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Gram (+)ev bacteria and Gram (-)ev bacteria

-Important -Extra -Notes
-In boy's slides -In girl's slides

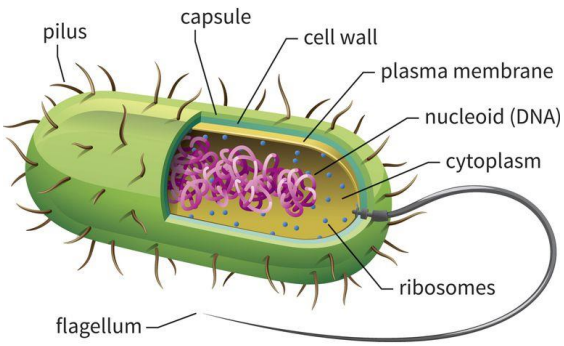
-Objectives:

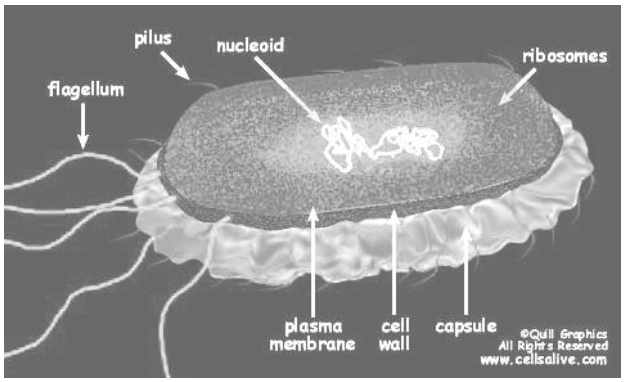
By the end of this lecture, the student should able to:

- Recall the general basic characteristics of bacteria
- Differentiate between gram positive and gram negative bacteria.
- Recall the classes and groups of gram positive bacteria, cocci and bacilli (rods)
- Recall the classes and groups of gram negative bacteria, cocci and bacilli (rods)
- Recall the common infections and diseases caused by these organisms
- Recall the common identification characteristics of these groups

In this link, you will find any correction or notes unmentioned in the team's work. Please check the link below Frequently.
https://docs.google.com/document/d/1WvdeC1atp7J-ZKWOUSukSLsEcosjZ0AqV4z2VcH2TA0/edit?usp=sharing

Bacterial cells:

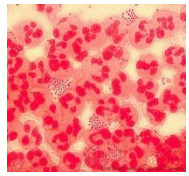




Gram Stain:

- Developed in 1884 by the Danish physician Hans Christian Gram.
- An important tool in bacterial taxonomy (the branch of science concerned with classification), distinguishing so-called Gram- positive bacteria, which remain colored 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.

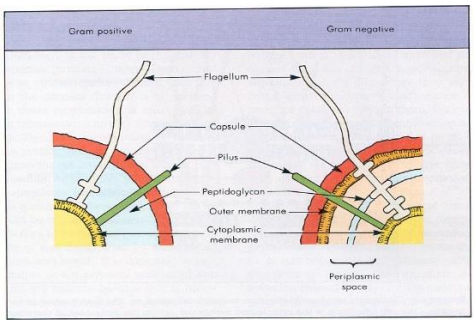
Pure culture of E. coli (Gram-negative rods).

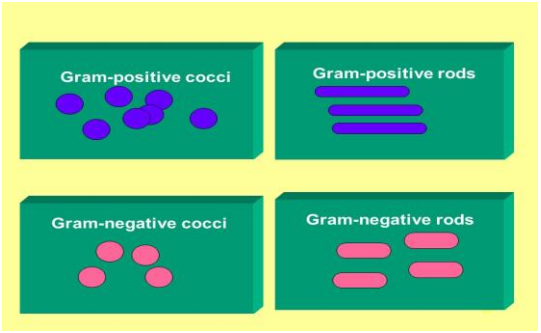


Neisseria gonorrhoeae in a smear of urethral pus (Gram-negative cocci, with pus cells)

Cell wall:

