

وَقُلْ رَبِّ زِدْنِي عِلْمًا



# RESPIRATORY SYSTEM

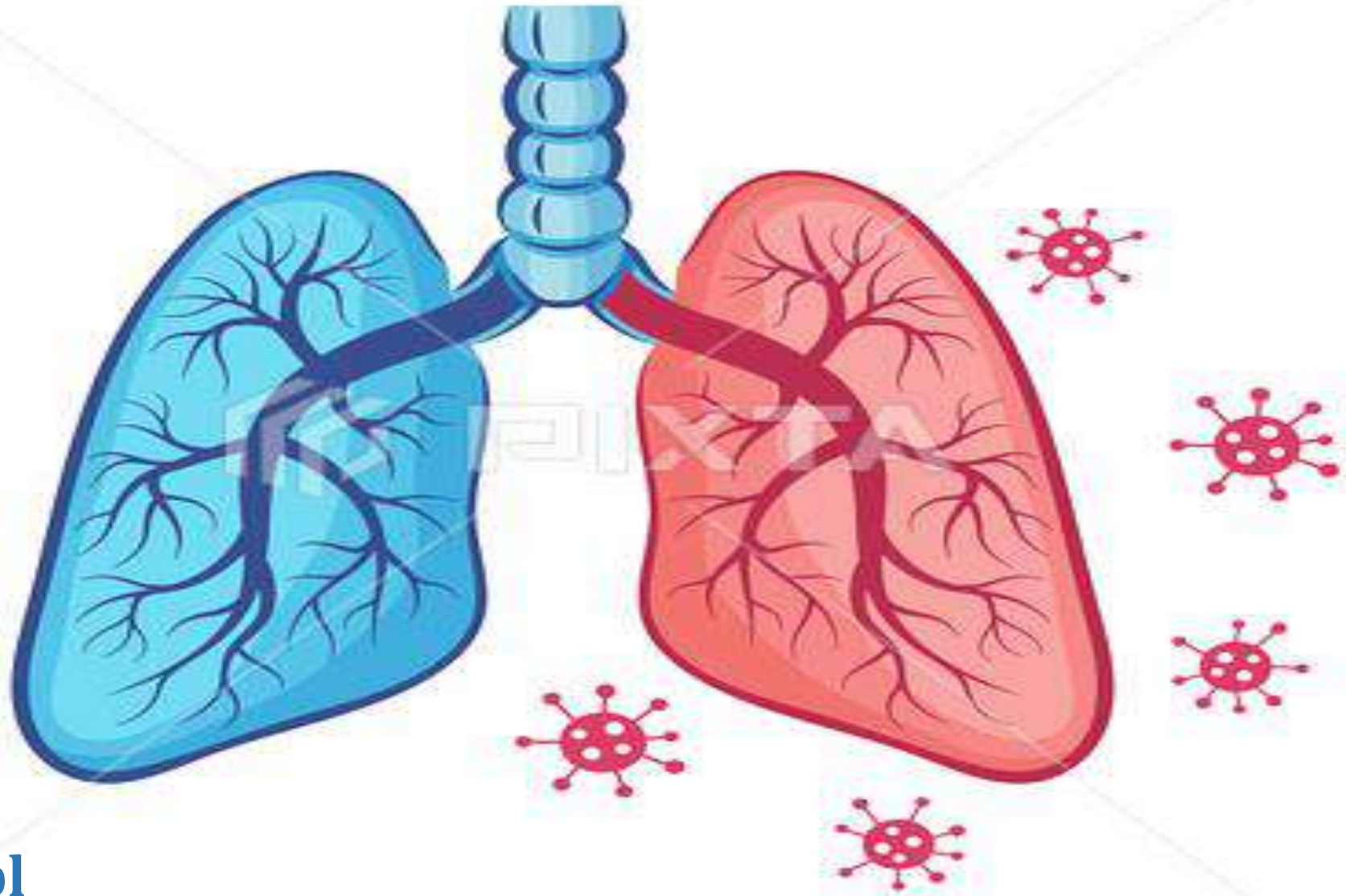
HA4AT BATCH

SUBJECT : \_\_\_\_\_

LEC NO. : 2 \_\_\_\_\_

DONE BY : Tabark Aldaboubi \_\_\_\_\_

# RESPIRATORY TRACT INFECTIONS - II



By  
Prof. Hala Tabl

### III- Infections of the ear:

**Otitis Externa:** infection of external canal

- **Pseudomonas aeruginosa.**
- **Aspergillus niger** بنحوي غنا - بجا نرق ال micology

**Otitis media:** inflammation of middle ear

- **Strep. pneumoniae**
- **Haemophilus influenzae**
- Moraxella catarrhalis
- Streptococcus pyogenes
- Staphylococcus aureus

### IV- Sinusitis:

- **Strep. pneumoniae**
- **Haemophilus influenzae**
- Moraxella catarrhalis
- Streptococcus pyogenes
- Staphylococcus aureus

### V- Acute Epiglottitis:

**Haemophilus influenzae**

**VI- Laryngitis and croup: Mostly viral** mostly Virus causes  
**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:

