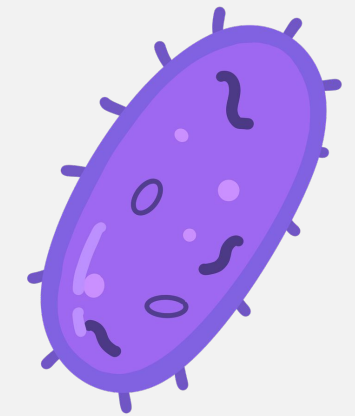
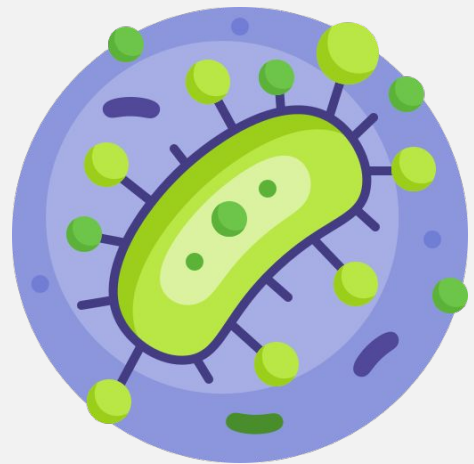


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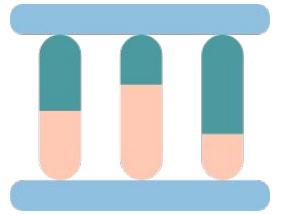
Gram + & Gram - Bacteria



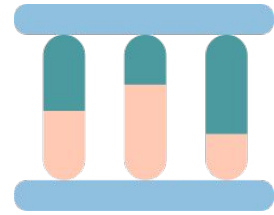
index:

- Main text.
- **Important.**
- In boys slides only.
- In girls slides only.
- Doctors notes.
- Extra info.

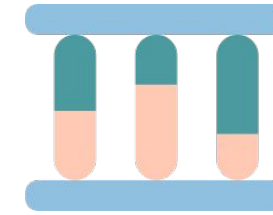
OBJECTIVES



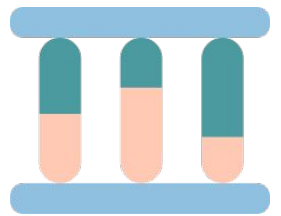
Recall the general basic characteristics of bacteria.



Differentiate between gram positive and gram negative bacteria.



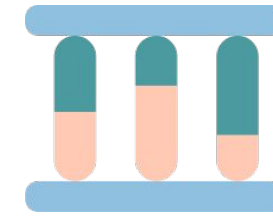
Recall the different groups, genera and species of gram positive bacteria (cocci and bacilli (rods)).



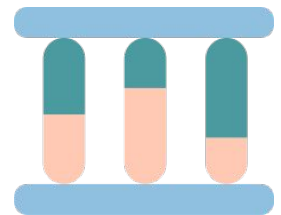
Recall the different groups, genera and species of gram negative bacteria (cocci and bacilli (rods)).



Recall the common infections and diseases caused by these organisms.



Recall the common identification characteristics of these groups and organisms.



Recall the different non gram sustainable bacteria.

المحاضرة هذي مهمة جدًا والمعلومات اللي فيها
بتفيدنا في كل البلوكات القادمة
إلى آخر بلوك سنة ثاني إن شاء الله، استعن بالله
وأسس نفسك صح.

Gram Stain :

Gram stain also can stains cells not just bacteria

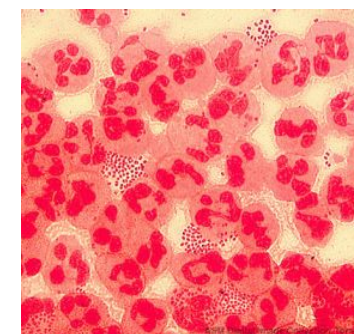
- Developed In 1884 by the Danish physician Hans Christian Gram.
- It's an important tool in bacterial taxonomy, distinguishes gram -ve bacteria from gram +ve:



- Can be applied to pure cultures (**faster and usually used**) of bacteria or to clinical specimens (**slower**).