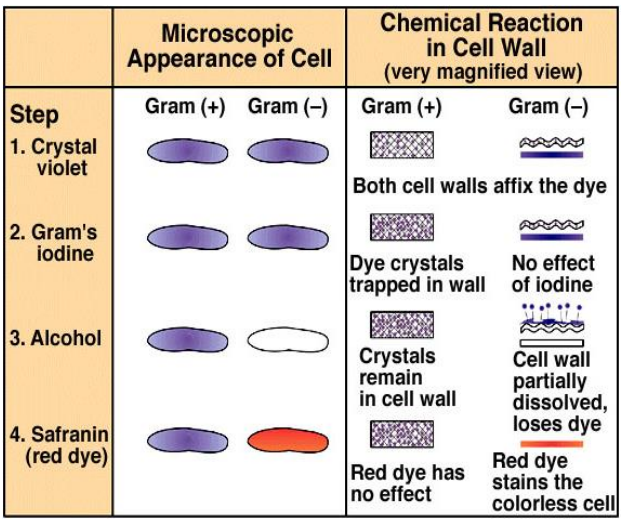
Gram positive cell wall	**Gram negative cell wall**
• **CONSISTS OF**	• Consists of
– **A THICK, HOMOGENOUS SHEATH OF PEPTIDOGLYCAN 20-80 NM THICK.** – PEPTIDOGLYCAN IS THE TARGET OF PENICILLIN.	– **thin shell of peptidoglycan**
– **TIGHTLY BOUND ACIDIC POLYSACCHARIDES, INCLUDING TEICHOIC ACID AND LIPOTEICHOIC ACID.**	– **an outer membrane containing lipopolysaccharide (LPS).** – Lipopolysaccharides mediate toxic shock and toxemia.
– **CELL MEMBRANE.**	– **inner membrane.**
-	– **periplasmic space.** – periplasmic space traps antibiotics (this is why gram -ve bacteria is more resistant.
• **RETAIN CRYSTAL VIOLET AND STAIN PURPLE.**	– **Lose crystal violet and stain pink from safranin counterstain.**

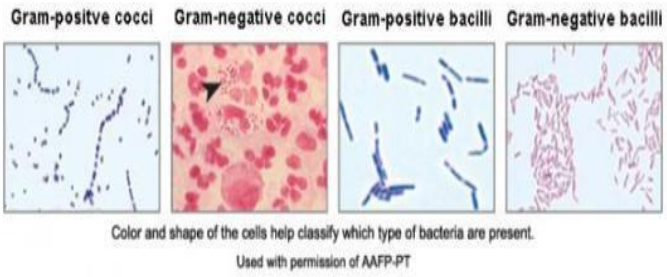




The Gram Stain:

Gram stain process			
Gram staining steps	Cell effects	Gram-positive	Gram-negative
Step 1 **Crystal violet** *primary stain added to specimen smear.*	Stains cells purple or blue.		
Step 2 **Iodine** *mordant makes dye less soluble so it adheres to cell walls.*	Cells remain purple or blue.		
Step 3 **Alcohol** *decolorizer washes away stain from gram-negative cell walls.*	Gram-positive cells remain purple or blue. Gram-negative cells are colorless.		
Step 4 **Safranin** *counterstain allows dye adherance to gram-negative cells.*	Gram-positive cells remain purple or blue. Gram-negative cells appear pink or red.		





Color and shape of the cells help classify which type of bacteria are present.
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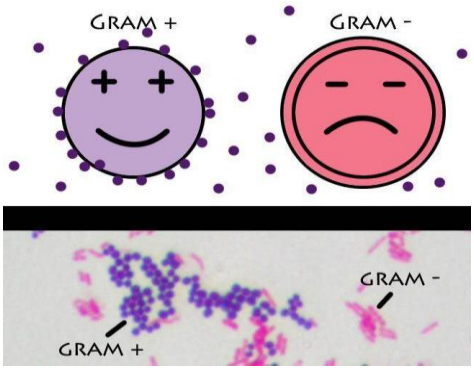


Dr's Notes

- Bacilli = rods.
- Anaerobe : means that bacteria only growth under anaerobic condition (without oxygen).
- Aerobe : means that bacteria only growth under aerobic condition (with oxygen) "rare".
- Facltative Anaerobe : means that bacteria can growth under anaerobic and aerobic conditions "most of aerobe".
- Pharyngitis most commonly causes by viruses.