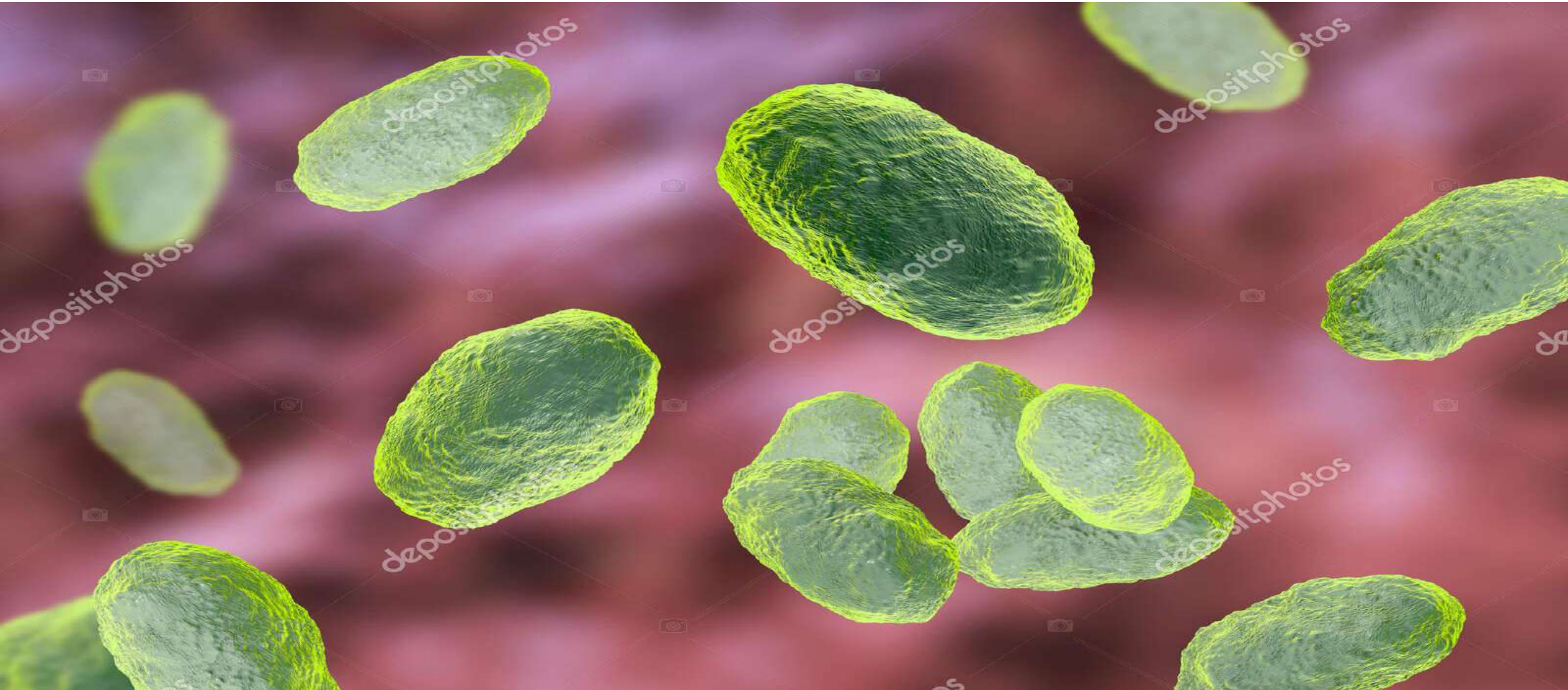
**RSV, Parainfluenza virus**



# HAEMOPHILUS INFLUENZA

“Blood Loving”

كانا مفكرين بالبداية انه الـ انفلونزا سيبها  
لحمها ووجدوا انه سيبها  
hemophilus influenza virus

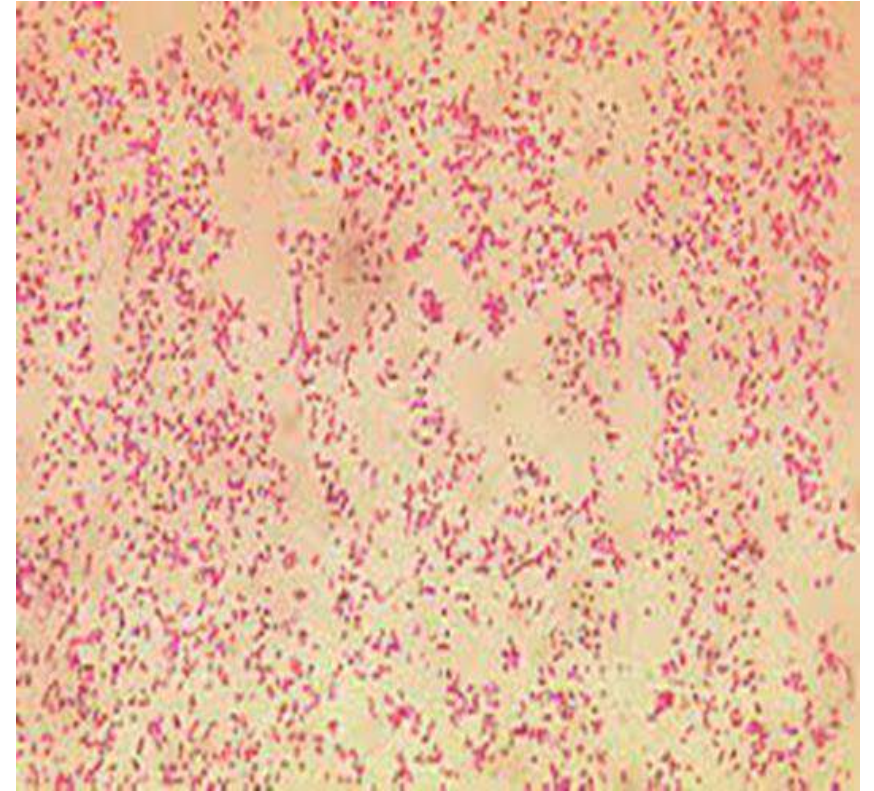


## Morphology:

تحت المجهر بنفكرها cocci → Short bacilli

- **Gram negative coccobacilli.**
- Non - motile, non - spore forming.
- **Some** types are capsulated.

فيا بعضها uncapsulated





# Culture:

- Grows aerobically, requires extra CO<sub>2</sub> (5-10%).
- Requires certain growth factors called **X factor** (hemin) and **V factor** (Coenzyme e.g. NAD).

نظام ملصقات :-  
 1 Factor 2 (بجتمعين) لنمو هائي البكتيريا  
 Chocolate agar = best media 2

Nicotinamide Adenine Dinucleotide

- Grows on blood agar in the following conditions:

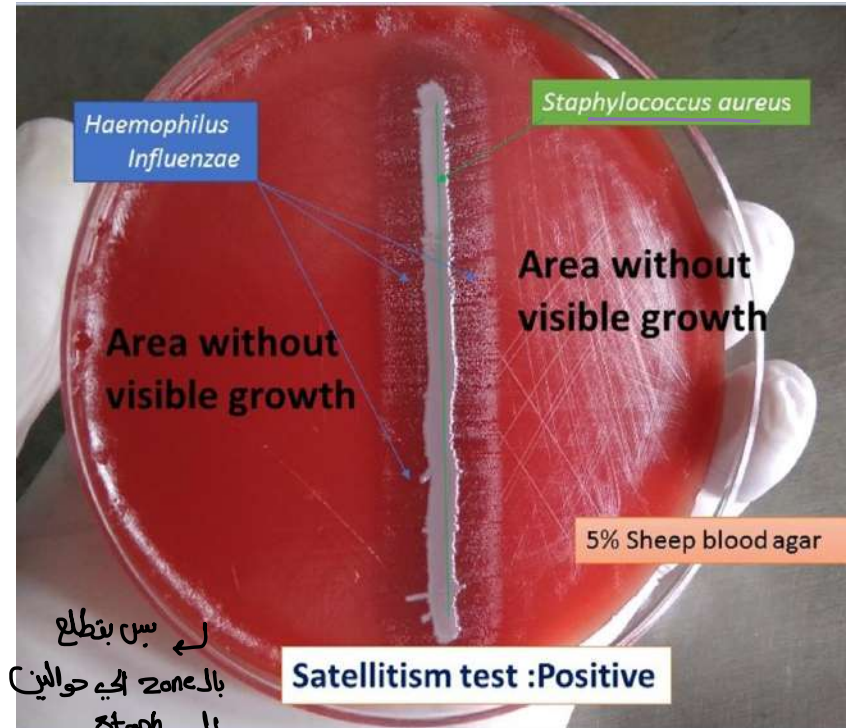
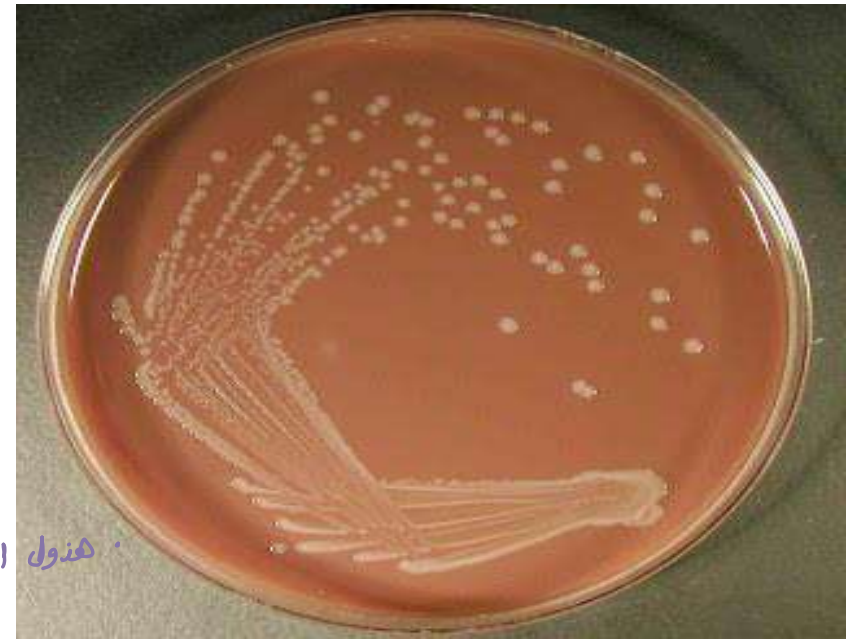
بجيب هذول ال Factor الي موجودين بتركيبات IsoVitalex

