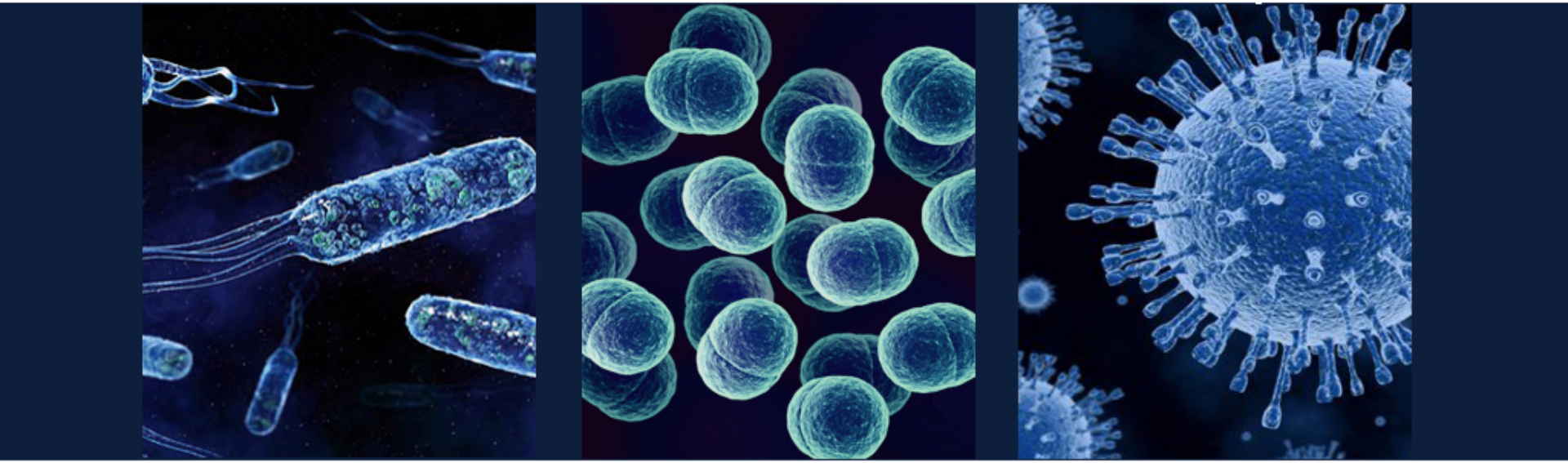
MICROBIOLOGY TEAM 435

هذا العمل لا يغني عن المرجع الأساسي للمذاكرة



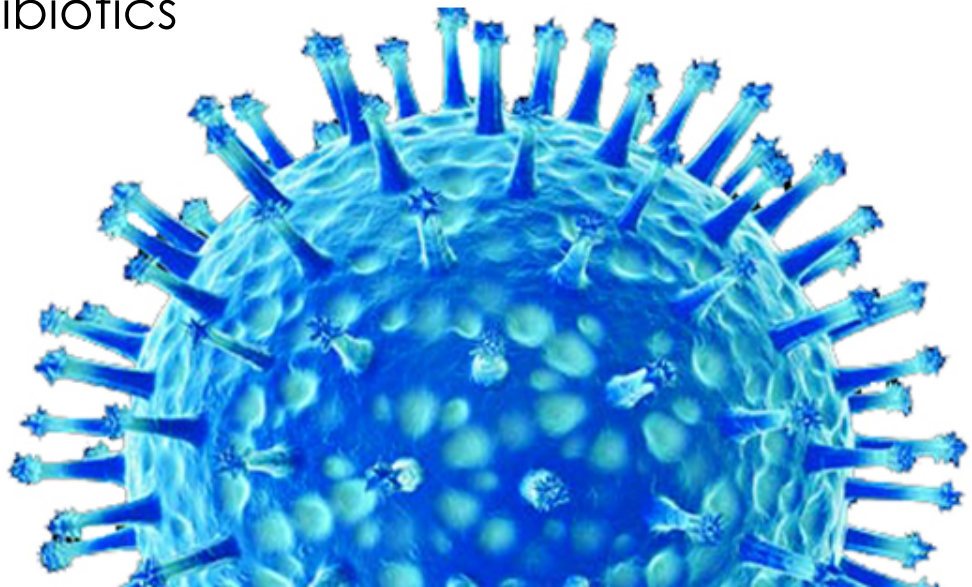
Lecture 6

Gram Positive & Negative Bacteria

● Important ● Term ● Extra explanation ● Additional notes

Objectives

- Know the general basic characteristics of bacteria.
- Differentiate between gram positive and gram negative bacteria characteristics.
- Know the classes and groups of gram positive bacteria and gram negative, cocci and bacilli (rods).
- Know the common identification characteristic of these groups.
- Know the common infections and diseases caused by these organisms and the antibiotics used for their treatment.



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.**

Type	Gram positive cell wall	Gram negative cell wall
Consist of	• **Thick**, homogenous sheath of **peptidoglycan** 20-80 nm thick • Tightly bound **acidic polysaccharides**, including **teichoic acid** and **lipoteichoic acid** • **Cell membrane**	• Outer membrane containing **lipopolysaccharide** (LPS) • **Thin** shell of **peptidoglycan** • Periplasmic space (between the cell wall & plasma membrane) • Inner membrane
