

Lecture 8



Gram Positive & Gram Negative Bacteria

- Additional Notes
- Important
- Explanation
- Examples

OBJECTIVES:

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

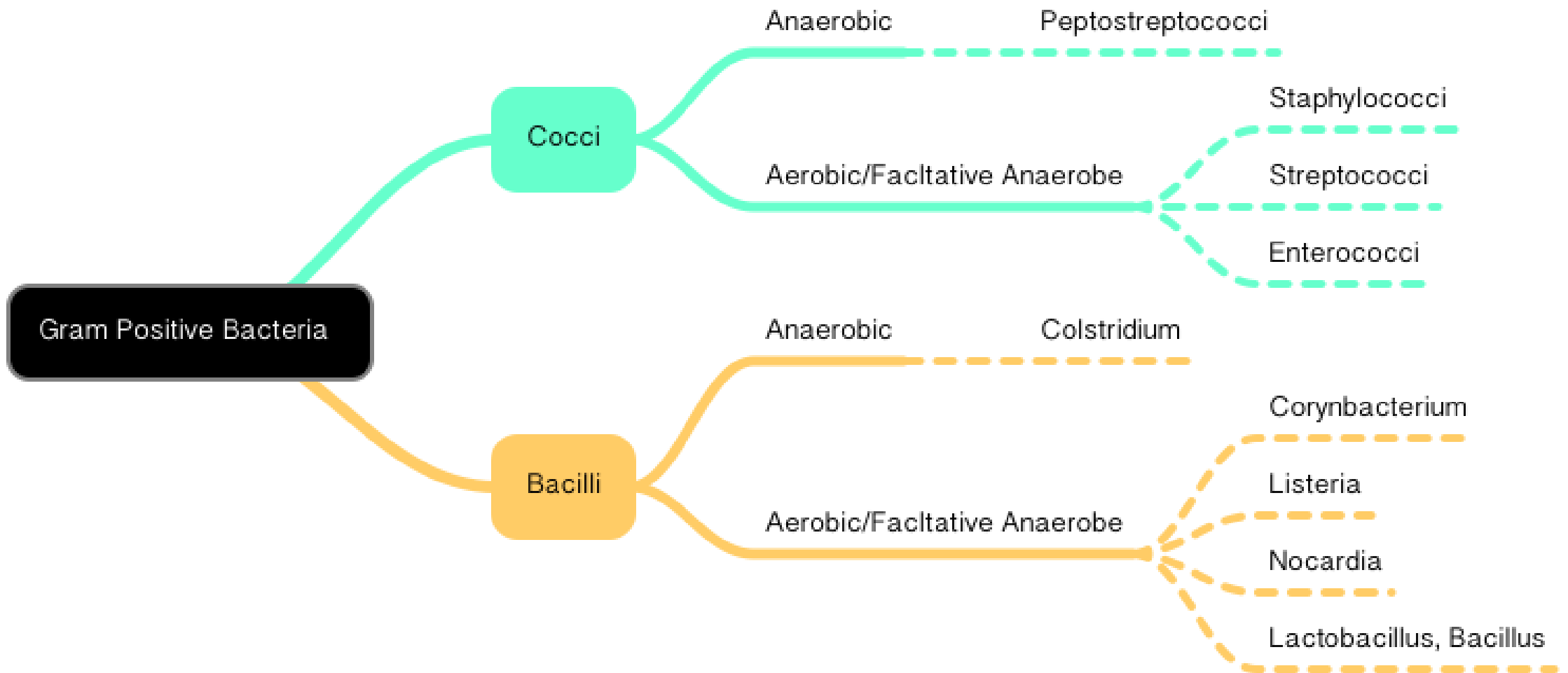
Gram Positive Cell Wall

- Consist 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 Negative Cell Wall

- Consist of:
 - ✓ An outer membrane containing lipopolysaccharide (LPS)
 - ✓ This shell of peptidoglycan
 - ✓ Periplasmic space
 - ✓ Inner membrane
- Lose crystal violet and stain pink or red from safranin counterstain.

THIS TABLE IS VERY IMPORTANT !!!