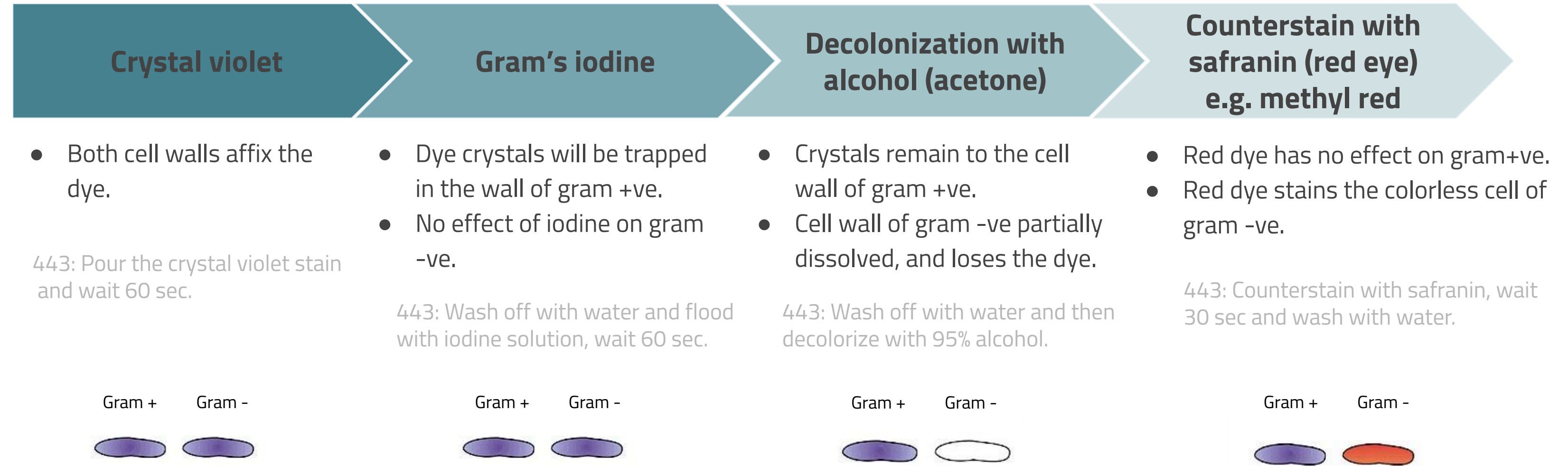


Pure culture of E. coli
(Gram-negative rods)



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

Gram Stain Process :



Bacteria can be classified based on their need for O₂:

1. Obligate aerobes: require oxygen for survival & growth.
2. Facultative anaerobes: they are aerobic but can grow in anaerobic environment if necessary. (can do both)
3. Obligate anaerobes: only grow under anaerobic conditions, die in the presence of oxygen.

Cell Wall:

Gram Positive

Consists of:

- **Thick**, homogenous sheath of **peptidoglycan** (20-80 nm thick).
- Cell membrane. (Plasma membrane)
- Tightly bound acidic polysaccharides: **teichoic acid**, lipoteichoic acid.

