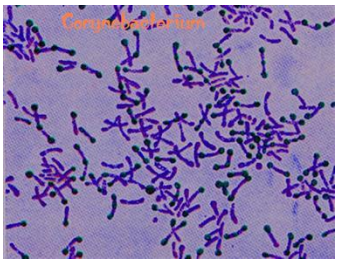
Medical Bacteriology –Lecture 9

Non Spore forming Gram Positive Bacilli

Corynebacterium



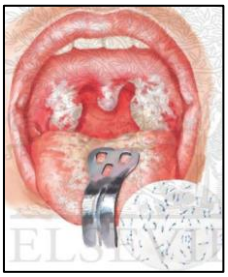
Corynebacterium

Characteristics:

- Gram-positive, rod-shaped bacteria
- Aerobic
- Non-motile
- classified as **Actinobacteria**, related to mycobacteria & actinomycetes.
- They do **not form spores** or **branch as do the actinomycetes**
- Forms irregular clusters**, club-shaped or V-shaped arrangements (resembling Chinese letters).**
- **Possess metachromatic granules**
- Cell wall containing **unusual lipids**
- **Non-acid fast stain**
- Fastidious, grow slowly in enriched media
- Consists of a diverse bacteria including animal and plant **pathogens**, as well as **saprophytes**.
- Some corynebacteria (Diphitiroids) are part of the normal flora of humans, colonize skin, respiratory tract. Can causes opportunistic infection in immunocompromised individual.
- **Medically important species;**

  Corynebacterium diphtheriae, the causal agent of the disease **diphtheria**.
- **Diphtheria toxin** (responsible for the **signs and symptoms of diphtheria)**.
- **Transmitted** from person to person via respiratory droplets or skin contact (open wond).

Corynebacterium diphtheria



Diphtheria is an upper and lower respiratory tract illness;

- **Characterized initially** by (sore throat, low fever, followed by an **adherent membrane (called a pseudomembrane** on tonsils, pharynx, and nasal cavity**).**
- **Later stages (**localized damage, bleeding, difficulty in breathing, myocarditis and peripheral neuritis**).**

Diphtheria is a rapidly developing, acute infection which involves both **local and systemic pathology**.

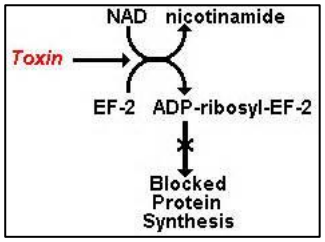
Pathogenicity: The pathogenicity of *C. diphtheriae* includes:

1. Entry---- the bacilli multiply locally in throat tissues, and produce toxin, which play an essential role in colonization process.

Local lesions; toxin causes necrosis of epithelial cells, as a result of this injury, blood plasma leaks into the area and a fibrin network forms which is interlaced with rapidly-growing *C. diphtheriae* cells.
This membranous called a **pseudomembrane**, covers over the site of the local lesion leading to respiratory distress, even suffocation.
Little is known about the adherence mechanisms of *C. diphtheriae*, but the bacteria produce several types of **pili**. The **diphtheria toxin**, as well, involved in colonization of the throat.

Typical presentation of **Bull neck**

2. Toxigenesis: the toxin is responsible for the lethal symptoms of the disease.
Diphtheria toxin produced by *C. diphtheriae*, can cause myocarditis, polyneuritis, and other systemic (invasions) toxic effects.



Mode of action of diphtheria toxin; causes death of eukaryotic cells and tissues by inhibition protein synthesis (elongation factor) in the cells.

- Diphtheria is a **very contagious disease** spread by direct contact or breathing aerosolized secretions of infected individuals.
Diphtheria is a **serious disease**, with fatality rates between 5% - 10%. In children under 5 years and adults over 40 years, the fatality rate may be as much as 20%.

Cutaneous diphtheria (Jungle sore): extra-respiratory disease;
A mild form of diphtheria can be restricted to the skin.
Acquired by wound/skin contact
Chronic non-healing ulcer results
Occurs primarily in the tropics, is rarely fatal.

C. diphtheria required Two factors to produces diphtheria toxin and cause infection:

(1) Low extracellular concentrations of iron

(2) Presence of a lysogenic prophage in the bacterial chromosome.

(High yields of toxin are synthesized only by lysogenic bacteria under conditions of iron deficiency)

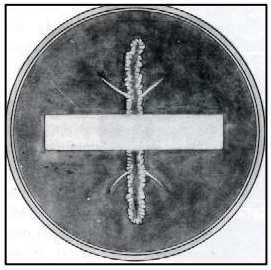
C. diphtheria diagnosis:

- Initial diagnosis is based on the presence of **pseudomembrane**
  - **Selective media:** 1- Loefflers serum medium
    2-Blood tellurite agar
  - **Toxin Production testing:**

1- Guinea pig-inoculation

Strain	Unprotected animal	Antitoxin- protected animal
Toxigenic	Death (2-3 days)	Survival
Non- toxigenic	Survival	Survival

2- Gel Precipitation (Elek test)



Immunity to Diphtheria (Treatment & Prevention)

Treatment

Penicillin and erythromycin kill the bacteria

- **Acquired immunity** to diphtheria is due to Administration of **antitoxin to neutralize toxin**
- **Passive immunity** is acquired trans **placenta** and can last at most 1 or 2 years after birth.
- Individuals that have fully recovered from diphtheria may continue to harbor the organisms in the throat or nose for weeks or months. (**Carrier**)
- Because of the high degree of susceptibility of children, **artificial immunization** at an early age **(Toxoid)** is given in 2 or 3 doses for primary immunization at an age of 3 - 4 months.

Trivalent vaccine containing (DPT vaccine): Diphtheria toxoid, Pertussis vaccine& Tetanus toxoid

Review Questions

- What is the distinct arrangement in *C. diphtheria*?
- What is the causative agent of Diphtheria, and what is the major virulence factor which responsible of disease and symptoms?
- What do you know about diphtheria symptoms?
- *C. diphtheria* requires factors to able to cause its infection, discus?
- Toxin production by *C. diphtheriae* can be demonstrated by two experimental methods. What are they?
- Give an example of contagious disease?
- What is the mode of action of Diphtheria toxin?
- What is the DPT vaccine?