- 1) On blood agar supplemented with e.g. IsoVitalex.
- 2) On heated blood agar (**Chocolate agar**) where V & X factors released from RBCs.

- 2) Close to colonies of Staph aureus (**Satellitism**).

- Produce **NO** hemolysis.

نقل  $\beta$  hemolysis وبالتالي ان zone الي حواليه يكون  
 صار تكبير للدم وطلع ال Factor الي يحتاجهم للنمو



لـ سن بتطلع  
 بال zone الي حواليه  
 ال Staph

# Virulence factors:

1) Polysaccharide capsule: **The major** virulence factor (antiphagocytic activity). *Antiphagocytic Activity لها*

➤ Capsulated strains can be classified into **6 types** (a-f).

➤ H. Influenzae **type b (Hib)** is the **most pathogenic** and its capsule composed of (polyribitol phosphate) (PRP). *Hib نوع السكر المكون لل capsule تسمى*

2) **Outer membrane:** ↓↓ mucociliary clearance → colonization.

*Colonization حركات ال cilia المسؤولة عن التخلص من اي Foreign body لما تعلق لهاي الغليات بتساعدوها انها تعلق*

3) **IgA protease:** degrades secretory IgA, thus facilitating attachment to the

respiratory mucosa.

*mucosal surface ال موجود بال Antibody  
المسؤول ان يضع ال organism انها تعلق Attachment لل الع  
فلما يدمرها بصير سهل عليا - عليا ال Attachment*

# Pathogenicity:

**Transmission:** droplet infection.

*more virulent and more invasive*

**A. Capsulated types (invasive) particularly type b (Hib) cause:**

*inflammation of epiglott*

**1- Epiglottitis:** This life-threatening disease of young children which can **obstruct the airway (medical emergency)**, is caused almost exclusively by H. influenzae. A swollen “cherry-red” epiglottis is seen.

**Tracheostomy or endotracheal intubation is life saving.**

*invasive to blood stream*

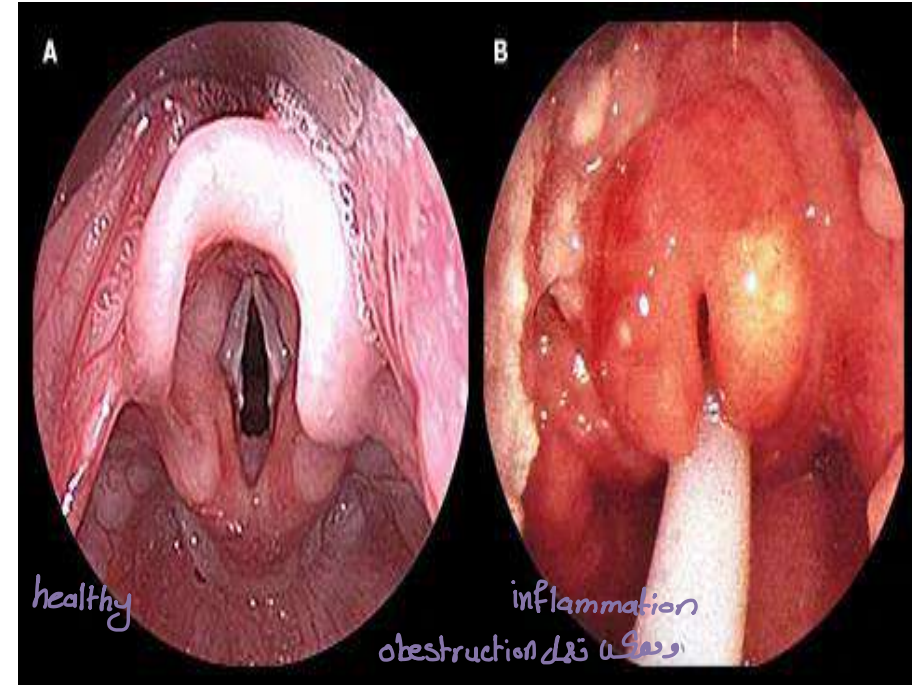
**2- Bacteraemia, Meningitis, Septic arthritis.**