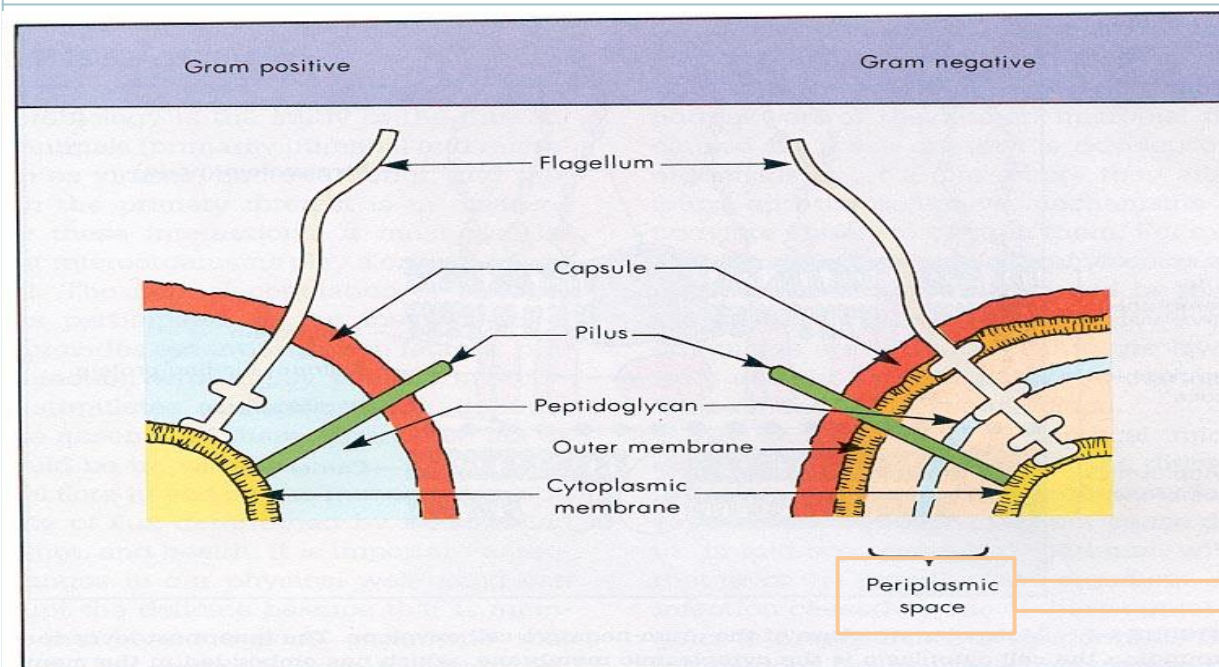
Retain crystal violet
And stain purple

Gram Negative

Consists of:

- **Outer membrane containing lipopolysaccharide (LPS).**
- **Thin shell of peptidoglycan.**
- Inner membrane. (Plasma membrane)
- Periplasmic space. (between plasma membrane and the thin peptidoglycan layer)

Lose crystal violet
And stain pink from safranin counterstain



Is the site of trapping of antibiotics,
which makes gram -ve bacteria more
resistible to antibiotics than gram +ve.


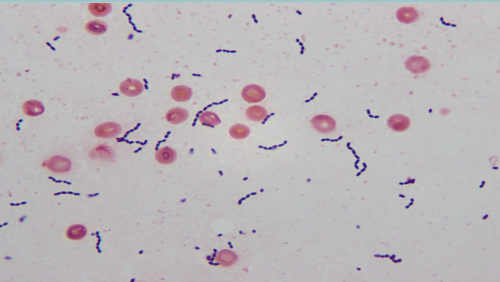


Gram -ve are more resistible to antibiotics due to:

- Outer membrane
- Periplasmic space

Tests used with Gram Positive Bacteria :

Catalase test:

It is used to distinguish between staphylococci bacteria from streptococci

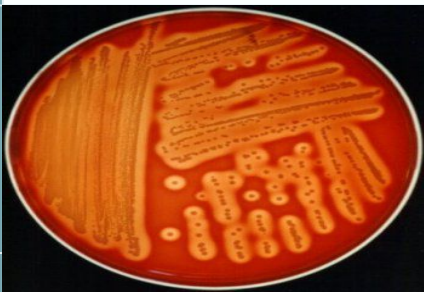
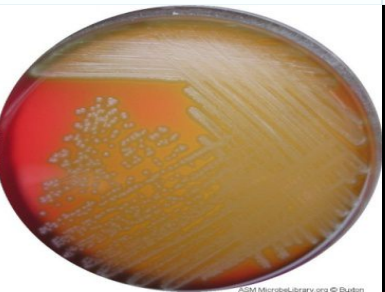

Test result	Positive	Negative
Type of bacteria		
Picture		
Name	Gram positive cocci in clusters Staphylococci	Gram positive cocci in chain Streptococci

It may come in the OSPE exam.
If it comes write the **full name** like this

"Catalase" is an enzyme that staphylococci contains but streptococci don't.