stain	**Retain** crystal violet and stain **PURPLE or BLUE**	**Lose** crystal violet and stain **PINK or RED** from safranin counterstain

تحتفظ هذه البكتيريا بلونها بعد أن تصبغت بصبغة جرام مهما تعرضت لأي مادة كيميائية، فهي كالكرستال قوية وصلبة

Safranin counterstain

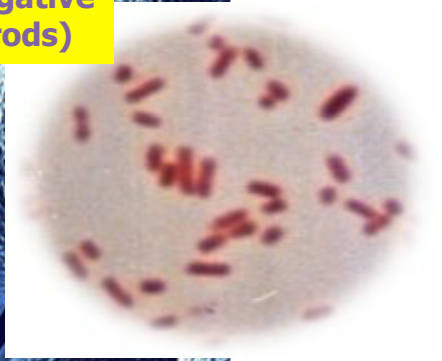
حتى لا تنسى تذكر أن:
الزعفران لونه أحمر و نوع هذه البكتيريا تتصبغ باللون الأحمر

Gram Stain

	Microscopic Appearance of Cell		Chemical Reaction in Cell Wall (very magnified view)	
Step	**Gram (+)**	**Gram (–)**	**Gram (+)**	**Gram (–)**
1. Crystal violet				
			Both cell walls affix the dye	
2. Gram's iodine				
	لاحظ كيف اختفى اللون البنفسجي وأصبحت بلا لون (Decolorization)		**Dye crystals trapped in wall**	**No effect of iodine**
3. Alcohol				
Or **acetone**			**Crystals remain in cell wall**	**Cell wall partially dissolved, loses dye**
4. Safranin (red dye)				
			Red dye has no effect	**Red dye stains the colorless cell**

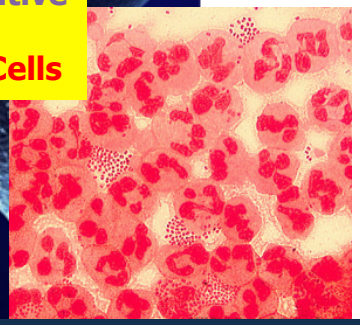
Gram Stain

Gram Negative Baciili(rods)