*شخص شايء ال spleen يكون اكثر عرضة لل infection*

**N.B. Asplenia (anatomical or functional) is important risk factor for infection with encapsulated organisms.**

*\* ال spleen اهم مكان مسؤول عن ال immunity ضد encapsulated organism*

*ال organism الحي لها capsule*





## B. The non-capsulated (non-typable) (non-invasive) strains cause:

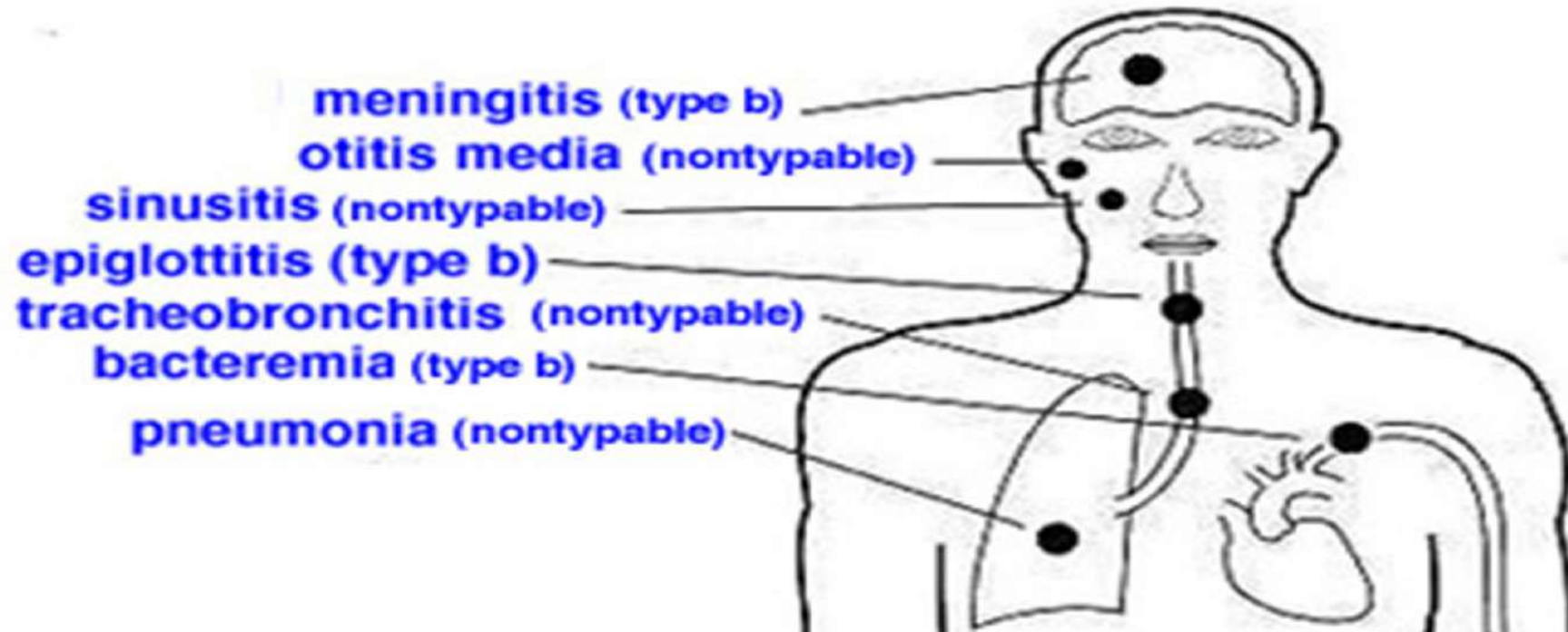
hemophilus influenzae      يجرى معها      Sinusitis and Otitis      الهم سبب له

1- Otitis media and sinusitis: (next to *Streptococcus pneumoniae*).

[immunity of lung]      [مأثرة على ال]      غالباً يتكون عندهم مشاكل الهلأ

2- Tracheobronchitis & Pneumonia: in adults and elderly, in presence of predisposing factors e.g. viral infections, malignancy COPD, cystic fibrosis...

### Haemophilus influenzae infections



# Laboratory diagnosis:

infection حسب المكان تاع ال

**A. Specimens:** CSF, blood, sputum, ear swab,...

**B. Microscopic examination:**

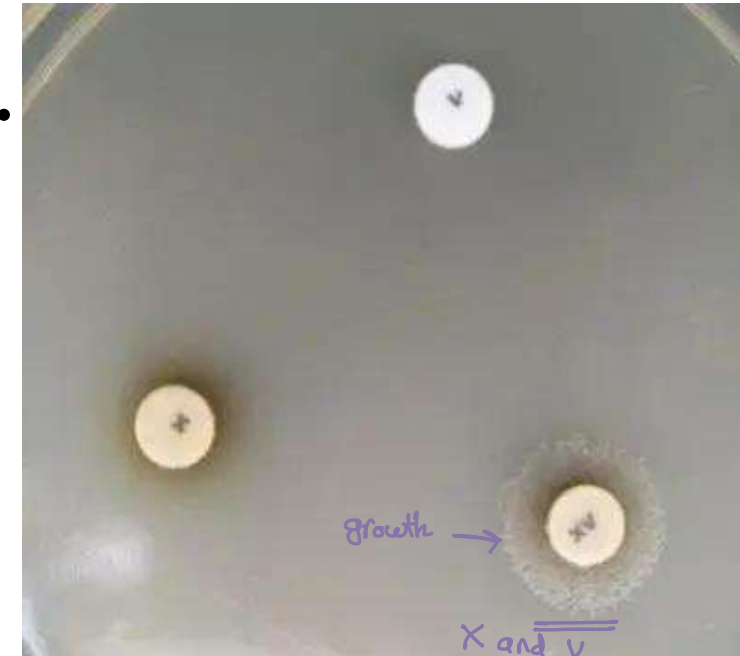
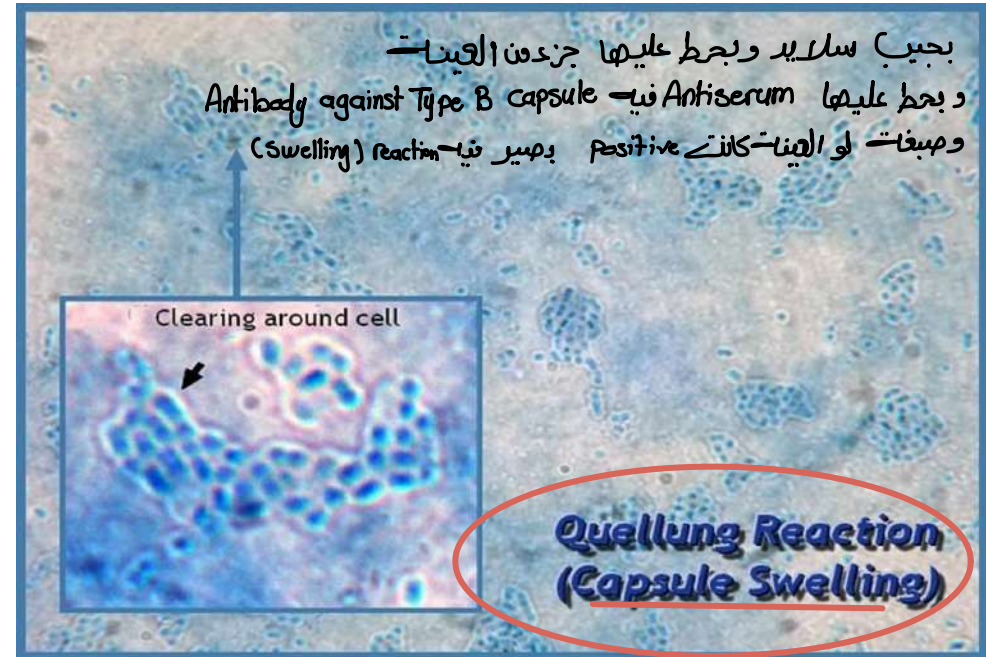
Gram-negative coccobacilli.

**C. Detection and typing of capsule: Quellung reaction.**

اختبار سريع  
or Capsule swelling test

**D. Cultivation:** on chocolate agar.

**E. X&V factor test:** (It requires both factors).



# Prophylaxis:

## ➤ H. influenza type b vaccine (Hib vaccine):

يُحفظ من ال Polysaccharide capsule

1- Polysaccharide vaccine.

