

وَقُلْ رَبِّ زِدْنِي عِلْمًا



RESPIRATORY SYSTEM

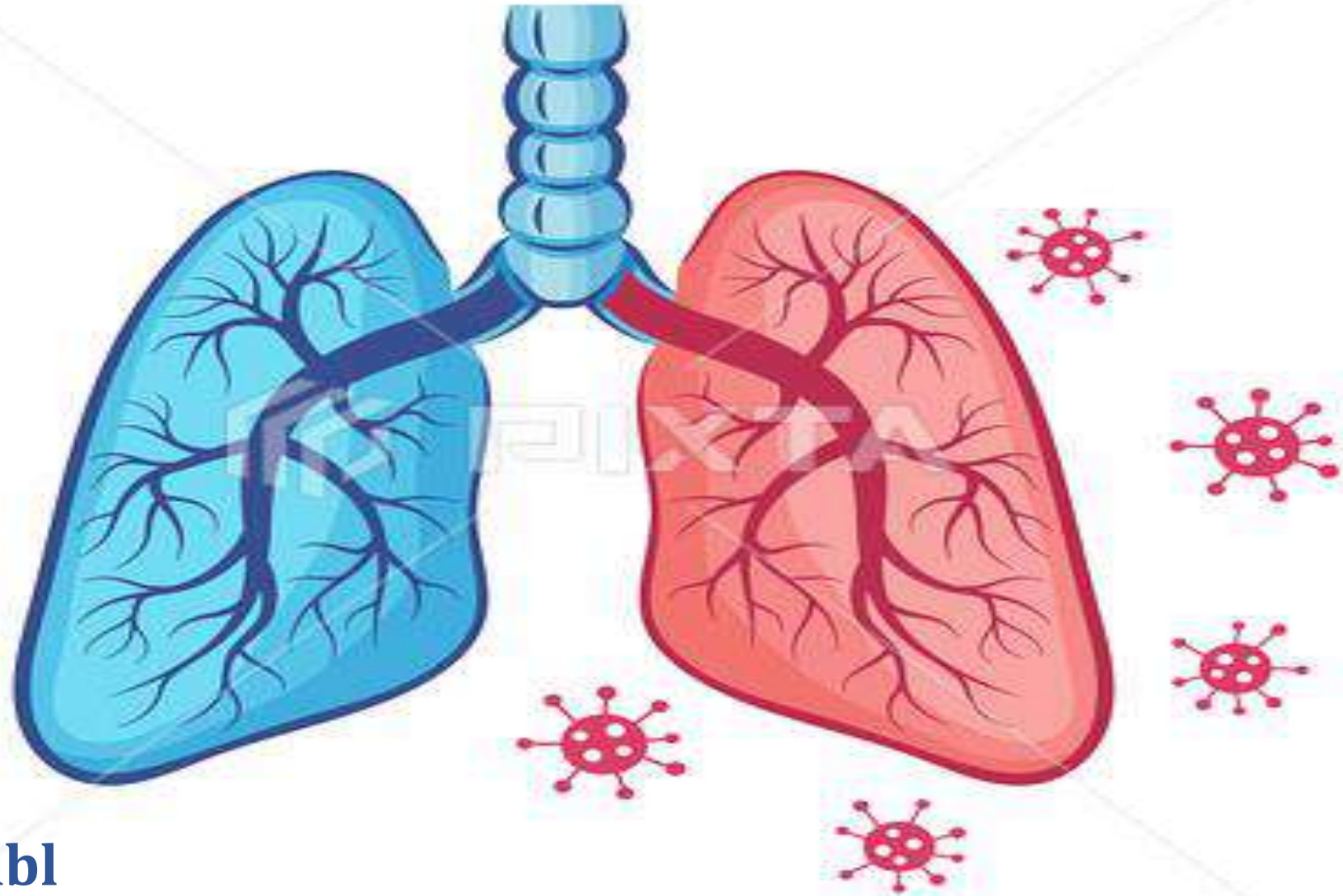
HA4AT BATCH

SUBJECT : _____

LEC NO. : 1

DONE BY : Tabark Aldaboubi

RESPIRATORY TRACT INFECTIONS - I



By
Prof. Hala Tabl

Respiratory Tract Infections

most important cause of RTI

* الجداول التي باول سلا يدبت تجميع لل
↓

I- Rhinitis (Common Cold):

* **Mostly of viral causes**

Rhinovirus

Coronavirus

Adenovirus,

Parainfluenza virus

Influenza virus

RSV

III- Infections of the ear:

Otitis Externa:

- Pseudomonas aeruginosa.
- Aspergillus niger (otomycosis).

Otitis media:

- Streptococcus pneumoniae
- Haemophilus influenzae
- Moraxella catarrhalis
- Streptococcus pyogenes
- Staphylococcus aureus

II- Sore throat and Pharyngitis:

* **Bacteria:**

- Streptococcus pyogenes.
- Corynebacterium diphtheriae.
- Vincent's organisms: Borrelia vincenti and Fusobacterium.

* **Fungi:** Candida.

* **Virus:** EBV and Adenoviruses.

IV- Sinusitis:

- Streptococcus pneumoniae
- Haemophilus influenzae
- Moraxella catarrhalis
- Streptococcus pyogenes
- Staphylococcus aureus

V- Acute Epiglottitis:

Haemophilus influenza type b

VI- Laryngitis and croup: Mostly viral

Parainfluenza, Influenza, Adenovirus.

VII- Tracheitis & Bronchitis:

* **Mostly viral:** Parainfluenza, Influenza, Adenovirus and RSV.

* **Bacteria:** Bordetella pertussis, Haemophilus influenza, Mycoplasma pneumonia, Chlamydia pneumonia and Streptococcus pneumonia.

VIII- Bronchiolitis:

RSV, Parainfluenza virus

IX- Pneumonia

Community Acquired Pneumonia (CAP):

Bacterial causes:

- **Streptococcus pneumoniae** (the commonest cause of **lobar** pneumonia in young children and elderly).
- Haemophilus influenzae
- Staphylococcus aureus
- Streptococcus pyogenes
- Bacillus anthracis (pneumonic anthrax)
- Yersinia pestis (pneumonic plague)
- Mycobacterium tuberculosis & Atypical mycobacteria

Atypical pneumonia:

(Mycoplasma pneumoniae, Legionella pneumophila, Chlamydia psittaci, Coxiella burnetii).

Fungal causes:

- Histoplasma capsulatum, Aspergillus fumigatus, Coccidioides immitis, Blastomyces dermatitis, Cryptococcus neoformans, Pneumocystis jirovecii

Viral causes:

Rarely the primary cause of pneumonia and when they cause pneumonia, it is mainly in infants and immuno-compromised patients.