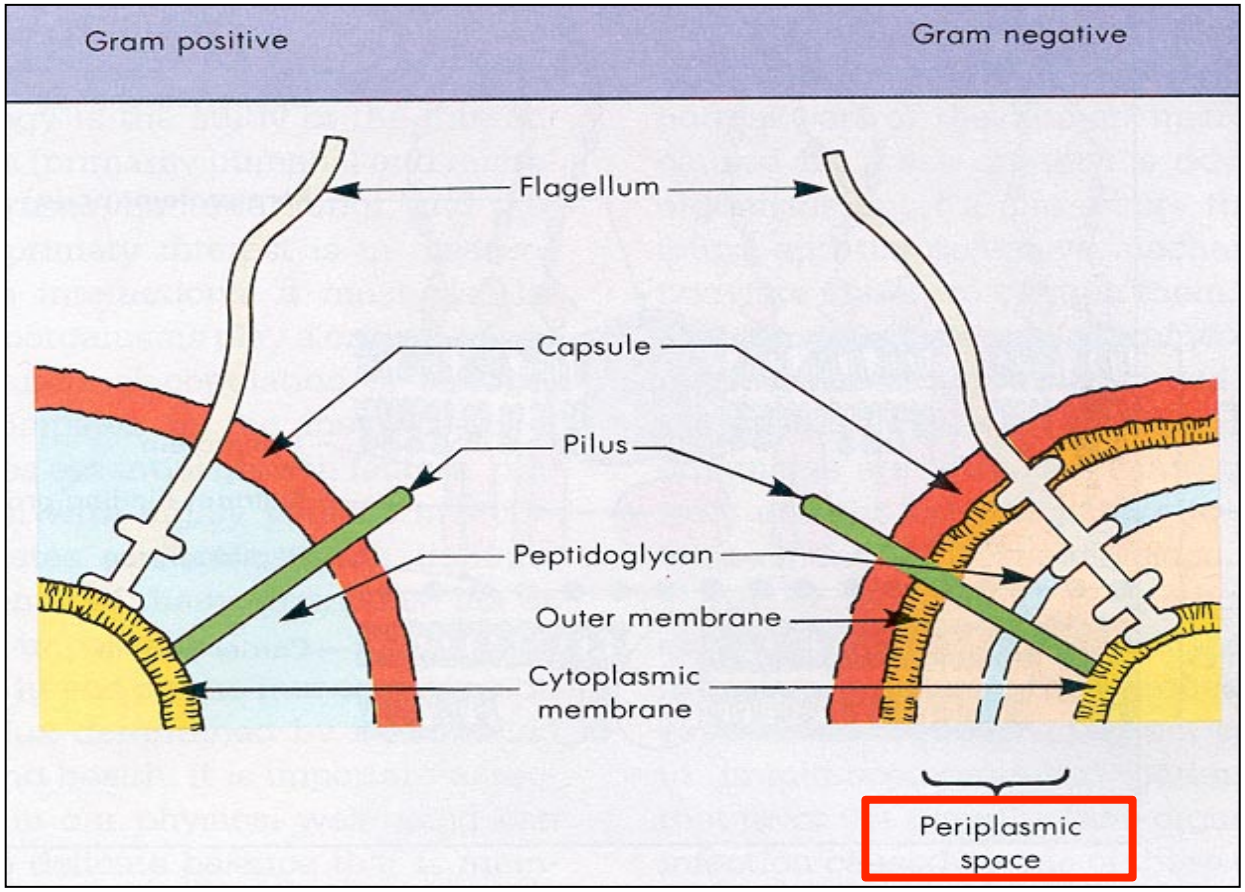


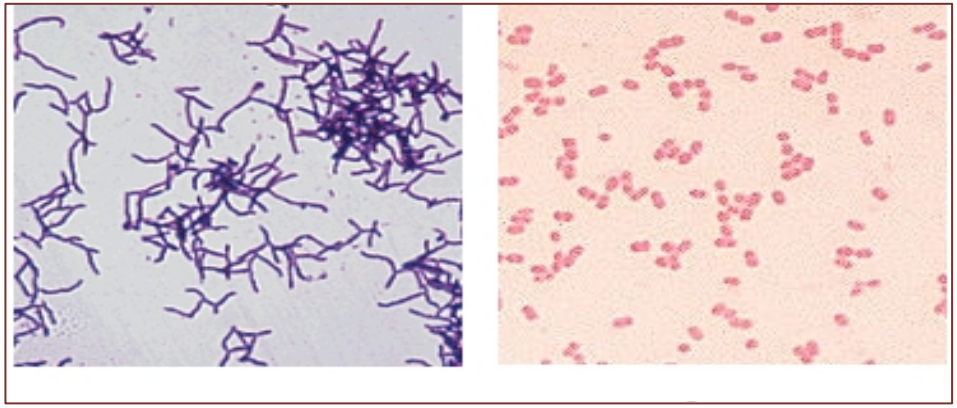
E.Coli
(Pure culture)