We can divide Gram + cocci by:

1- either it's in clusters (more common with stain) (and most likely would be Staphylococci), or it's in chains (pairs) (and most likely would be Streptococci)

2- if they have the enzyme (catalase يكسر الهيدروجين وحنا نضيفه ع مادة معينة ف اذا تفاعلت وطلع فقاعات معناته + واذا لا معناته -), (+, in clusters) or don't (- in chains).

- we can divide the Staphylococci by:

- an enzyme called (Coagulase; from coagulation), if it's (+ = aureus) if it's (- = epidermis).

- and we can identify Streotococci by:

- Hemolysis, Alpha, Beta, non-hemolytic (gamma).

- and we can divide the beta to groups :

- based on an Antigone in their cell walls could be A, B, C, or G.

- We divide the Gram + bacilli by:

- either they have spores or not.

- Non-gram-stainable bacteria:

ما يطلع الستاين لسببين:

انهم ما عندهم سيل وول بالأساس، أو فيه اختلاف بمكونات السيل الوول تبعهم.

-unusual gram positive:

نستخدم معهم نوع ستاين مختلف، ويطلع لونهم pink.

-We can distinguish the gram - bacilli by:

1- If it's sugar fermenter or non-fomenter. تنتج الطاقة من السكر عن طريق التخمر أو لا).

2- by an enzyme (oxidase نحط البكتيريا ع ورقة فيها مادة معينة، اذا تغير لونها معناته بوزيتف الإنزيم موجود وكسر المحلول، واذا ما تغير نيقتف),

3- fastidious: لها أماكن وخواص معينة عشان تعيش.

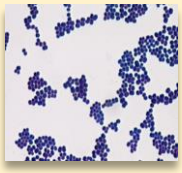
GRAM POSITIVE (+) BACTERIA

*GRAM POSITIVE (+) COCCI

Aerobic / facultative Anaerobe

In clusters (Staphylococci) Catalase (+)

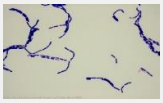
*Staphylococcus aureus :	*Staph. Epidermidis , E.g. Saprophiticus.
Coagulase (+), Most important pathogen.	**Coagulase (-).** *Normal flora of the skin.*



In chains or pairs (streptococci) Catalase (-)

Divided by type of hemolysis:

- Alpha hemolytic:
  - S. viridans – oral flora, infective endocarditis (infection of the heart).
  - S. pneumoniae – important cause of community acquired pneumonia, diseases : (pneumonia meningitis) (pathogen).
- Beta hemolytic:
  - Group A:
    - Important cause of pharyngitis (sore throat) and cellulitis, Rheumatic fever. E.g. S. pyogenes.
  - Group B:
    - Diseases: Neonatal infection.
- Non-hemolysis (gamma):
  - ENTEROCOCCUS, → diseases: urine, blood infection.



Gram + in chain.

Anaerobic

In cluster (peptococcus)

In chain (peptastre-ptococcus) (brain abscess)

GRAM POSITIVE (+) Bacilli (rods)

Aerobic / facultative Anaerobe

Spore forming (Bacillus spp.)

Bacillus spp.:

E.g.

Bacillus anthracis, that cause anthracis .(الجمرة الخبيثة)

Non-Spore forming. (Listeria, Corynebacterium.)

- Corynebacterium diphtheria:
  - WHICH CAUSE:
    - Fever pharyngitis cervical LAD (disease of the lymph nodes).
    - thick, gray, adherent membrane.
    - Sequelae: airway obstruction, myocarditis.
  - هي نورمال فلورا ولكن في منها باثوجينيك مثل ال diptheria.

Anaerobic

Spore forming (Clostridium)

- Clostridium:
  - Clostridium tetani (c. tetani) causes Tetanus (شلل مع تشنج) .
  - Clostridium perfringens (c. perfringes) causes Gas gangrene.
  - Clostridium botulinum (c. botulinum) causes:
    - Botulism.(شلل بدون تشنج)
    - Descending weakness → paralysis.
    - Diplopia, dysphagia → respiratory failure.

Non-Spore forming.

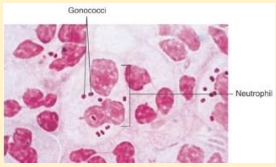
E.g.
Eubacterium.