- Influenza
- Respiratory syncytial virus (predominant in infants).
- Para - influenza virus
- Adenoviruses

Parasitic causes:

- Paragonimus westermani
- Loeffler's syndrome (Ascaris lumbricoides, Strongyloides stercoralis, Ancylostoma duodenale).

Hospital Acquired (Nosocomial) Pneumonia (HAP):

(48hs or more after admission)

(Klebsiella pneumoniae, Pseudomonas aeruginosa and E. coli, Staphylococcus aureus MRSA).

Empyema (a collection of pus in the pleural cavity): Mostly caused by pyogenic G+ve cocci especially **Staphylococcus aureus** and G-ve bacilli especially **Klebsiella pneumoniae**.

Lung Abscess: Anaerobes (Peptostreptococcus spp., Prevotella spp. and Fusobacterium nucleatum) and Staph. aureus.

Sore throat and Pharyngitis:

* Bacteria:

* ايج استر يتحكي عنده البكتورية (The most common) او بتكون حاطينها بلون غامق) يكون مهمم جدًا

- Streptococcus pyogenes (**The most common cause**).
- Corynebacterium diphtheriae.
- Vincent's organisms: Borrelia vincenti and Fusobacterium.

* Fungi: Candida. → اختناها بالجينييرال

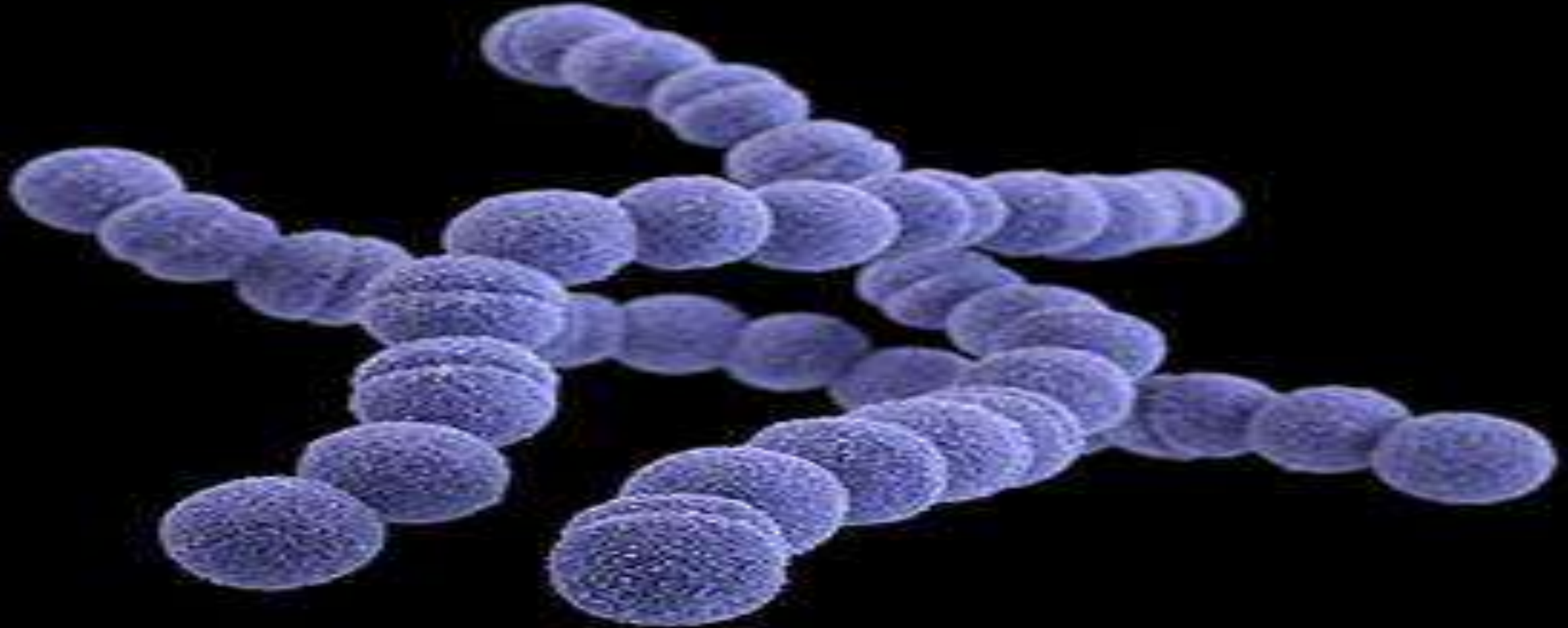
* Virus: EBV and Adenoviruses.