Gram Negative Cocci With Pus Cells

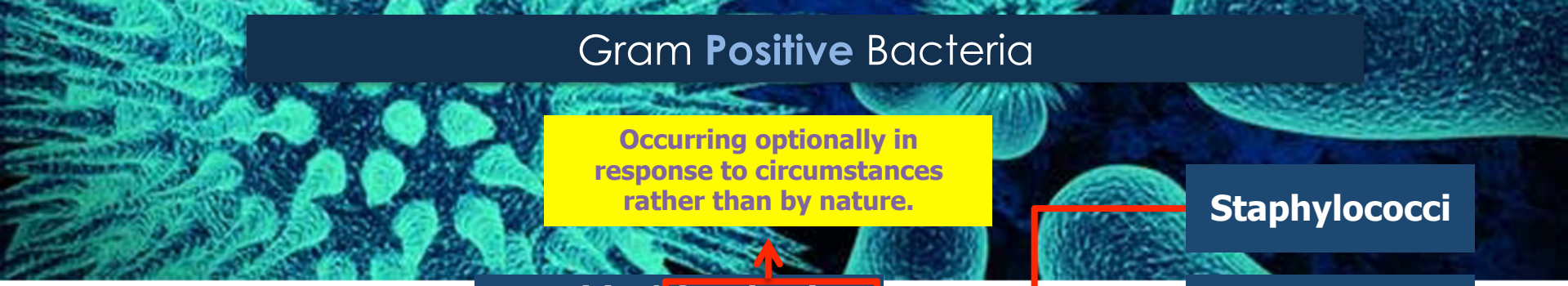


Neisseria gonorrhoeae
(Smear of urethral pus**)**
- Clinical specimen





Gram Positive Bacteria



Occurring optionally in response to circumstances rather than by nature.

- Gram Positive Bacteria
  - Cocci
    - Aerobic / facultative Anaerobic
      - Staphylococci
      - Streptococci
      - Enterococccci
    - Anaerobic
      - Peptostreptococci
  - Bacilli
    - Aerobic / facultative Anaerobic
      - Cornybacterium
      - Listeria
      - Nocardia
      - Latobacillus , Bacillus
    - Anaerobic
      - Clostridium

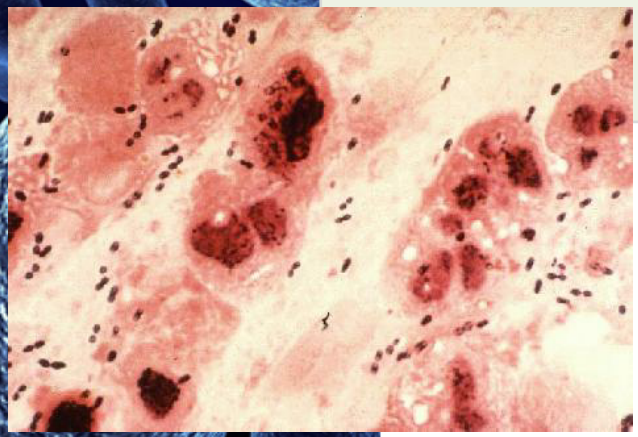
Gram Positive Bacteria

Gram Positive Cocci
(Aerobic / facultative Anaerobic)

