

Gram positive  
bacilli

# Classification of medically important bacteria

## Rigid thick walled cells

### Gram positive

Cocci

Bacilli    Spore forming  
             Non-spore forming

### Gram negative

Cocci

Bacilli    Aerobic  
             Anaerobic  
             Facultative anaerobic

### Acid fast (eg: Mycobacteria)

## Flexible thin-walled cells (eg: Spirochetes)

## Wall-less cells (eg: Mycoplasma)

# Classification of medically important bacteria

Rigid thick walled cells

Gram positive

**Bacilli**

**Spore forming**

Aerobic - Eg: *Bacillus* spp

Anaerobic - Eg: *Clostridium* spp

**Non-spore forming**

Non – filamentous - Eg: *Corynebacterium* , *Listeria*

Filamentous – Eg: *Actinomyces* , *Nocardia*

**Bacillus spp**

# Genus - Bacillus

## ▶ Pathogenic spp

- ***B. anthracis***
- ***B. cereus***
- *B. subtilis*

## ▶ Non - pathogenic spp

- Saprophytes
- Common lab contaminants

# **B anthracis**

Disease – Anthrax  
(Zoonotic disease)

- ▶ Large, straight, square ended bacilli
- ▶ Non motile
- ▶ Capsulated
- ▶ Spore
  - Oval & central
  - Not formed in vivo
  - Not stain with Gram staining



# Normal habitat

- ▶ Infected animals

eg: cattle, pigs , goats

- ▶ Bacilli excreted in faeces , urine & saliva  
of infected animals



**Tx**

► By

Direct contact with infected animals  
spores

► Acquire through

◆ Abraded skin

◆ Inhalation

# Pathogenesis

## Virulent factors

### *1. Capsule*

Antiphagocytic

### *2. Anthrax toxin*

Increase vascular permeability

Cause edema & congestion

# Cutaneous anthrax

Bacilli enter through abraded skin / mucus membrane



Bacilli multiply & produce toxins



Lesion starts as a papule



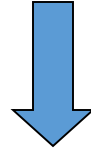
Center become necrotic



Black center (Eschar) surrounded by vesicles (*Malignant pustule*)



Bacilli spread to local lymphatics



Blood



Septicemia



Death

## **B. cereus**

- ▶ Saprophytes.

Spore wide spread in raw foods  
eg: Cereal , Rice

- ▶ Heat resistant
- ▶ Culture resembles *B. anthracis*
- ▶ Cause food poisoning

## Probable source

- ▶ Fried rice
- ▶ Rice boiled & left out at room T
- ▶ Spore germinate
- ▶ Heat stable toxin not destroyed by frying.

# FP - 2 types

## 1. Emetic type

- ▶ IBP 1-6 hrs
- ▶ Vomiting is main symptom
- ▶ Occur due to **preformed toxin**  
(Heat & acid stable)
- ▶ Similar to *S. aureus* FP

## *2. Diarrhoeal type*

- ▶ IBP – 8-16 hrs
- ▶ Main symptoms
  - Abdominal pain
  - Diarrhoea
- ▶ Occur due to heat labile enterotoxin formed **within the intestine**



# Corynebacterium spp

## Genus contain,

- ▶ Pathogens
- ▶ Commensals (Skin , RT , UT )
- ▶ Saprophytes

## Important spp

- ▶ *C. diphtheriae* – causes diphtheria
- ▶ *C. jeikeium* – wound infection

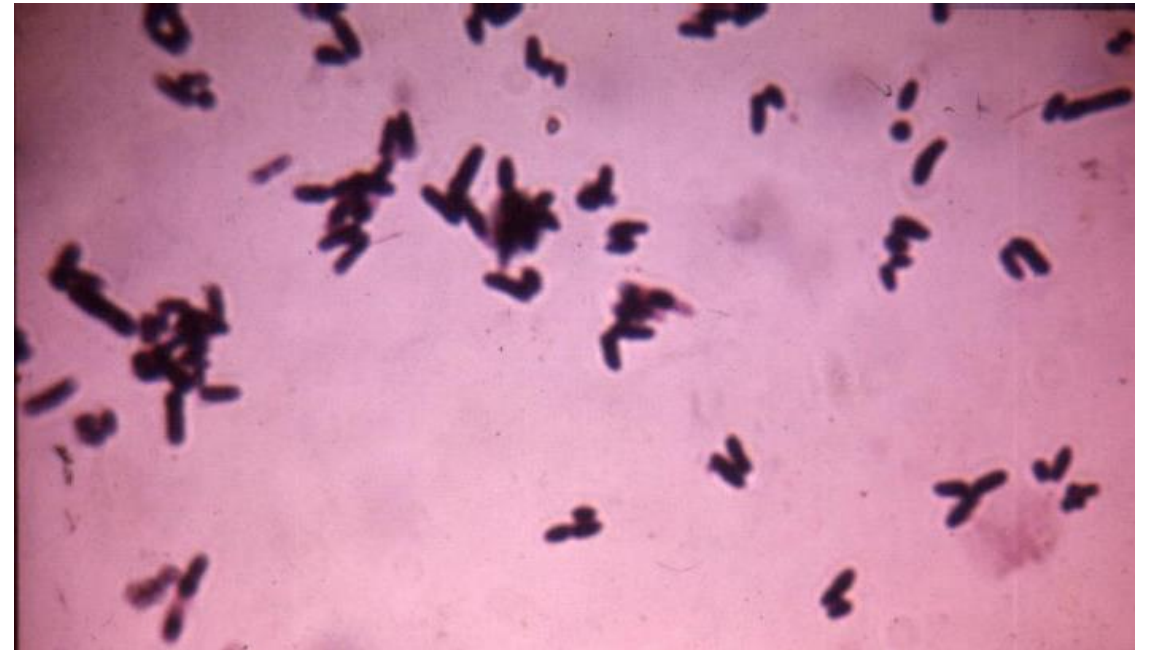
# *Corynebacterium diphtheriae*

## Features

- ▶ Pleomorphic bacilli
- ▶ Club shaped
- ▶ Oval & globular form

## *Dividing cells*

- ▶ produce bends
- ▶ Attached after division or
- ▶ Arrange parallels (palisading)