↓
Epstein Bar Virus

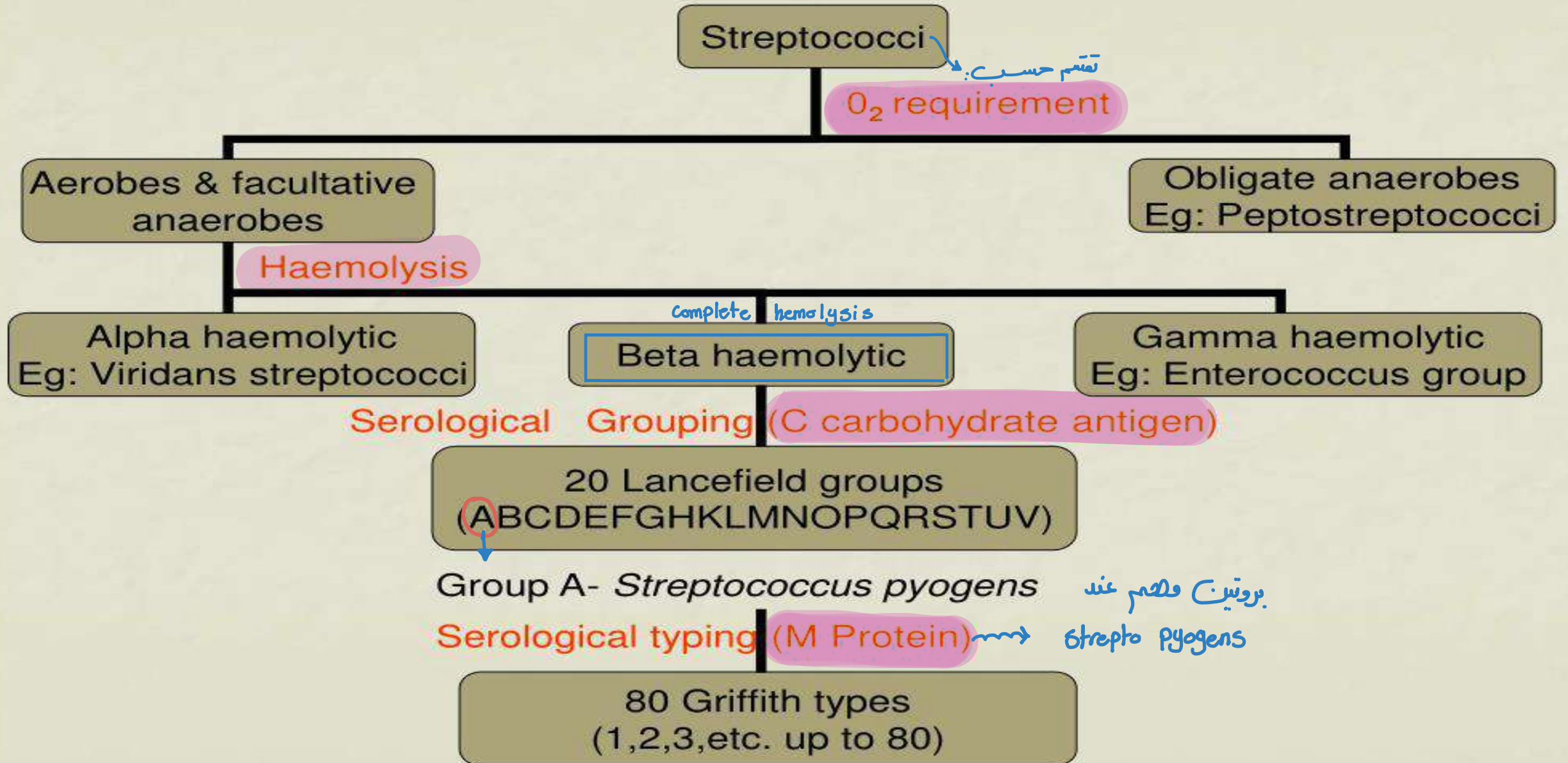
GROUP A, BETA- HAEMOLYTIC STREPTOCOCCI

The most common → (STREPTOCOCCUS PYOGENES)

Something arranged in chain something rounded generating pus



CLASSIFICATION:



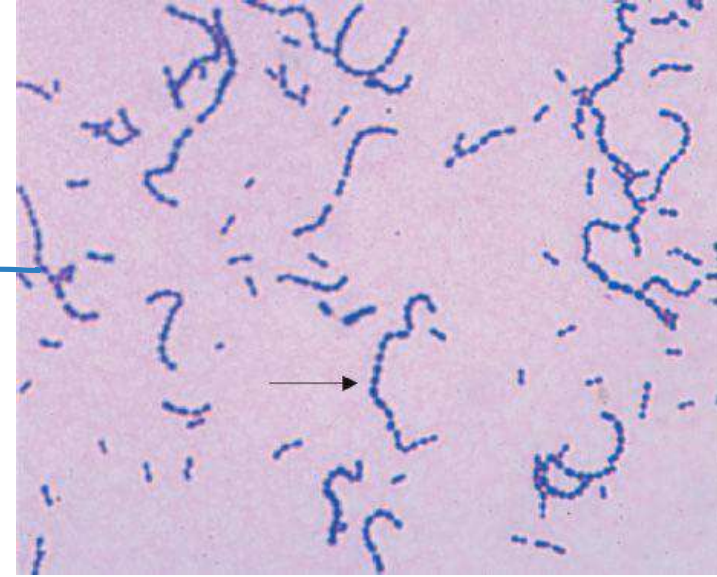
MORPHOLOGY:

- Gram-positive cocci.
- Arranged in ^{سلاسل} chains or pairs.
- Some ^{بعضها} are capsulated.

CULTURE:

- They are facultative anaerobes. ^{لها متطلبات خاصة للنمو (ينمو بال blood)} grow in presence or absence of O₂
- Fastidious organism grow on blood agar and produce ^{حوالي 100 Culture يكون complete rupture of RBCs → zone of clearance} complete (Beta) hemolysis. Growth and hemolysis are aided by incubation in 10% CO₂.

لونته يكون ازرق او نهدي
كونا (gram +)



بزيدي النمو والتكسيري بوجود نسبة اعلى من CO₂

BIOCHEMICAL REACTION:

rapid, important ^{للتمييز بين} → Strepto and Staph

➤ **Catalase negative** (Differentiate with Staphylococci which are catalase positive).

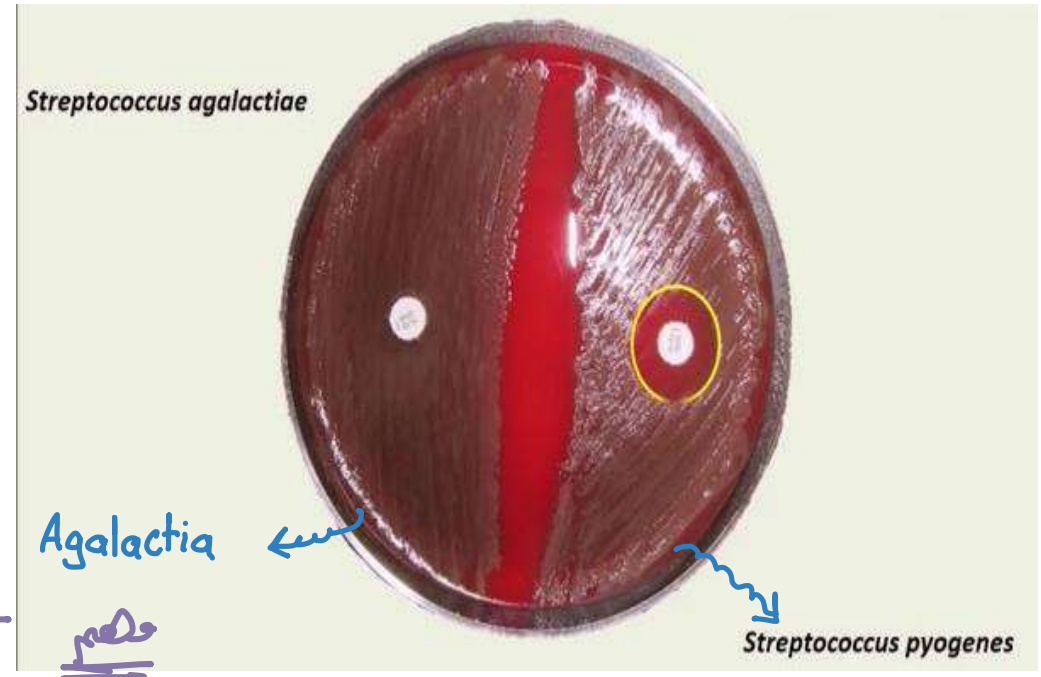
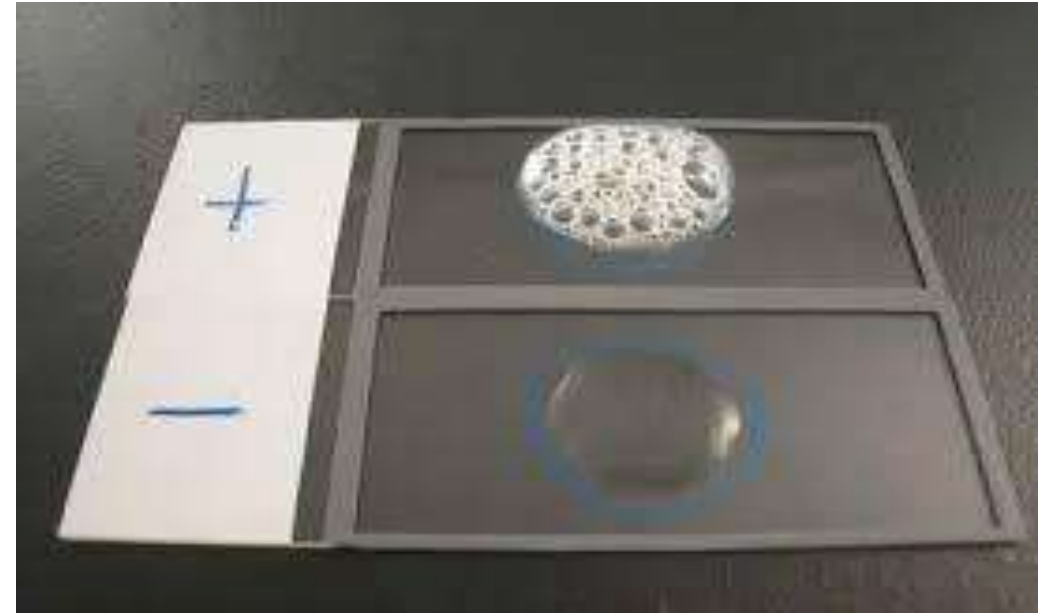
➤ **Bacitracin sensitive** (Differentiate with other beta hemolytic streptococci such as