1. Staphylococci

* Catalase-**positive**
* Gram-positive cocci in **clusters**

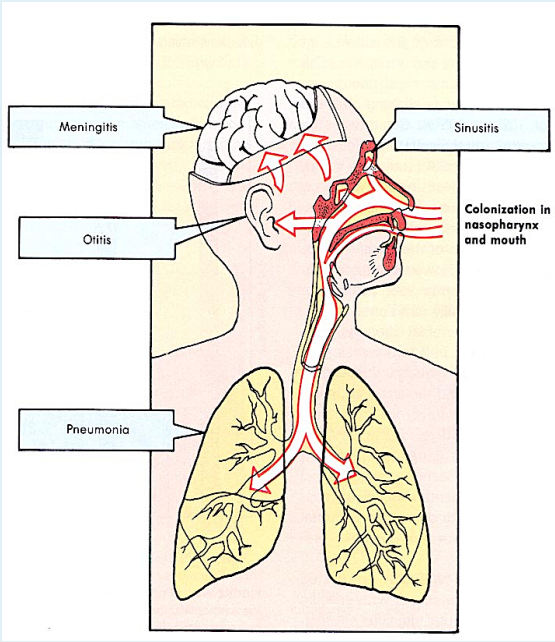
Coagulase-positive	Coagulase negative
Staphylococcus aureus Most **important pathogen**	***Staphylococcus epidermidis*** Normal flora in the **skin** ***Staphylococcus saprophiticus***



Gram Positive Bacteria

2. Streptococci

* Catalase-**negative**
* Gram-positive cocci in **chains** or **pairs**

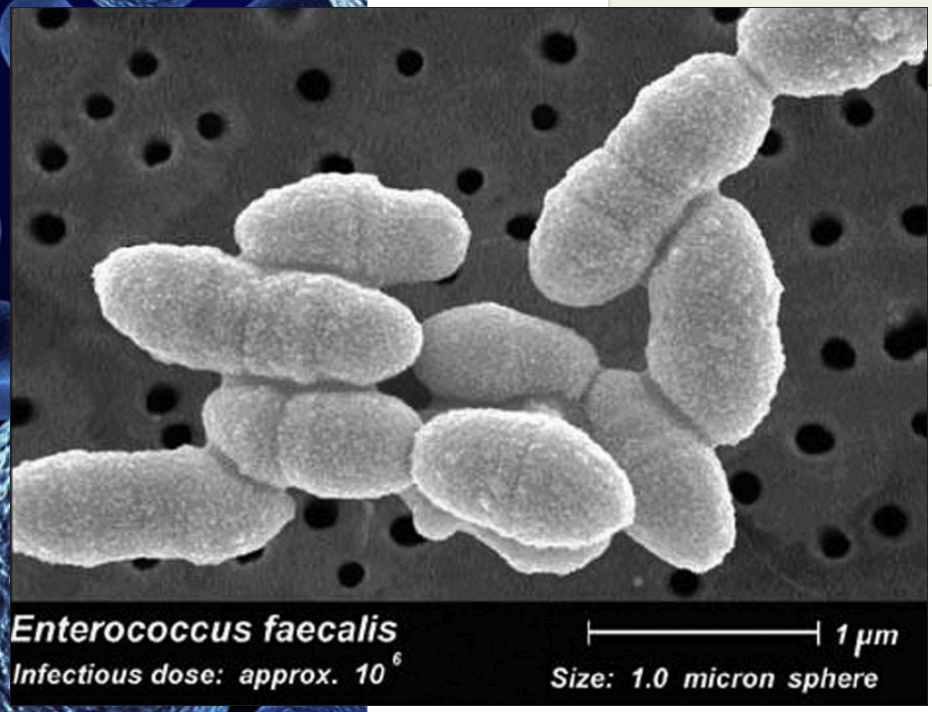
Streptococcus pyogenes	***Viridans streptococci***	***Streptococcus pneumoniae***
An example **of Group β - Hemolytic streptococcus** (Most clinically important of this group)	Occur in the **mouth** as normal flora.	Causes: - Meningitis - Sinusitis - Otitis - Pneumonia
Pathogenesis :		
Pharyngitis (most common) **Cellulitis** (acute inflammation of subcutaneous tissue) **Rheumatic Fever** Characterized by: Fever, Migrating polyarthritis , carditis and immunologic cross reactivity **Acute Glomerulonephritis:** Edema, hypertension, hematuria antigen-antibody complex deposition	Causes **endocarditis** * Endocarditis is an infection of the inner lining of your heart (endocardium)]	