GRAM NEGATIVE (-) BACTERIA

GRAM NEGATIVE (-) COCCI

Aerobic / facultative Anaerobe — In Pairs

- **Neisseria gonorrhoeae (also called the gonococcus)**
  - **causes gonorrhea.**
- **Neisseria meningitidis (also called the meningococcus)**
  - **is one of the most common causes of bacterial meningitis.**
  - **(it is considered as potential pathogen in the oropharynx).**
- **Neisseria -> intracellular organism.**
- **Both Gram-negative intracellular diplococci.**
- **Moraxella catarrhalis.**
- **Their diseses: (Genital, Meninges, and respatory infectin).**



Anaerobic

E.g.
- Vellonella.

(rare cause infection).

*GRAM NEGATIVE (-) Bacilli (rods)

Aerobic / facultative Anaerobe

- **Enteric Bacteria they ferment sugars (oxide -) most important are;**

E.G.
1- E. coli (normal flora but can cause diseases).
2- Salmonella (not normal flora "exogenous").
3- Shigella.
4- Yersinia and Klebsiellosis pneumonia.
5- Proteus.

- **Fastidious GNRs:**

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

-Oxidase negative , non – fermentative i.e. they do not ferment sugars e.g:

- Acinobacter spp. (very resistance)

Ssp. = species.

- Oxidase positive
1-fermentative i.e. they do ferment sugars e.g:

- comma shaped (sickle) and also fermentative, most important is Vibrio cholerae that causes cholera. which is a disease characterized by:
1) Severe diarrhea.
2) Dehydration.

2- non – fermentative i.e. they do not ferment sugars e.g:
- Pseudomonas that causes infection in Immunocompromised patients (very resistance to antibiotics.) .

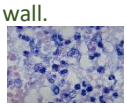
Anaerobic

E.g.
- Bacteroides fragilis.
- Fusobacterium.

Non-Gram-Stainable bacteria

-Unusual Gram-positives:

E.g.
- Mycobacteria, Contain mycolic acid in cell wall.



-No cell wall:

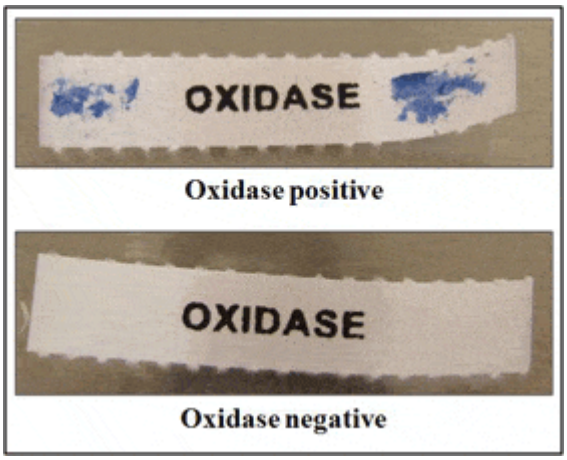
*Mycoplasmas:
-Smallest free-living organisms.
-No cell wall
-E.g.
M. pneumonia, M. genitalium

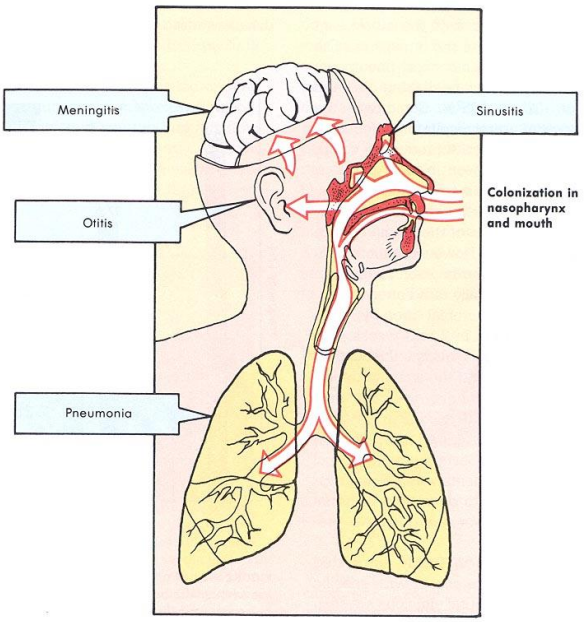
-Obligate intra-cellular:

- Chlamydia:
  E.g.
  C. pneumoniae, C. trachomatis
- Rickettsia.