S. agalactiae which is bacitracin resistant).

Streptococcus group D ^{ال D وال Streptopyogen} ^{تتميز بين}
= resistant

pyogen → can't grow in presence Bacitracin - inhibition zone

Agalactia → Can grow in presence Bacitracin



VIRULNCE FACTORS:

Attachment

A) Adherence factors: promotes adherence to epithelial cells.

1- Fibronectin-binding protein (protein F) and lipoteichoic acids (LTA)

2- M protein: hair like projections covering the cell wall.

B) Anti-phagocytic factors:

1- M protein: it is a major virulence factor that resist phagocytosis.

* According to M protein, group A are classified to more than 80 types.

2- Hyaluronic acid capsule: acts as immunological mask to avoid phagocytosis.

As it is chemically similar to hyaluronic acid of the host connective tissue, therefore, it is not immunogenic.

3- C5a peptidase: breaks down C5a complement so that it no longer attracts phagocytes.

Component in immune system → attraction to phagocytic cell, phagocytosis
بتكسر
ويعمل على إبطال بصيرتها
ويعمل على إبطال بصيرتها
ويعمل على إبطال بصيرتها



C) Spreading factors: Group of enzymes that break down the normal host tissues and so, facilitates the rapid spread and invasion of *S. pyogenes*:

بعل لysis لل Fibrin

1- Streptokinase (Fibrinolysin):- Dissolves fibrin in clots, thrombi, and emboli.

بکسر ال DNA

2- Streptodornase (Deoxynuclease)(DNase):- Depolymerizes and degrades DNA.

في خلايا بتموت بطلع منها ال DNA مسك بزود ال viscosity بتاعت ال Pus ، بيق حركة ال organism
فبکسر عشان يتشر بسهولة.

So, Streptokinase and streptodornase used in:

صار سيخلصوا هاي ال Factor الي فوق وسيفيدوا منها

- Treatment of pulmonary emboli and coronary artery and venous thrombosis.
- Liquefy exudates and facilitate removal of pus and necrotic tissues.

3- Hyaluronidase: Splits hyaluronic acid, a component of host connective tissue.

D) Toxines: ^{cytotoxin}

1- **Streptolysins (Hemolysins) (pore forming cytotoxin)**: lyse red blood cells, white blood cells, and platelets.

a) **Streptolysin O**: (oxygen labile).

It is antigenic, and antibody to it (ASO) develops after group A streptococcal infections. ^{Stimuli to immune system → Antibody ASO يتكون}
_{Anti streptolysin O}

The titer of ASO antibody is important in the diagnosis.

b) **Streptolysin S**: (oxygen stable), not antigenic.

It is responsible for β-hemolysis on the surface of a blood agar plate.

2- **Pyrogenic (fever inducing) exotoxins**: Three different exotoxins (SPE A, B and C).

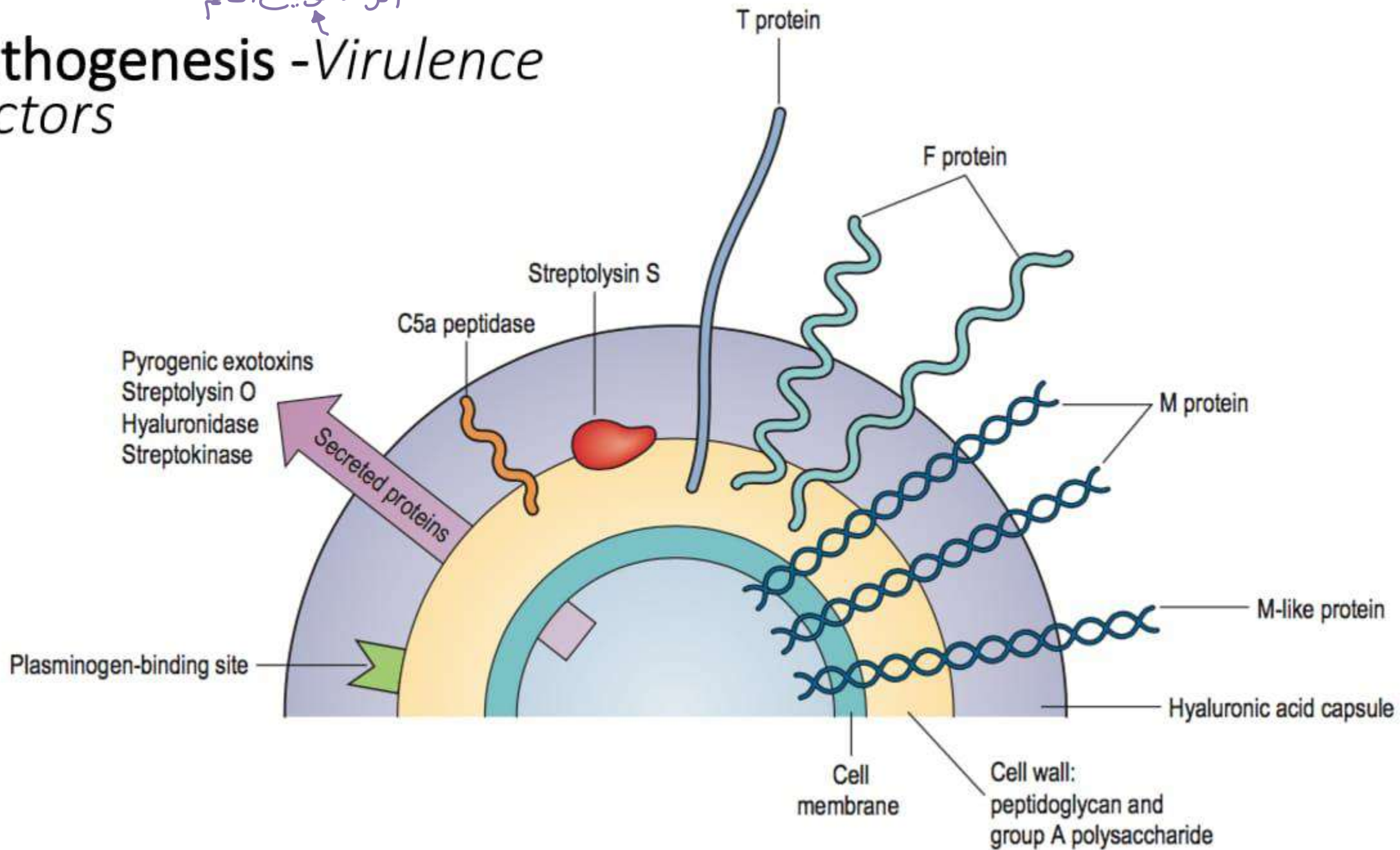
SPE A (erythrotoxic toxin): It causes the **rash** that occurs in scarlet fever.