2- Conjugate vaccine (capsule + carrier protein).

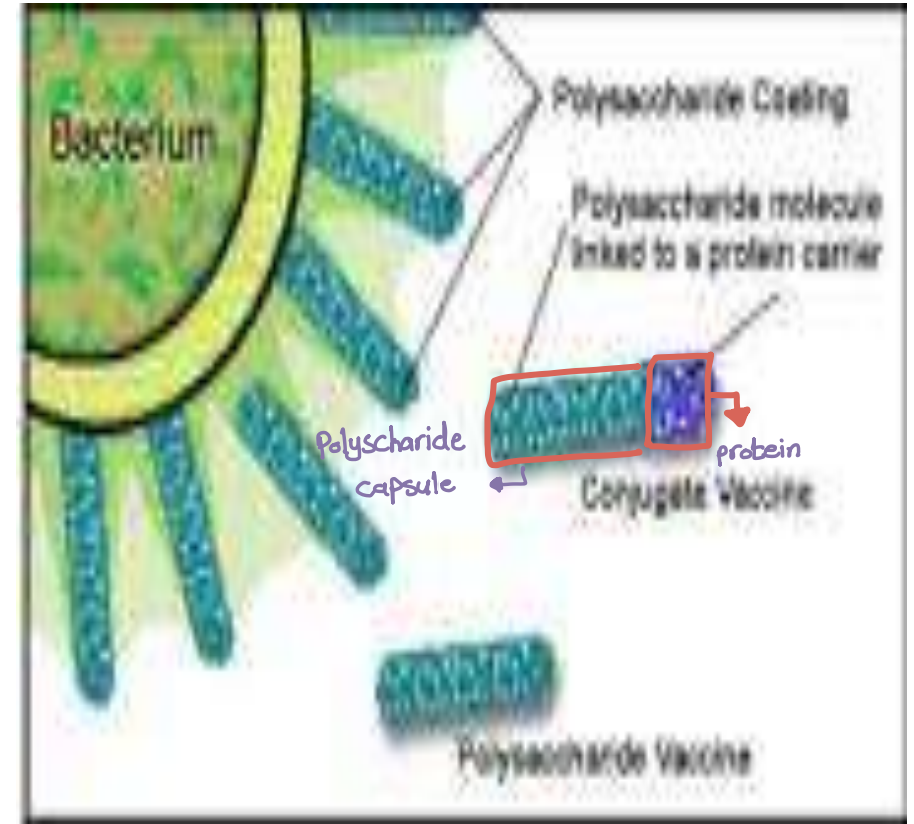
بوجود ال Polysaccharide capsule مع ال carrier protein  
وظيفة - انها بتعمل stimuli immune respons against capsule

(given in 3 doses at 2, 3 and 4 months of age)

احد العطايم الالصارية الذي يؤخذ على عن شهرين ٤ ٣ ٤ اشهر.

**Succeeded in reducing cases to near zero level.**

➤ **Rifampicin:** is used for chemoprophylaxis of unvaccinated close contacts of cases of Hib meningitis (decreases respiratory carriage of the organism).





# BORDETELLAE PERTUSSIS → قحة شديدة Sever Cough

اسم العالم الي اكتشفها

“The causative agent of Whooping cough (Pertussis)”  
سعال ديكبي

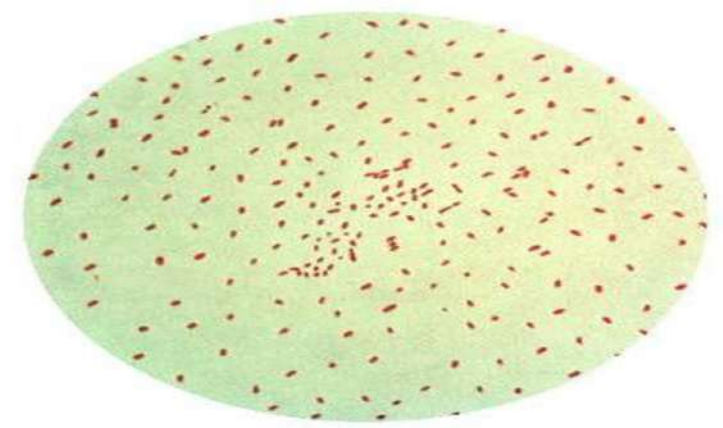


## Morphology:

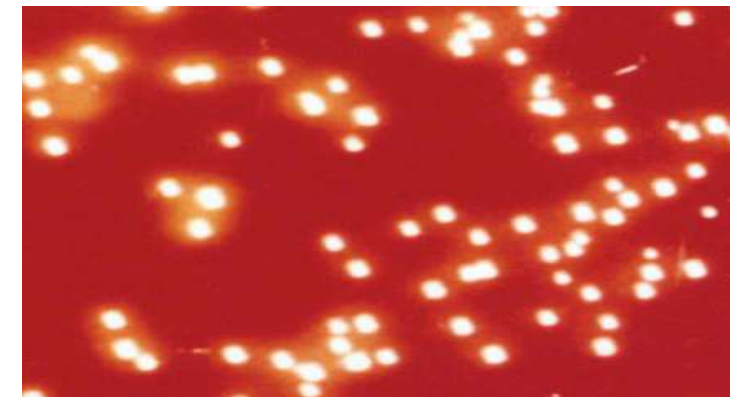
It is **Gram negative coccobacillus**.

## Culture:

- It is a strict aerobe.
- It grows on complex enriched media e.g. **Bordet Gengou medium** or <sup>2</sup> **charcoal-cephalexin blood agar**.
- Colonies are greyish white with shiny convex surface  
*نقطة الزئبق*  
“Mercury drop” appearance.
- It does **NOT** require **X** and **V** factors.
- Virulent strains produce **haemolysis** on blood agar.



Charcoal-cephalexin blood agar



Bordet Gengou medium

# Virulence factors:

- **Filamentous hemagglutinin (FHA):** ↘

Attachment      فسقول عفال

- Colonization factor that **promote attachment** of the organism to the cilia of the epithelial cells of respiratory mucosa.

- **Pertussis toxin (PTx):**

- Colonization factor.

- It has **adenyl cyclase activity** → ↑↑cAMP → **edema** of the respiratory mucosa. <sup>تورم</sup>

- It <sup>↓</sup>suppress phagocytic activity (immune evasion).