Gram Positive Bacteria

3. Enterococci

Example

Enterococcus faecalis



Gram **positive** bacteria

Bacilli

A-Non spore forming
B-Spore forming

Anaerobic

C.tetani

Gas gagarene

- C. tetani , Cause: Tetanus.
- C. perfringens, Cause:**Gas**
- **gangarene**.
- C. botulinum , Cause: **botulism**.
- Descending weakness-->**paralysis**
- diplopia, dysphagia-->**respiratory failure**
- C. diphtheriae, Cause: Fever, pharyngitis, **cervical LAD** (disease of the lymph nodes).

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

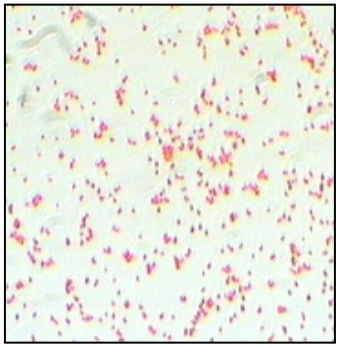
C. tetani and C. botulinum both **anaerobes** produce the same toxin but REMEMBER that **tetani's** toxin **inhibits** the inhibitory impulses in the brain otherwise **botlulinum's** toxin will **inhibit** the **release** of **ACH**.

Aerobic/facultative anaerobe

Aerobic spore forming most important is **Bacillus anthracis** ,that causes **anthracis**
-Bacillus anthracis has the only bacterial capsule that's made of **POLYPEPTIDE**.

Gram- **Negative** Cocci

- ***Neisseria gonorrhoeae***
  - ***The Gonococcus***
- ***Neisseria meningitidis****(it is considered as potential pathogen in the oropharynx)*
  - ***The Meningococcus***



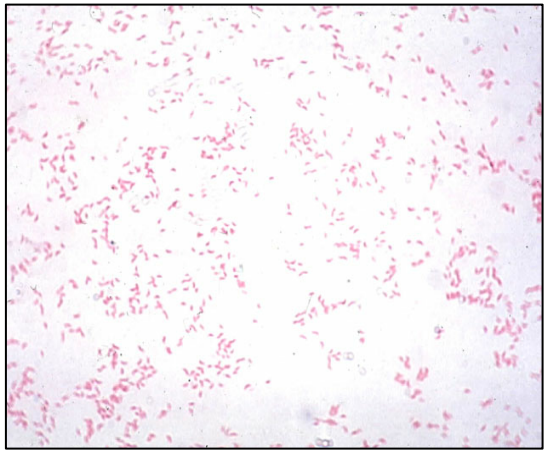
- Both Gram-negative intracellular **diplococci**
- Moraxella catarrhalis

Gram- **Negative** Rods

- Enteric Bacteria they **ferment sugars** most important are;
  - ***E. coli***
  - ***Salmonella***
  - ***Shigella***
  - ***Yersinia and Klebsiella pneumoniae***
  - ***Proteus***

Gram- **Negative** Rods

- **Fastidious GNRs**
  - ***Bordetella pertussis***
  - ***Haemophilus influenzae***
  - ***Campylobacter jejuni***
  - ***Helicobacter pylori***
  - ***Legionella pneumophila***
- **Anaerobic GNRs**
  - ***Bacteroides fragilis*** (It is one of the anaerobes that resist penicillin so instead we should use Metronidazole for its treatment).
  - ***Fusobacterium***



Oxidise positive non i.e. they do not ferment sugars e.g:.