-spirochaetes:

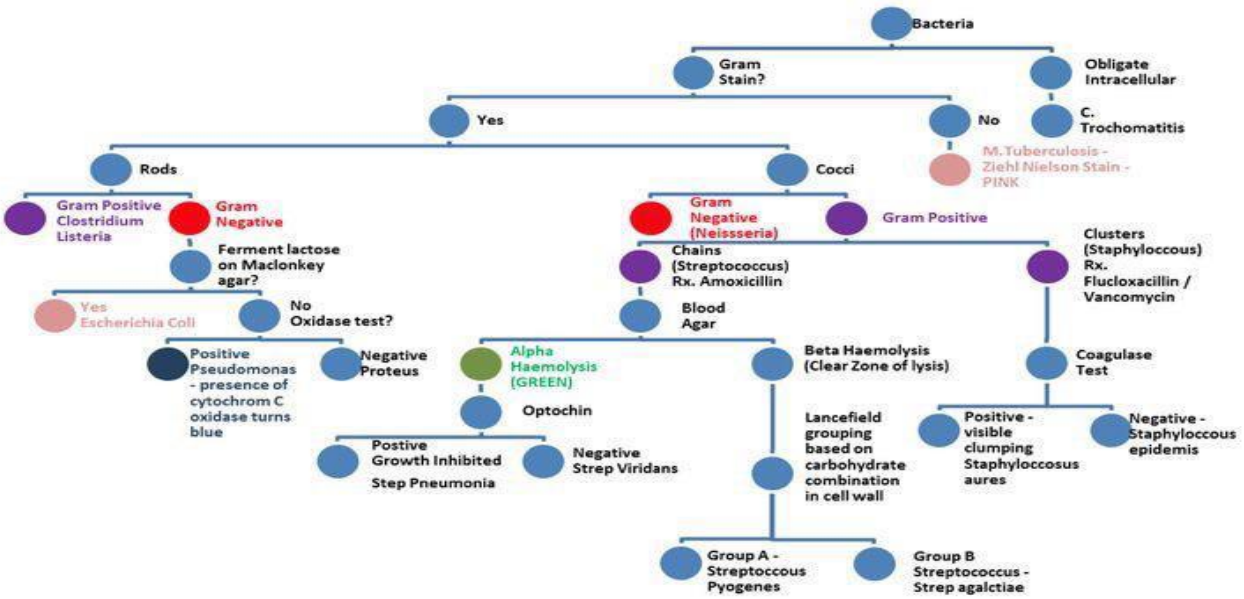
E.g.
* Treponema Pallidum, cause of syphilis (الزُهري).





S. pneumoniae diseases:

Vibrio cholerae



MCQs & SAQs:

1- peptostreptococci is ?: **A) gram + anaerobic cocci** **B) gram - anaerobic cocci** **C) gram + aerobic cocci** **D) gram - aerobic cocci**	**2- staphylococci is ?:** **A) catalase +** **B) catalase-** **C) gram +** **D) a + c**
3- C . Perfringens can cause ?: **A)fever** **B) pharyngitis** **C) air way obstruction** **D) gas gangrene**	**4- which of the following is a characteristic of (mycobacteria) ?:** **A) no cell wall** **B) contain mycolic acid in the cell wall** **C) the smallest free-living organism** **D) a + c**
5- a patient presented to the hospital with severe diarrhea and dehydration, he most likely has ?: **A) mycobacteria infection** **B) vibrio cholera infection** **C) peptostreptococcus infection** **D) neisseria infection**	**6- the first reagent used in gram stain is ?:** **A) iodine** **B) crystal violet** **C) methyl red** **D) acetone**
7- gram stain can be applied to ?: **A) pure cultures** **B) clinical specimens** **C) nether** **D) a + b**	**8-____ bacteria have a thick, thick, homogenous sheath of Peptidoglycan** **A-gram positive** **B- gram negative** **C-infectious** **D- non-infectious**

1- what counter stain is used in gram stain and why do we use it ? :

Ans : safranin counter stain and we use it because it helps us to see the gram (-) bacteria

2- list 3 aerobic gram positive cocci ?:

staphylococcus , enterococcus , and streptococcus .

]

1- A
2- D
3- D
4- B
5- B
6- B
7- D
8- A

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