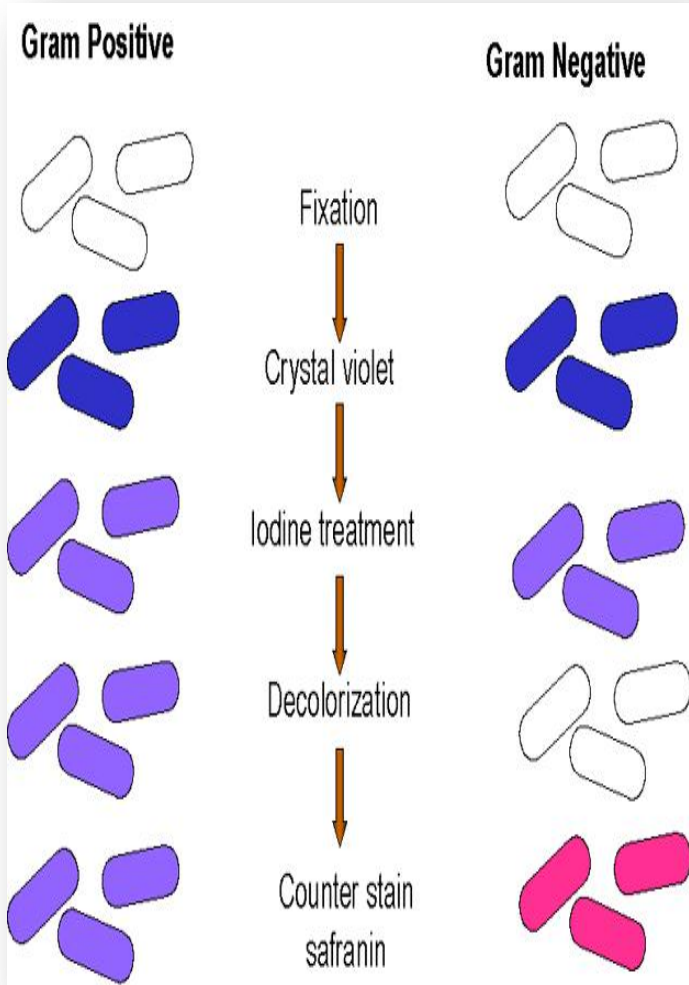
Gram -tive cell wall

Consists of:

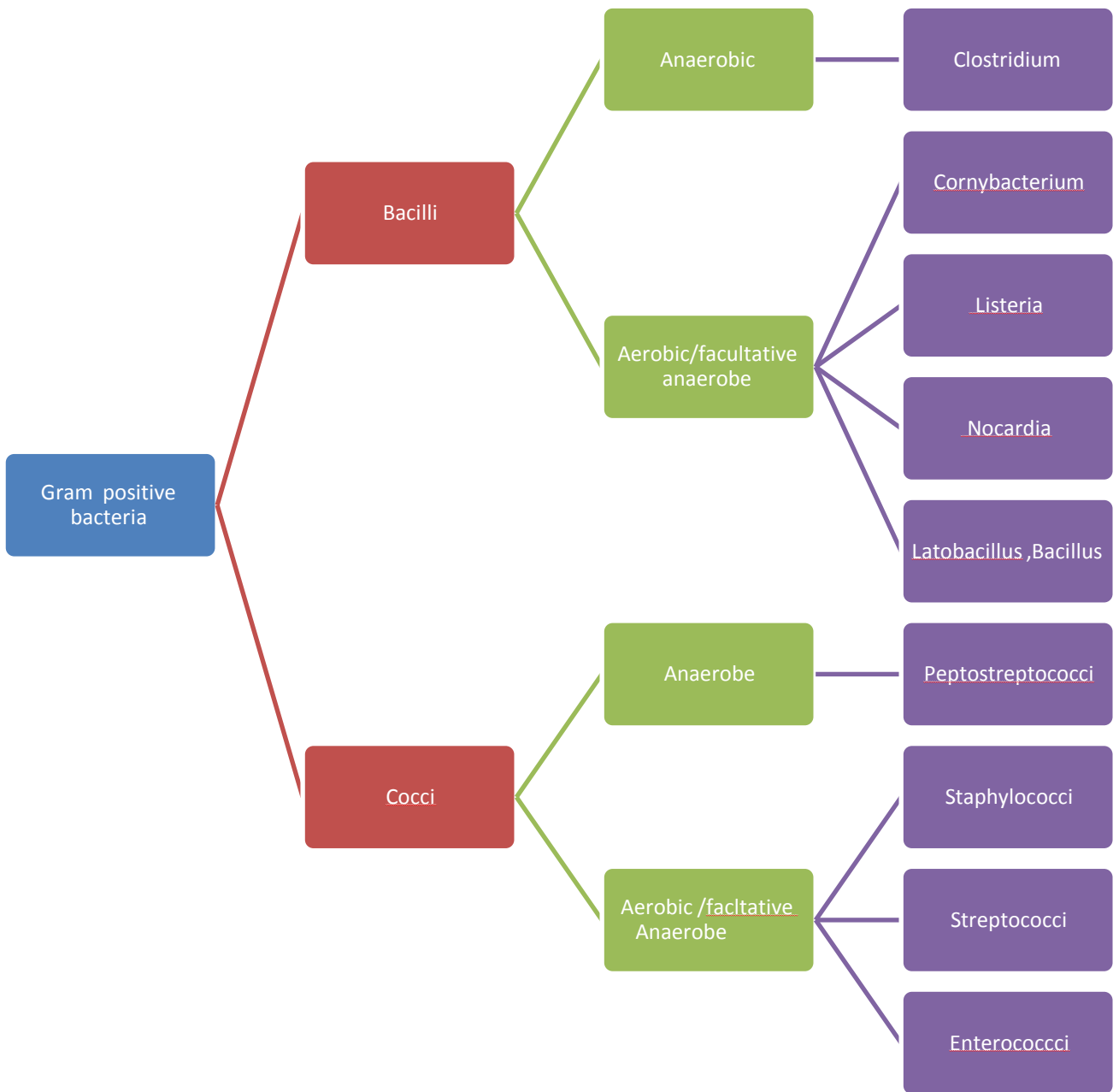
- ✓ an outer membrane containing lipopolysaccharide (LPS)
- ✓ thin shell of peptidoglycan
- ✓ periplasmic space
- ✓ inner membrane
- ✓ **Lose crystal violet and stain pink from safranin counterstain**