- **Tracheal cytotoxin (TCT):**

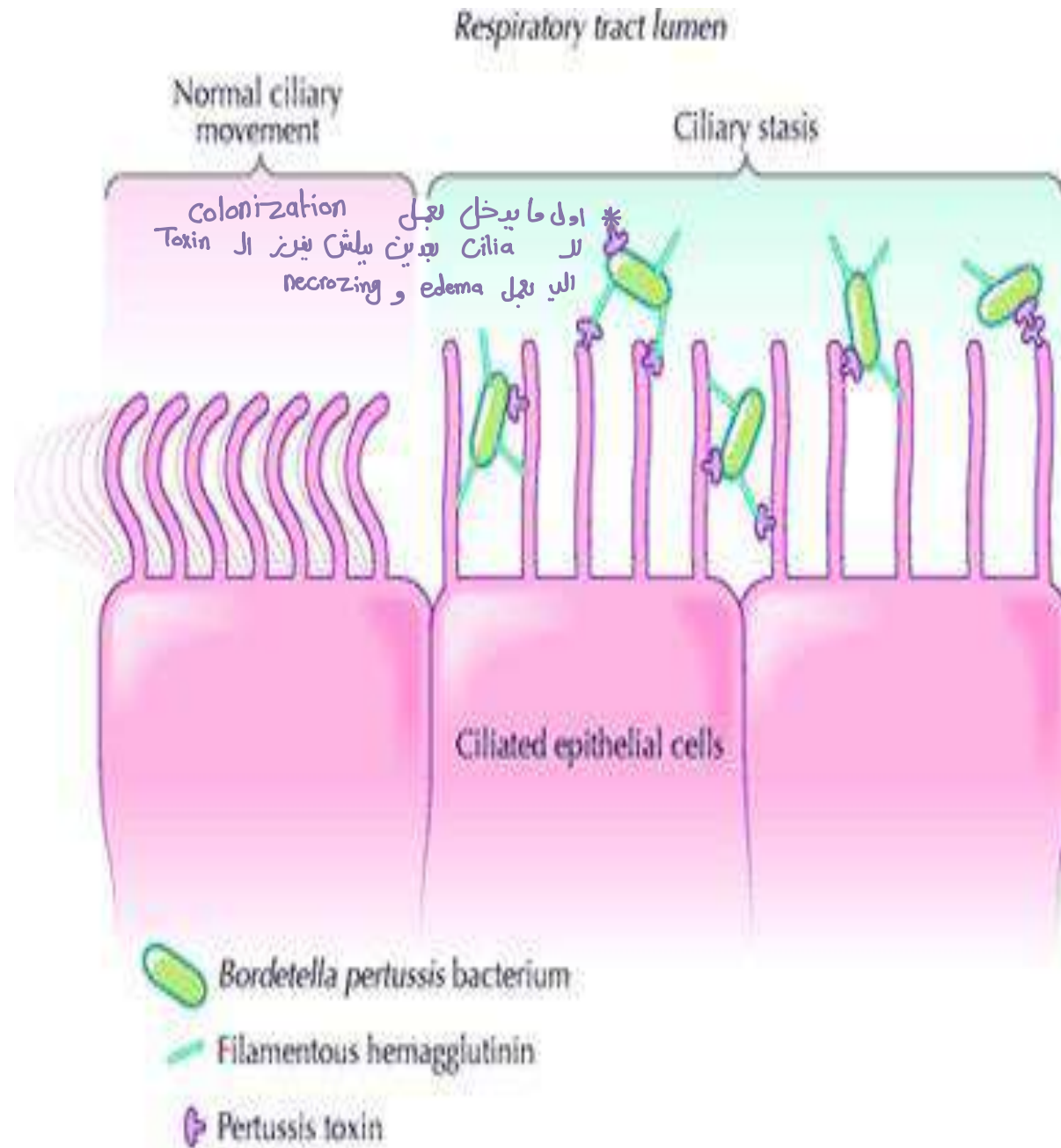
↓  
الموت

- **Necrosis (cell death)** of ciliated cells of the respiratory mucosa.



After the bacterium adheres to and colonizes the ciliated epithelium of the respiratory tract, it secretes toxins that lead to the death of these epithelium cells, a ciliary stasis, edema of the mucus membrane and an accumulation of mucus and cell debris that triggers coughing.

المفروض لو ال Cilia شغالة كل هاي ال mucus و debris انها تروح بس كونه مهار لها Paralysis بتتجمع بال respiratory وبتقل trigger coughing



# Whooping cough (Pertussis)

- It is highly communicable disease that occurs primarily in **infants and young children**.



- Infection transmitted by **droplet** infection.

- Disease occurs in three stages:

**1- Catarrhal stage:** (1-2 weeks): Fever, anorexia, malaise, rhinorrhea, sneezing. *non specific manifestation*

**2- Paroxysmal stage:** (2-4 weeks): *ممكن توصل ل 6 اسابيع* **Repetitive cough with explosive character** followed by *كل attack* a high-pitched intake of breath that sounds like **"whoop"**. This may be associated with *↳ Paroxysmal Attack* vomiting, cyanosis and convulsions. *بس يتعرض لنوبات قحة شديده بعدها مع يضطر يوقف نفس عيق بطلع معاه هومت high pitched*

**3- Convalescent stage:** Gradual recovery over weeks (**followed by long lasting immunity**).

- **Complications:** (*لذا وصل ل lung* pneumonia, subconjunctival or cerebral haemorrhage, encephalopathy, Rib Fracture).

# Laboratory diagnosis:

- **Specimen:** Nasopharyngeal swab.
- **Culture:** a-Direct plating on Bordet-Gengou medium

b- The cough plate method. اجبي طبقة ال Culture واحطه قدام  
الطفل وهو يقح (بدونما اخذ swab يعني)



- **Direct fluorescent antibody (FA) test.**

immunological test ~> اجبين العينات وبفرد لها على شريحة ال fluorescent وبتصيف Antibody خاص  
وبتفرج عليهم تحت الميكروسكوب ( اذا كان positive يعني تحت الميكروسكوب )

- **Serologic detection of antibodies**

Collection directly distance of 12-18"  
on cough plate



## Treatment:

- **Supportive care:** (e.g., <sup>سبب ال hypoxia</sup> oxygen therapy and suction of mucus) during the paroxysmal stage is important, especially in infants.
- **Antibiotic (Azithromycin):** reduces the number of organisms in the throat and decreases the risk of <sup>دوره يكمن بمنع</sup> secondary complications but has little effect on the course of the disease at the <sup>Paroxysmal stage</sup> “prolonged cough” stage because the toxins have **already** damaged the respiratory mucosa. <sup>تأثير قليل على ال Cause ناعة المرض خصوصاً لو كان بال stage 2</sup>

**Prophylaxis:** Two types of vaccines:

**A- Killed whole cell vaccine.**

جاء بالبكتيريا وقتلها وحفظها بال Vaccine

بعل خطر العرَض لل-encephalopathy اذا استخدم بعد اسنين

It is suspected of causing various side effects, including **post-vaccine encephalopathy** at a rate of 1 case/million doses. It is still in use in many countries other than the United States.

بمات تستخدمه واستبدلوه ب- Acellular Vaccine

**B- Acellular vaccine: (fewer side effects than killed vaccine),** a combination of:

- Pertussis toxoid (genetically inactivated toxin).
- Filamentous hemagglutinin.
- Other virulence factors.

مجموعة  
Antigen  
سوا

It is usually administered in combination with toxoid of diphtheria and tetanus as follow:

Killed whole United state (Acellular)

**DPT or DTaP:** Primary series: 2, 4 and 6 months followed by **two boosters** at 15-18 months

سنة ونص تقريبا

and at 4-6 years.