_{احمر} ^{rash} _{ال} ^{المسؤول عن ظهور ال} _{ال} ^{Toxin}

* ^{فش كل ال} _{Streptococcus} ^{بتكون موجودة مجتمعة بكل strain} _{pyogen} ^{ون ال} _{Virulence Factor}

الرسمة توضيح الهم

Pathogenesis - Virulence factors



Diseases caused by Streptococcus Pyogenes:

S. pyogenes causes three types of diseases:

(1) **Pyogenic (suppurative) (pus-forming)** diseases such as ^{التهاب} **pharyngitis**,

impetigo, cellulitis and puerperal sepsis.

(2) **Toxigenic** diseases such as **scarlet fever** and toxic shock syndrome.

(3) **Immunologic** diseases such as rheumatic fever and acute glomerulonephritis

(AGN) (post-streptococcal diseases).

Streptococcal infection بتصير بعد ال
مهمة لأنها complication بتصير بعد pharyngitis

1) Streptococcal pharyngitis (Strep throat) (Acute follicular tonsillitis):-

التهاب اللوز اللمبي الحاد.

- Affect mainly children (5-15 ys).
- Red swollen tonsils. There is **purulent exudate** (Patches & streaks of pus).
- Enlarged and tender cervical lymph nodes, painful swallowing. *difficult Swallowing*
- High fever, sore throat.



mucus membrane → red و بتكون ال Tonsil Swollen
يكون فيه pus ← ما بتكون ظاهرة عند الاطفال
الي اعمارهم كثير صغيرة

2) Scarlet fever (scarlatina):-

الحمى القرمزية

بتصير بال strain المحي قادره تفرز erythrogenic toxin

- Caused by streptococci that produce **erythrogenic toxin** (strains of *S. pyogenes* **lysogenized** by a **bacteriophage** carrying the gene for the toxin).

bacteriophage ← حامله جين erythrogenic toxin

- Affect children < 10 years.

وتروح تدخله ال Streptococci الي بتروح تملوا transcription

ويتحولوا لبروتين ويتفرزوا

- It is characterized by **fever, sore throat, and a scarlet erythematous rash**.

inflammation

بتبلش على ال chest ويتنتشر

- Rash first seen on the upper chest, then extremities.
- A “**strawberry**” **tongue** is a characteristic lesion seen in scarlet fever.



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Post-streptococcal diseases: اعراضا بتتميز بعد اسابيع من ال Streptococcal infection تكون ال Strepto طلقة من الجسم

➤ Some strains of *S. pyogenes* bearing certain **M proteins** are nephrogenic and cause glomerulonephritis, while other strains bearing different M proteins are rheumatogenic and cause rheumatic fever.

في انواع من ال Strepto عندها M protein تشبه تركيب معين موجود بالقلب

في انواع من ال Strepto عندها M protein تشبه تركيب معين موجود بالكلب

➤ These disorders occur **weeks** (time to produce sufficient antibodies) after a local infection with group A streptococci.

ال Antibody الي بتكون بروج يهاجم خلايا الجسم نفسه

➤ The inflammation is caused by an immunologic (**autoantibody**) response to streptococcal M proteins that **cross-react** with human tissues.

➤ **Acute Rheumatic fever:** Follows **pharyngitis (not skin infection)**.

➤ **Acute Glomerulonephritis (AGN):** Follows **skin infections** rather than pharyngitis.

DIAGNOSTIC LABORATORY TESTS:

من المناطق التي فيها PUS

a) **Specimens:** Throat swab for diagnosis of streptococcal pharyngitis.

b) **Gram stained smears:** are not useful in streptococcal pharyngitis (S. viridans are members of the normal flora).
↓
كثيرا ما يكون فيه normal flora

c) **Culture:** on blood agar (10% CO₂) show:

small, translucent β hemolytic colonies which is catalase negative and inhibited by bacitracin (bacitracin sensitive)

سريعة

d) **Antigen detection tests:** ELISA or agglutination tests used for **rapid** antigen detection.

e) **Serology (ASO test):** (for diagnosis of **post-streptococcal diseases**) ← وهامة

ASO titers are high soon after infections. In patients suspected of having rheumatic fever, an elevated ASO titer is typically used as evidence of previous infection because throat culture results are often negative at the time the patient presents with rheumatic fever.

rheumatic fever cardiac manifestation Tonsillitis من وتكرر وهامة من فترة كان عنده اجا طفل وا هله خبروا الدكتور انه

TREATMENT:

➤ All B-haemolytic group A streptococci are sensitive to penicillin G.

➤ Treatment of scarlet fever:

In addition to penicillin, antitoxin serum is given. It shortens the course of the disease.

Antitoxin to erythrogenic toxin prevents the rash but not interfere with streptococcal infection.

PREVENTION:

➤ Rheumatic fever can be prevented by adequate treatment of strept. pharyngitis for 10 days.

➤ Prevention of streptococcal infections (usually with long acting penicillin once each month)

in persons who have had rheumatic fever is important to prevent recurrence of the disease.