Hemolysis test:

It divides streptococci into 3 groups based on their specific hemolytic ability:

	Beta-hemolytic	Alpha-hemolytic	Non-hemolytic (Gamma-hemolytic)
Ability of producing hemolysin	Produces hemolysin	Produces hemolysin But not sufficient	Doesn't produce hemolysin
Appearance on blood agar			
Example	- Group A Streptococcus - Group B Streptococcus	-Streptococcus pneumoniae -streptococcus viridans	Enterococcus

Gram +ve Bacteria

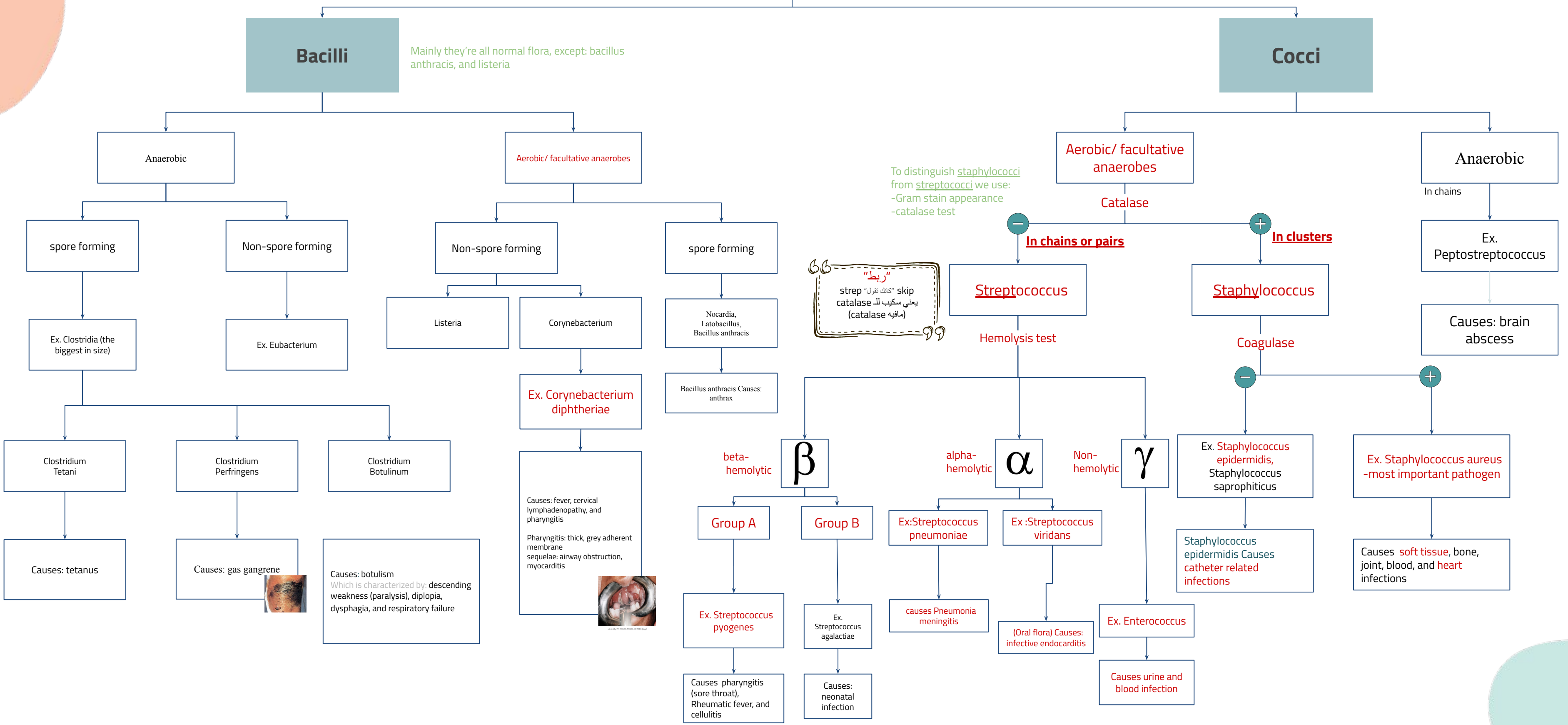
Gram +Ve Bacteria

Dr. Khalifa focus on Gram +Ve Cocci

Bacilli

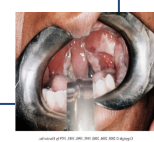
Mainly they're all normal flora, except: bacillus anthracis, and listeria

Cocci



To distinguish staphylococci from streptococci we use:
-Gram stain appearance
-catalase test

ربط " ربط " skip
strep " كاتفك تقول " skip
catalase يعني سكيب للـ (catalase مافيه)



Extra Notes For Better Understanding And Memorization:

هذي السلايد إضافية، مو موجودة في السلايدات فقط لمساعدتك على ربط المعلومات

السلايد اللي قبل ما يخوف فقط نعرف ان ال cocci تنقسم الى قسمين Anaerobic+Aerobic وال Aerobic تنقسم إلى Staph+Strept نفرق بينهم عن طريق ال Catalase Test اذا كان + يعني Staph, اذا كان - يعني Strept.