THE GRAM STAIN



Step	Microscopic Appearance of Cell		Chemical Reaction in Cell Wall (very magnified view)	
	Gram (+)	Gram (-)	Gram (+)	Gram (-)
1. Crystal violet				
2. Gram's iodine				
3. Alcohol				
4. Safranin (red dye)				



GRAM-POSITIVE COCCI	Staphylococci	1.Catalase-positive 2.Gram-positive cocci in clusters	<i>Staphylococcus aureus</i> 1.coagulase-positive most important 2.pathogen
			<i>Staph. epidermidis</i> and other coagulase negative staphylococci eg: <i>S saprophyticus</i>
	Streptococci	1.Catalase-negative 2.Gram-positive cocci in <u>chains or pairs</u>	<i>Strep. pyogenes</i>
			<i>Strep. pneumoniae</i>
			<i>Viridans-type streps</i>
			<i>Enterococcus faecalis</i>

- **STREPTOCOCCUS**

- **S. viridans**-oral flora -infective endocarditis
- **S. pyogenes** divided by type of haemolysis
 1. Group A, beta hemolytic strep
 2. pharyngitis, cellulitis

3. acute glomerulonephritis

- edema, hypertension, hematuria
- antigen-antibody complex depositio
- **S. PNEUMONIAE**

4. rheumatic fever

- fever
- migrating polyarthriti
- carditi
- immunologic cross reactivity

GRAM POSITIVE BACILLI:

forming

1. A-Spore forming

2. B-Non spore

Spore forming are divided into:-

1. AEROBIC SPORE FORMING MOST IMPORTANT IS

Bacillus anthracis, that causes anthracis

2. ANEROBIC GRAM POSITIVE BACILLI

1. C. tetani - Tetanus



2. C. perfringens Gas gangrene



4. C. diphtheriae - Fever, pharyngitis, cervical LAD

- thick, gray, adherent membrane
- sequelae-->airway obstruction, myocarditi

3. C. botulinum - botulism

- Descending weakness-->paralysis
- diplopia, dysphagia-->respiratory failure

GRAM-NEGATIVE COCCI

- ❖ *Neisseria gonorrhoeae* :The Gonococcus
- ❖ *Neisseria meningitides*: The Meningococcus
- ❖ Both Gram-negative intracellular diplococci
- ❖ *Moraxella catarrhalis*

GRAM-NEGATIVE RODS

- **Enteric Bacteria they ferment sugars most important are:** 1. *E.coli*, 2. *Salmonella*, 3. *Shigella*, 4. *Yersinia* and *Klebsiella pneumonia*, 5. *Proteus*.

- **Gram-Negative Rods**

❖ **Fastidious GNRs**

1. *Bordetella pertussis*
2. *Haemophilus influenzae*
3. *Campylobacter jejuni*
4. *Helicobacter pylori*
5. *Legionella pneumophila*

❖ **Anaerobic GNRs**

1. *Bacteroides fragilis*
2. *Fusobacterium*

- ❖ **Oxidise positive non fermentative i.e. they do not ferment sugars**
e.g. *Pseudomonas* that causes infection in Immunocompromised patients
- ❖ **Oxidise negative non fermentative e.g.** (*Acinobacter* species)

Notes that: Oxidise positive comma shaped and also fermentative most important is *Vibrio cholerae* that causes cholera which is a disease characterized by severe diarrhea and dehydration

UNUSUAL GRAM NEGATIVE

ORGANISMS: Mycoplasmas

- ❖ Smallest free-living organisms
- ❖ No cell wall
- ❖ *M. pneumonia*, *M. genitalium*

NON-GRAM-STAINABLE BACTERIA

- Unusual gram-positives
- Spirochaetes
- Obligate intra-cellular bacteria