**Td or Tdap:** Boosters of every 10 years are recommended.

False (Single unit) (مش واضح تفسيرها) (ممكن) rust copper (صدأ النحاس) exopigment (بتغرز لونها اخضر)

# PSEUDOMONAS AERUGINOSA

“One of the top antimicrobial resistance threats world-wide”

“One of the most important causes of nosocomial infections”



Multidrug-resistant *Pseudomonas aeruginosa*  
Centers for Disease Control and Prevention



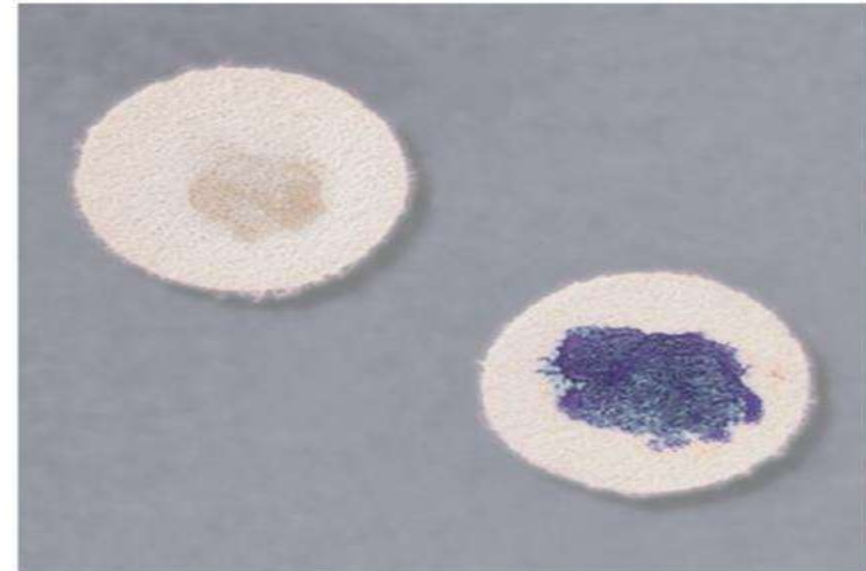
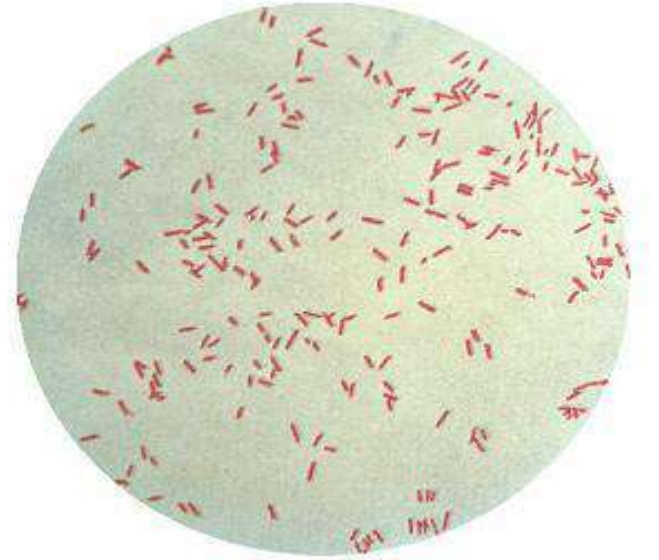
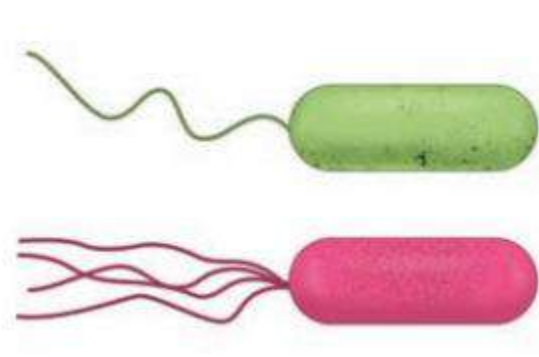
## Morphology:

Gram negative bacilli.

**Motile** with single or multiple polar flagella.

## Biochemical Reaction:

- It is **oxidase positive**.
- It does not ferment sugars (non-fermenters).



اي اسثي موجود بالسود الفائق ملصق

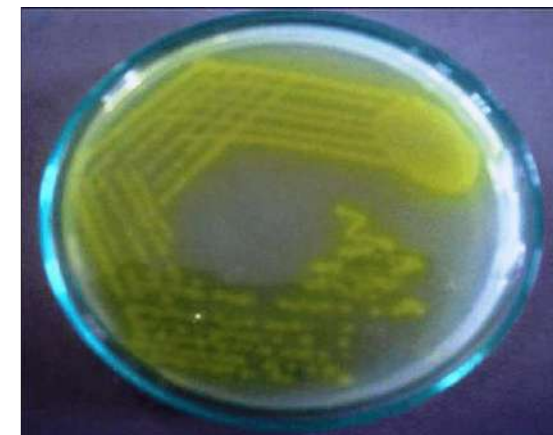
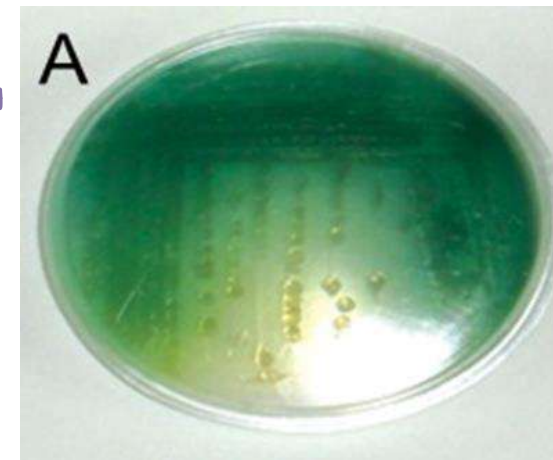
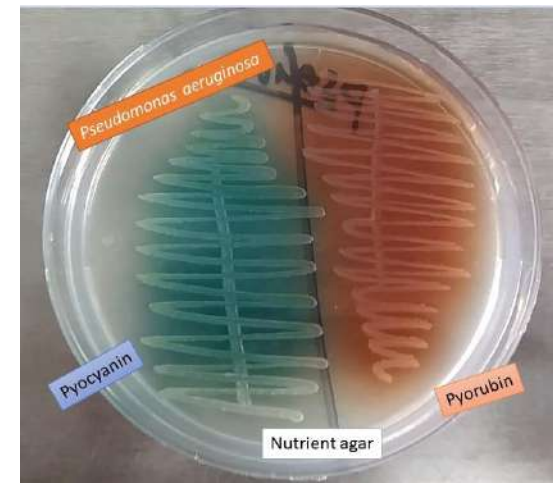
## Culture:

- Obligate (strict) aerobe.
- Grow well between 37°C-42°C, its growth at 42°C differentiate it from other pseudomonads.
- Produce a sweet or grape like odor (fruity aroma).
- On MacConkey's → non-lactose-fermenting (pale yellow) colonies.
- Produce exopigment (useful in clinical and laboratory diagnosis):
  - ↓ Pigment انواع ال
  - ↓ defuse in agar
  - ↓ العيائن بتكون مبيت عليها اللون
- (1) **Pyocyanin**, blue-green pigment.  
↳ most common
- (2) **Pyoverdinin**, a yellow-green pigment (fluoresces under UV light).
- (3) **Pyorubin**, a red pigment.
- (4) **Pyomelanin**, a brownish black pigment.