ال Staph برضو تنقسم إلى قسمين Staph.epidermidis و Staph.aureus نفرق بينهم عن طريق ال Coagulase Test اذا كان + يعني Staph.aureus واذا كان - يعني Staph.epidermidis.
ال Strept تنقسم الى ثلاث اقسام Alpha,Beta,Gamma نفرق بينهم عن طريق ال Hemolysis Test

1

catalase test measures presence of the catalase enzyme, it is found in some bacteria including "staphylococcus", it helps the bacteria to get rid of called hydrogen peroxide a toxic oxygen-derived free radical.



2

In hemolysis test we see the bacteria in bacteria culture "Blood Agar" and based on bacteria behavior we can know if it's :

- **Beta Hemolytic**

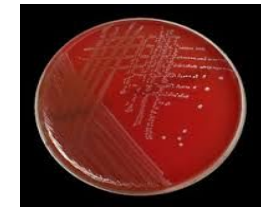
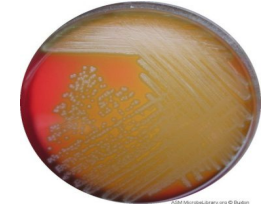
إذا كسرت كريات الدم الحمراء اللي حولها بشكل كامل نسمي هذي البكتيريا :

- **Alpha hemolytic**

إذا صار تكسير جزئياً واللي حول البكتيريا أخضر نسميها :

- **Non hemolytic (Gamma)**

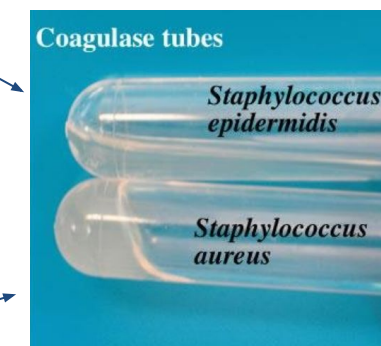
إذا لا يوجد تكسير نسميها :



3

Coagulase it's an enzyme present in (**staphylococcus**) coagulate the plasma and convert the **fibrinogen into fibrin**