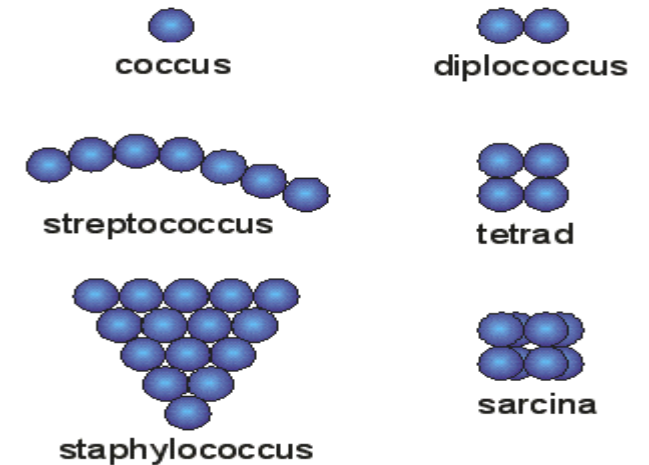
Gram-positive Cocci

■ Staphylococci:

- Catalase-positive.
- Gram-positive cocci in clusters.
- ✓ *Staphylococcus aureus* “most important”:
coagulase-positive most important pathogen.
- ✓ *Staph. Epidermidis* “normal flora in the skin”:
coagulase negative staphylococci.

■ Streptococci:

- Catalase-negative.
- Gram-positive cocci in chains or pairs.
- ✓ *Strep. Pyogenes* “associated with abscess, and might cause rheumatic fever”.
- ✓ *Strep. Pneumoniae* “a major cause of pneumonia”
- ✓ Viridans-type streps
- ✓ *Enterococcus faecalis*



Gram-positive Bacilli

- Divided to:
 - Non-spore forming
 - Spore forming
 - Aerobic spore:
 - E.g.: *Bacillus anthracis*⁽¹⁾. that causes anthracis.
 - Anaerobic spore:
 - *C. tetani*⁽²⁾, Cause: Tetanus.
 - *C. perfringens*, Cause: Gas gangrene.
 - *C. botulinum*⁽³⁾, Cause: botulism.
 - *C. diphtheriae*, Cause: Fever, pharyngitis, cervical LAD “disease of the lymph nodes”.

⁽¹⁾Remember that it has the only bacterial capsule that's made of POLYPEPTIDE.

^{(2),(3)}Both anaerobes produce the same toxin but REMEMBER that *tetani's* toxin inhibits the inhibitory impulses in the brain otherwise *botulinum's* toxin will inhibit the release of ACH

Gram-Negative Cocci

- *Neisseria gonorrhoeae*.
 - ✓ The Gonococcus.
- *Neisseria meningitidis*⁽¹⁾.
 - ✓ The Meningococcus.
- Both Gram-negative intracellular diplococci.
- *Moraxella catarrhalis*. “can cause infections of the respiratory system, middle ear, eye, central nervous system, and joints of humans”.

⁽¹⁾It is considered as potential pathogen in the oropharynx

Gram-Negative Rods

- Enteric Bacteria, they ferment sugars.
- Most important are:
 - ✓ *E. coli*⁽¹⁾, “The most normal flora in the body”.
 - ✓ *Salmonella*
 - ✓ *Shigella*
 - ✓ *Yersinia* and *Klebsiella pneumoniae*
 - ✓ *Proteus*
- Fastidious Gram-Negative Rods:
 - ✓ *Bordetella pertussis*.
 - ✓ *Haemophilus influenzae*⁽²⁾.
 - ✓ *Campylobacter jejuni*.
 - ✓ *Helicobacter pylori*.
 - ✓ *Legionella pneumophila*.
- Anaerobic Gram-Negative Rods:
 - ✓ *Bacteroides fragilis*⁽³⁾.
 - ✓ *Fusobacterium*

⁽¹⁾It is an intestinal flora that produce vit K & B, it is also considered as a source of opportunistic infection.

⁽²⁾It is considered as potential pathogen in the oropharynx.

⁽³⁾It is one of the anaerobes that resist penicillin so instead we should use Metronidazole for its treatment

Non-Gram-stainable bacteria

- Unusual gram-positives:
 - ✓ Spirochaetes.
 - ✓ Obligate intra-cellular bacteria.
- Unusual gram negative organisms:
 - ✓ Mycoplasmas:
 - Smallest free-living organisms
 - No cell wall
 - E.g.: *M. pneumonia*, *M. genitalium*

Sorry for being late to download this lecture.
Hopefully we made microbiology easier and more
interesting to all of you.



BEST OF LUCK FUTURE DOCTORS