-**Pseudomonas** that causes infection in Immunocompromised patients

-Oxidise negative non fermentative e.g. **Acinobacter species**

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**

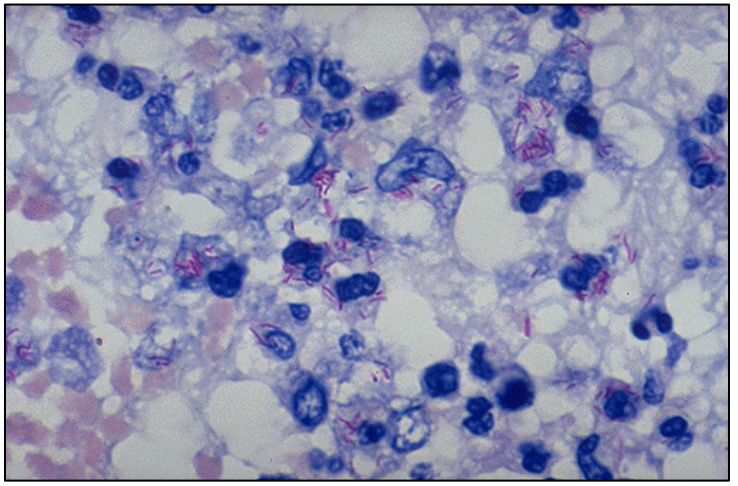
Non-Gram-stainable bacteria

Unusual gram-positives

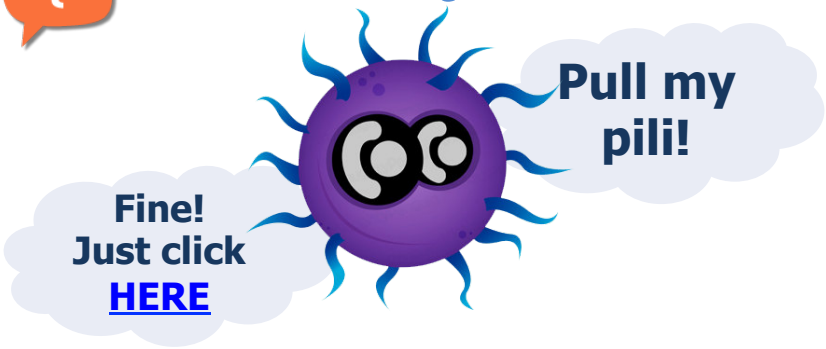
-Spirochaetes
-Obligate intra-cellular bacteria

Unusual gram-Negative

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



Online Quiz



Videos

Gram Positive Bacteria vs Gram Negative Bacteria

Gram Staining

Bacterial characteristics - Gram staining

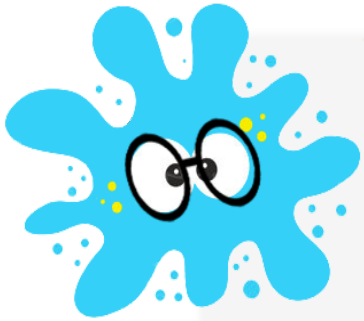
Books that could help you

- Lippincott's Illustrated Reviews : Microbiology Second Edition.
- Lippincott's Microcards Microbiology Flash Cards Third Edition.

MiCRObiology

TEAM 435

We do things better



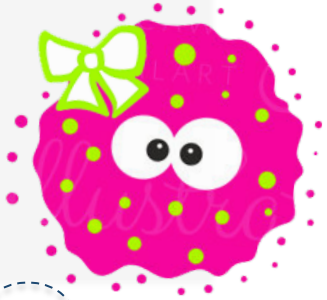
Boys Team

- Ali Alzahrani
- Khalid Sharahily
- Ahmad Alzahrani
- Zeyad Alsalem
- Muhammad Dossary
- Meshal Alhazmy
- Hamzah Alfiar

Girls Team

- Lamya Alsaghan
- Nojood Alhaidri
- Monera Alayuni
- Alanoud AlOmair
- Shahad Alenezi
- Aisha Al-Sabbagh
- Bodour Julaidan
- Noura AlTawil
- Deema AlFaris
- Sara Al-Hussein
- Suha Alenezy
- Latifah Alsukait
- Dalal Alhuzaimi
- Reema Allhaidan

Girls power!



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Contact us!

إن أصبنا فمن **الله** عز وجل، وإن أخطأنا فمن **أنفسنا والشيطان**