سائلة تماماً، no coagulation



رغم ان ال tube مايل الا ان البلازما متصلبة، صار لها coagulation

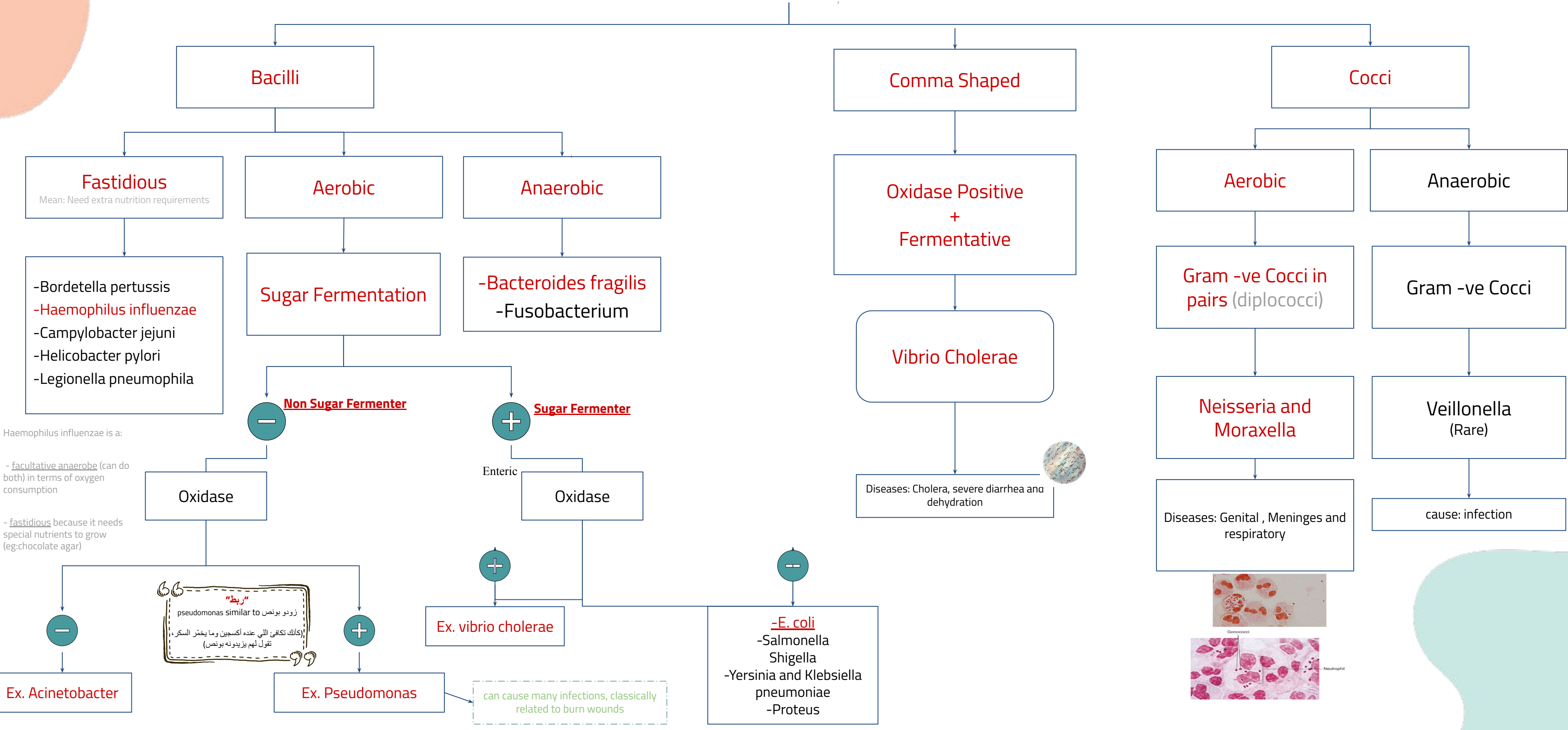
4

staphylococcus aureus is one of the most important pathogens,

من أهم مسببات المرض الموجودة عند 20% من الناس، وبتكرر في أغلب البلوكات الجاية إن شاء الله