* اهداف ال prevention انه افنع حدوث ال disease

* بعطي ال Antibiotic ← ١٠ ايام ما يوقفوا بعد اكم يوم لما يتحسن

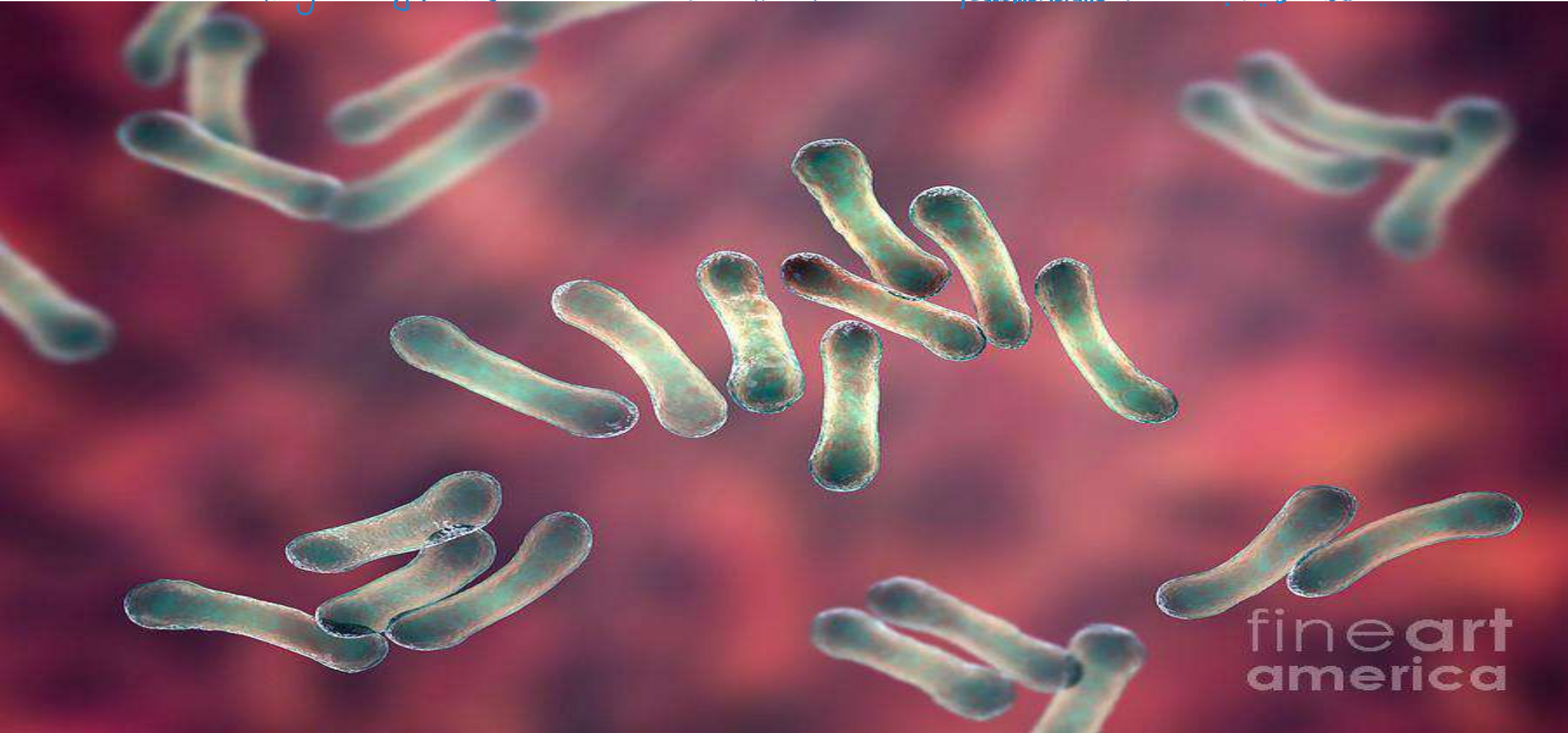
* اي طفل بتكرر عنده يُفضل فحلا (ASO test) واذا تم تشخيصه بـ rheumatic fever لنم اقبل اعطيه Penicillin long acting

(مرة كل شهر طول حياته)

CORYNEBACTERIUM DIPHTHERIAE

Something elongated (one end wider than the other)

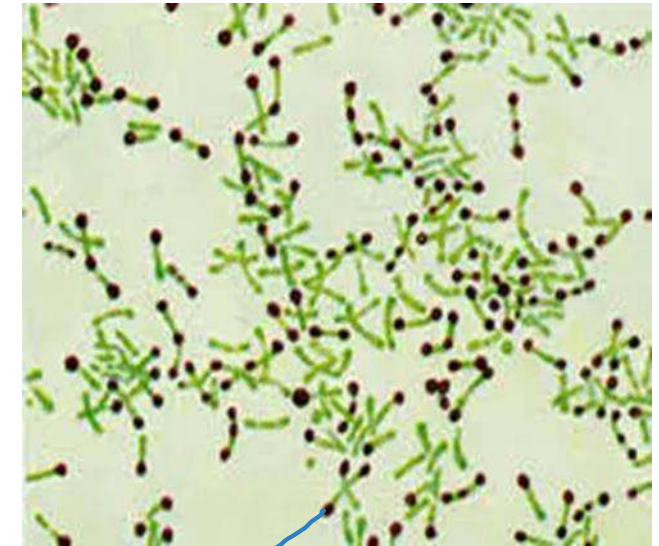
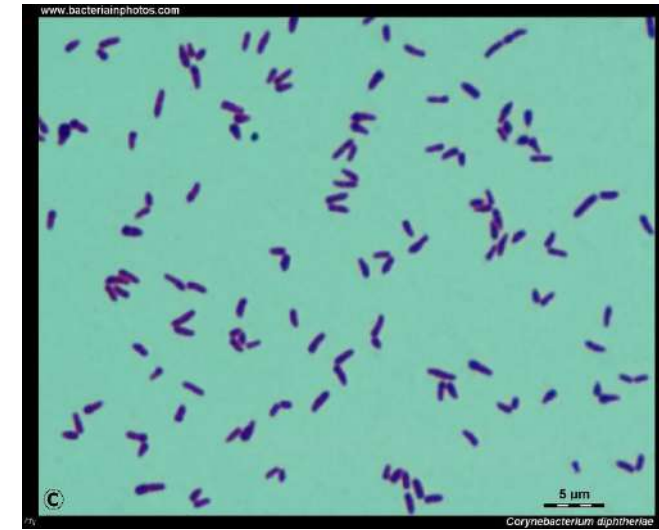
↳ ^{جلد} pseudomembrane → ^{المغسلا- زبي الجلك}



fineart
america

MORPHOLOGY:

- Gram positive rods. *bacilli*
- **Non-spore-forming**. Non-motile.
- They are **club-shaped** and lie at acute angles to each other giving **V, Y or Chinese-letter appearance**.
بكون شكلهم زي الحروف الصيني
Small group بعض
اذا كانوا في ترتيبوا على شكل حرف V
- The bacilli have a characteristic beaded appearance due to the presence of inclusion granules called metachromatic or volutin granules. These granules do not appear by Gram stain but can be seen by methylene blue or **Neisser or Albert's stain**.
عشان اشوفهم بوضوح سيستخدم صبغات مثل
1
2



Albert's stain

CULTURE:

- Aerobes.
- Do not grow on ordinary media, but grow on enriched media;

1- On **Loffler's serum**, they give grayish white colonies.