بتقدر تعيش عند درجات حرارة عاليات

ب دهنات

اذا تم زراعتها على MacConkey بتظهر ↓



# Virulence factors:

1- Pili (fimbriae) → مسؤولة على ال Attachment

2- Endotoxin (Lipopolysaccharide): causes septic shock.

3- Exotoxin A: Inhibit protein synthesis and causes tissue necrosis. cell death

4- Extracellular enzymes: e.g., elastases, facilitates invasion into the blood.   
breaks down to elastin ← يساعدها تيجل

5- Pyocyanin: damages the cilia and cause cell death.

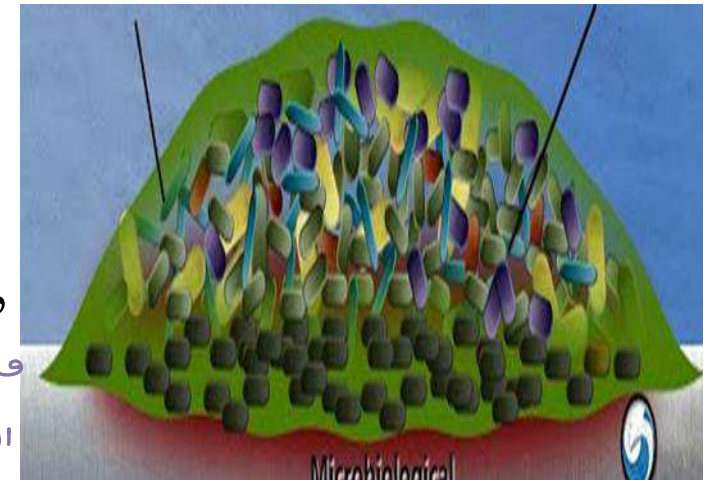
6- Alginate (glycocalyx): (Mucoid strains) that forms

adherent **Biofilm** protecting from antibodies, complement,

and antibiotics.   
فادته هيفيت بفرزها ال organism خصوصًا ال mucoid strains بتساعد تكو Biofilm (تتكل من ال organism)   
الها medical important رتذها اذا انتكونت على medical device بتكون مشكلت لئنها بتكون ال   
organism (resistance) بتمنع ال diffusion تاخ ال Antibody

7- Broad antibiotic resistance: (intrinsic and acquired).

“One of the top antimicrobial resistance threats world-wide”





## Medical importance of *P. aeruginosa*:

بعيش لمستوى منخفض من ال nutrient

- It flourishes in wet environments and can grow in **simple aqueous solutions** (only traces of nutrients) (e.g., tap water, swimming pool, spa and jacuzzi, sinks, contact lens solution, ...).
- It has a remarkable ability to **withstand disinfectants**, it has been found growing in soap solutions, in antiseptics, and in detergents.  
*تقييم Antiseptic solution*
- All these factors favor their persistence in the hospital environment and hence, account for their role in **hospital-acquired (nosocomial) infections**.  
*لأنه بعيش بالمعدات*
- *P. aeruginosa* is an **opportunistic pathogen** that causes infections in :  
*غالبًا يكون المريض عنده pathogen ثانوي*
  - In whom skin host defenses are destroyed (e.g., **extensive burns**).
  - In those with chronic respiratory disease (e.g., **cystic fibrosis**).
  - In those who are **immunosuppressed** and with neutropenia.
  - With **medical devices** e.g. catheters, ventilators, I.V line, ....

# Clinical findings:

## 1- Respiratory infections:

**Hospital-acquired pneumonia** (especially **ventilator-associated pneumonia** and in **cystic fibrosis** patients).

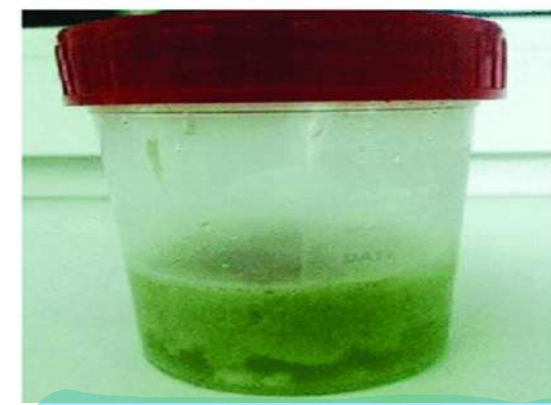
## 2- External ear infections:

**Malignant otitis externa** (esp. in diabetics), **swimmer's ear**.

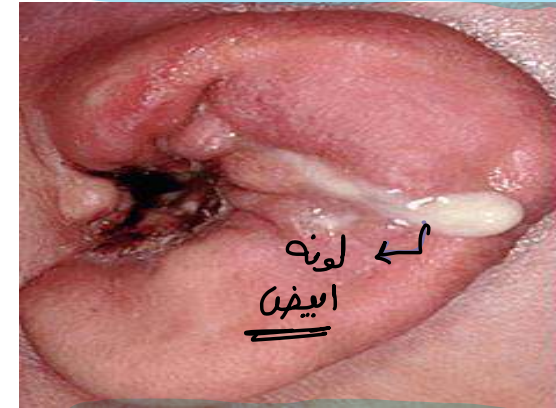
## 3- Eye infections:

Corneal ulcer usually follow minor trauma to the cornea (frequently associated with contact lens use).

بالذات بالي سبتخدموا عدسات  
العيون



Greenish colour of sputum



malignant otitis externa



Corneal ulcer

4- Folliculitis (hot tub rash). *Swimming pool*

5- Skin & wound infections:

(e.g. Ecthyma Gangrenosum, green nail syndrome).

6- Urinary tract infections:

in those with indwelling catheters.

7- Meningitis: following lumbar puncture.



Folliculitis



Green nail syndrome



Ecthyma Gangrenosum



Green drainage in diabetic foot



## Laboratory diagnosis:

- 1- Specimens: Sputum, ear discharge,.... *حسب مكان ال infection*
- 2- Smear: Gram negative bacilli. *غير فريد جدًا*
- 3- Culture: On different media. The organism identified by:
  - **Its odor.**
  - **Exopigment production.**
  - **Ability to grow at 42°C.**
  - **Oxidase-positive.**

## Treatment:

- Because *P. aeruginosa* is **resistant to many antibiotics (MDR)**, treatment must be tailored to the sensitivity of each isolate and monitored frequently; resistant strains can emerge during therapy.
- **Combinations** of active antibiotics generally required.

بِسْمِ اللّٰهِ  
وَمَنْ كَانَ رَجَائُكَ حَيِّسًا صَدْرَكَ ...

---

*Thank  
you*