Gram -ve Bacteria

Gram -Ve Bacteria

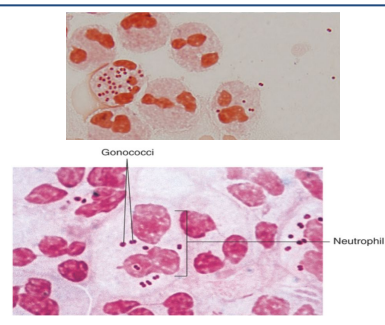


Haemophilus influenzae is a:

- facultative anaerobe (can do both) in terms of oxygen consumption
- fastidious because it needs special nutrients to grow (eg:chocolate agar)

زودو بونص "ربط" pseudomonas similar to
 (كانك تكافئ اللي عنده اكسجين وما يختر السكر، تقول لهم يزودونه بونص)

can cause many infections, classically related to burn wounds



Extra Notes For Better Understanding And Memorization:

هذي السلايد اضافية، مو موجودة في السلايدات فقط
لمساعدتك على ربط المعلومات

1

sugar fermentation test is used to test an organism's ability to ferment the sugar glucose or not.

2

fastidious bacteria are difficult to grow in the laboratory because they needs extra nutritional environmental requirements.

3

The oxidase test is used to identify bacteria that produce cytochrome c oxidase, note: All bacteria that are oxidase positive are aerobic. (the opposite is not always true)

4

The most **important** group of bacteria after staphylococcus aureus is Enterobacteriales, and it main example is **E.coli**

Non Gram-Stainable Bacteria

Cause	Example	Reasons
Unusual Gram-positives	<ul style="list-style-type: none">● Mycobacteria	Contain mycolic acid in cell wall
Bacteria with no cell wall (Mycoplasmas)	<ul style="list-style-type: none">● Mycoplasmas<ul style="list-style-type: none">– M. pneumonia, M. genitalium	<ul style="list-style-type: none">● Smallest free-living organisms● No cell wall
Obligate intra-cellular bacteria (Chlamydia)	<ul style="list-style-type: none">● Chlamydia<ul style="list-style-type: none">– C. pneumoniae, C. trachomatis● Rickettsia	<ul style="list-style-type: none">● (cannot make their own ATP)
Some spirochaetes	<ul style="list-style-type: none">▪ Treponema pallidum	<ul style="list-style-type: none">● cause of syphilis



These cases are very important.

Quiz

Q1: A patient with a urinary tract infection, lab test showed that it's a gram+ bacteria in chains, catalase negative, non hemolytic. What is the bacteria?

- A Enterococcus B Streptococcus pneumonia C Streptococcus pyogenes D Staphylococcus viridans

Q2: A patient has respiratory tract infection, has a growth of gram positive cocci in chains or pairs, catalase negative ,(alpha hemolytic) What is the bacteria?

- A S. pyogenes B Peptostreptococcus C S. pneumoniae D Enterococcus

Q3: A patient has a Growing gram negative bacilli, sugar fermenter, oxidase negative, What is the bacteria What is the bacteria?

- A S. pneumoniae B E. Coli C Vibrio Cholera D Peptostreptococcus

Q4: A patient has burn wound infection growing a non fermenting bacteria, gram negative bacilli, oxidase positive ?

- A Pseudomonas B E. Coli C Acinetobacter D Haemophilus influenzae

Q5: A patient with blood stream infection. Cultures are growing gram +ve cocci in clusters, catalase and coagulase positive. What's the most likely causative organism. What is the bacteria ?

- A Neisseria B Streptococcus pyogenes C Enterococcus D Staphylococcus aureus



MEET THE TEAM

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