2- On **blood tellurite agar** (Selective medium)

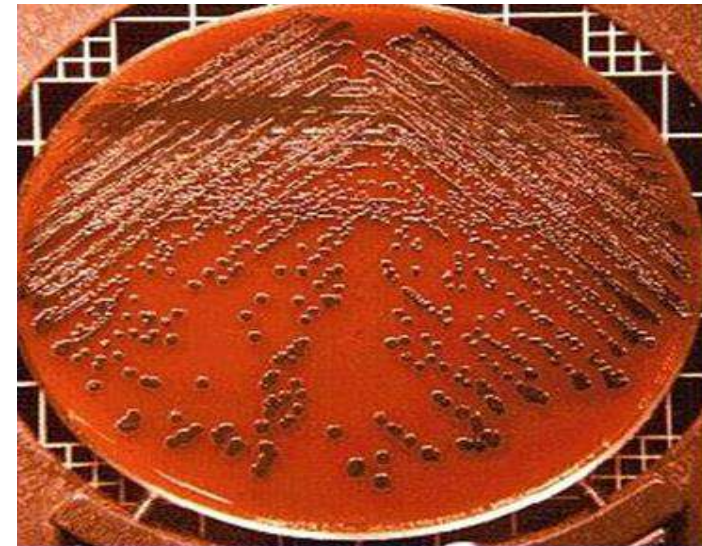
(blood agar + 0.04% potassium tellurite), they give

black colonies.

selective هي المادة هي التي خلتوا
لأنها تمنع نمو كل ال (- و + gram)
Diphtheriae فاعدا



Loeffler's serum slope

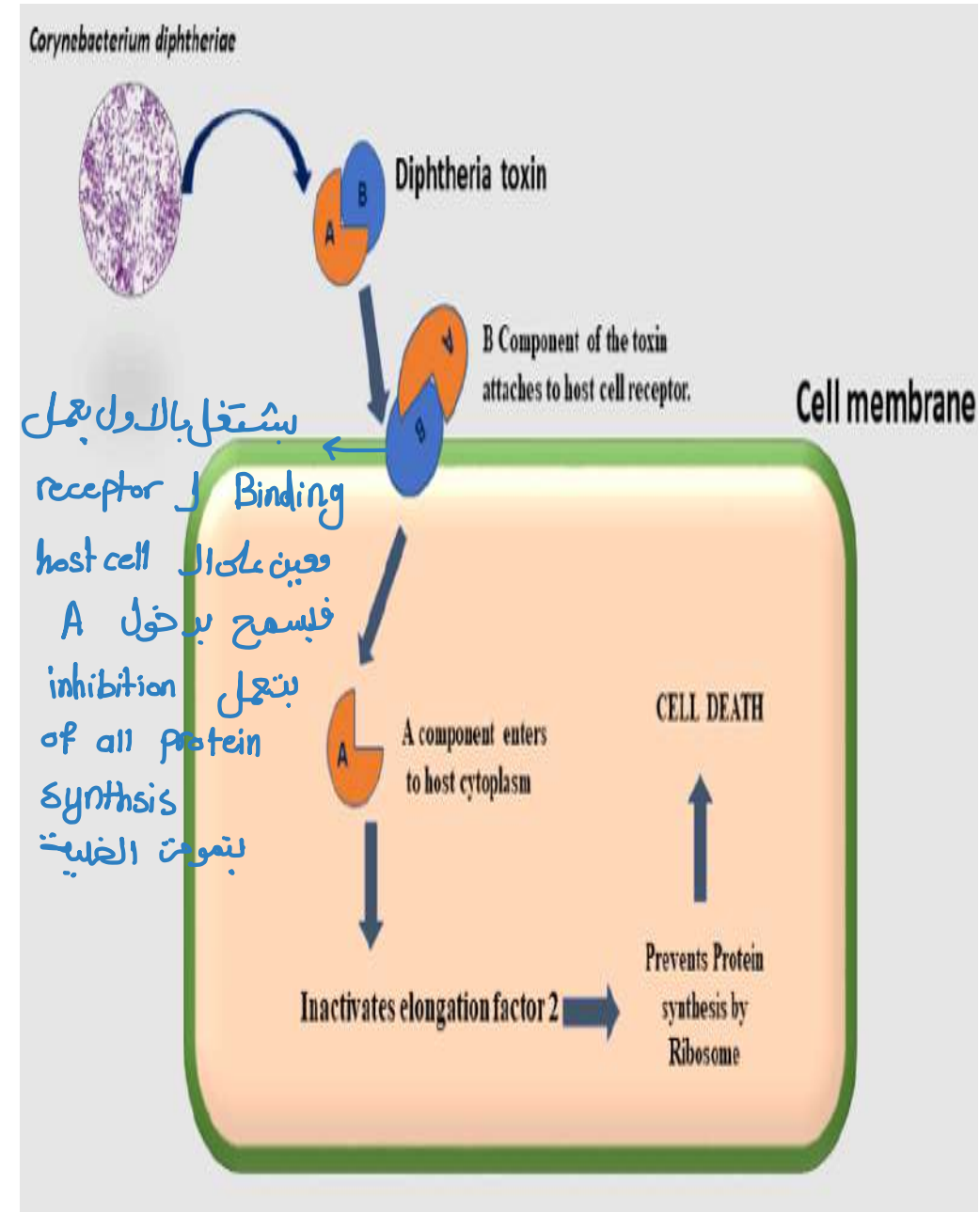


Tellurite
blood agar

Toxin فيهما Strain كل ال

VIRULENCE FACTORS:

- **Diphtheria toxin is the main virulence factor.**
- The toxin is produced **only** by strains of **C. diphtheriae** infected with **bacteriophage** which carry the gene for toxin production. So, only **lysogenic** strains of C. diphtheriae are **toxigenic** and **virulent**.
- It consists of two fragments (A, B);
- Fragment B is responsible for the transport of fragment A into the cell.
- Fragment A is responsible for **inhibition of protein synthesis (Inactivate elongation factor2).**



PATHOGENESIS:

A) Tonsillar diphtheria:

- Is the commonest type and is transmitted by droplets (from **case or carrier**).
- It's a very contagious, life-threatening disease that affect mainly small children but can affect adults.
- The organism **does not invade** the deep tissue and **never** enters the blood stream. The organism **multiply locally**, releasing the toxin causing inflammation of the throat, local necrosis with fibrinous exudate resulting in formation of a spreading grayish white **pseudomembrane**.
- The exotoxin released **diffuses** to the blood stream causing **toxaemia** and affects the **heart, kidneys & nervous tissue**.

حبيبات العنبراف

حامل ال organism
ليس ما عنده العنبراف

ينتشر بسرعة

ما يروح على الدم

عقن بال Fibrine

pharynx

وخطي ال

Trachea
larynx

وممكن ينزل ال

ال Toxin يروح على الدم

B) Nasal infection is also common while **conjunctival** or **skin** diphtheriae is rare and spread by contact.

CLINICAL PICTURE & COMPLICATIONS:

The incubation period is 1-7 days.

The patient presents with mild fever and general ill health.

طبقة متصلة مغطيت منطقة ال Pharynx ممكن يسوع ينقطع منه جزء ويروح سيكر اي مكان بال airway
The tonsils are covered with a **grayish pseudomembrane**

which may extend to the posterior laryngeal wall or larynx.

The cervical lymph nodes are enlarged.

يسوع ينقطع منه جزء ويروح سيكر اي مكان بال airway لجل اختناق
Suffocation may occur due to laryngeal obstruction.

Irregularities of cardiac rhythm indicate damage to the heart.

Nerve involvement may lead to **difficulties in swallowing, speech, vision** or paralysis of limbs.



ال Toxin توصل للدع تروح على القلب
وتقل Heart Failure

LABORATORY DIAGNOSIS:

- **Mainly clinical diagnosis.**
- **Laboratory diagnosis: (to confirm the clinical diagnosis).**

Throat swabs (very carefully) from the membrane are examined as follows:

A. Direct smears: are stained with **Gram, methylene blue or Neisser stains.**

Gram positive bacilli with characteristic morphology of *C. diphtheriae* may be seen in a small proportion of cases (**negative result cannot exclude diphtheria**).

B. Cultures: are made on **Loeffler's serum and blood tellurite media.**

مش كل الحال من بتعطيني Positive Film فاذا اطلعن negative ما بجلي انه خلمس فاعنده diphtheriae وانما بعل culture .

بجانب الـ Antitoxin لـ Antitoxin اعطي Antibiotic بنفس الوقت

TREATMENT:

→ started early. without delay → ما سبتن النتائج وسيا العلاج بطول
السبب !! انه عمل neutralization to toxic لـ Antitoxin اعطي بطول بطول
عشان الحقوا قبل ما يعمل irreversible damage

1- Diphtheriae anti-toxin serum:

- It should be given **without delay** when there is a strong clinical suspicion of diphtheriae.
- It **neutralizes the free toxin** (Not fixed toxin) before it causes irreversible damage.
- It is produced in **animals** (e.g. horse) by the repeated injection of toxoid.
- It is injected IM or IV after suitable precautions to rule out **allergy** to the animal serum.
ممکن يعيل حساسية لهيئة لـ Antitoxin اعطي لـ اختبار الحساسية

2- Chemotherapy:

Antibiotics are given **in association with anti-toxic serum**.

They inhibit local multiplications of C. diphtheria so, reduce their number of in throat →→

→ arrest further toxin production.

PREVENTION AND CONTROL:

A- Isolation: Patients with diphtheriae should be isolated.

B- Active immunization (vaccine): → Toxicity معقول من ال Toxin بعد ما صار لها عناية شالوا فيها ال
Antigenicity بس ضلعت محتفظة بال

Diphtheriae toxoid (Toxin with removed toxicity but retained antigenicity).

Such toxoid is usually combined with tetanus toxoid and pertussis vaccine and given as follows: ال ٣ سوا يعطوا = DPT السعك الديكيد

DPT: Primary series: at the age of 2, 4 and 6 months followed by two boosters at 15-18 months and at 4-6 years. الثلاثين البكتيري

Td: Boosters every 10 years are recommended. (Pertussis vaccine may cause encephalopathy if given after 6 years of age). ينصح بأنه نعطيه جرعات كل ١٠ سنين

C- Passive immunization:

Td Pertussis Vaccine بس بعد ٦ سنين بهيرش اعطي فبصير

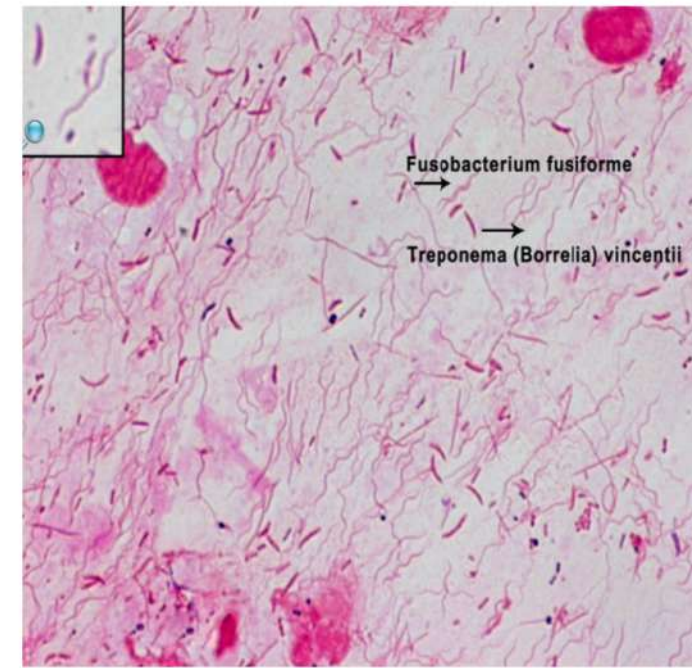
Anti-toxin serum is given to contacts of a case.

A booster dose of toxoid is given at the same time but at a different site.

Contacts that were not immunized before should start active Immunization by taking toxoid.

FUSO-SPIROCHETAL DISEASE (Vincent's angina)

- Vincent's angina is **ulcero-membranous** pharyngitis and tonsillitis, caused by infection with two types of bacteria (Normal mouth commensals):
 - Fusiform (^{spindle shap} Fusobacterium) gram -ve **anaerobic** bacilli.
 - Spirochaetes (*Borrelia vincenti*) gram -ve ^{طوال} spiral bacilli.
- Characterized by unilateral pseud-membrane.
- It is more pronounced in **Immunocompromized** individuals.
rare in healthy people



لا
يُوجد
قُوَّةٌ أكبر
مِن قُوَّةِ
الْأَمَلِ