*Chinese letter appearance*

# Transmission

Air borne / Droplet

Main route

Mainly from carriers

Fomites

Organisms in dried secretions

Rare

# Pathogenesis

*Nasal / nasopharyngeal / laryngeal diphtheria*

Inhalation of bacilli



Bacilli multiply locally



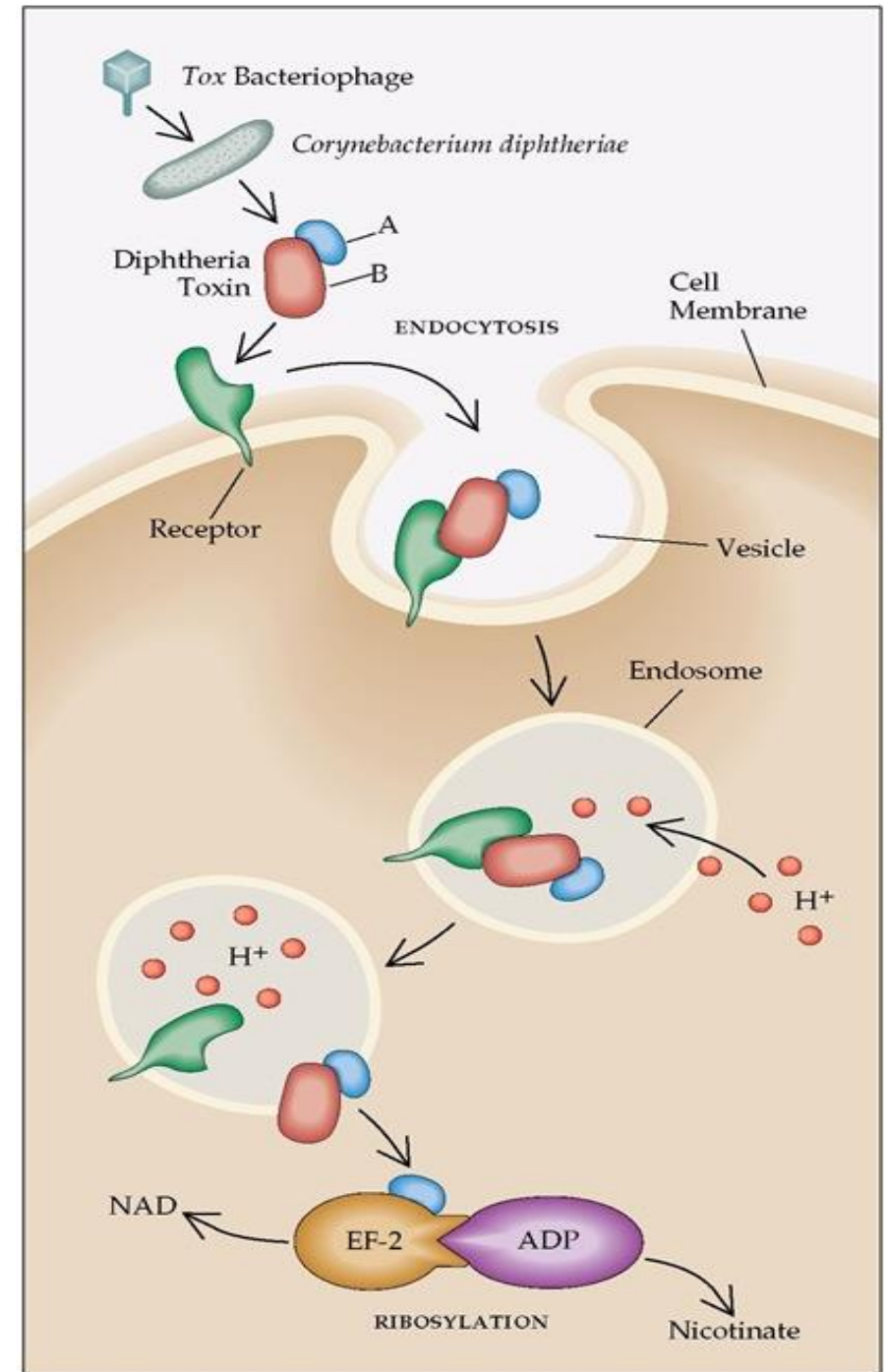
Infect mucus membrane (without invasion)



Produce **exotoxin** (**Diphtheria toxin**)

# Diphtheria toxin

- ▶ Composed of 2 fragments (A & B)
- ▶ B help for the transport of A
- ▶ Toxin rapidly diffuse into target tissues
- ▶ A inhibit protein synthesis
- ▶ Has special affinity to
  - Heart muscles
  - Nerve endings
- ▶ Causes necrotic & neurotoxic changes



## *Local effect*

Toxin destroys epithelial cells & polymorphs



Acute inflammatory response



Produce an ulcer



Covered with grayish white **pseudomembrane**



Infection may spread to post nasal cavities



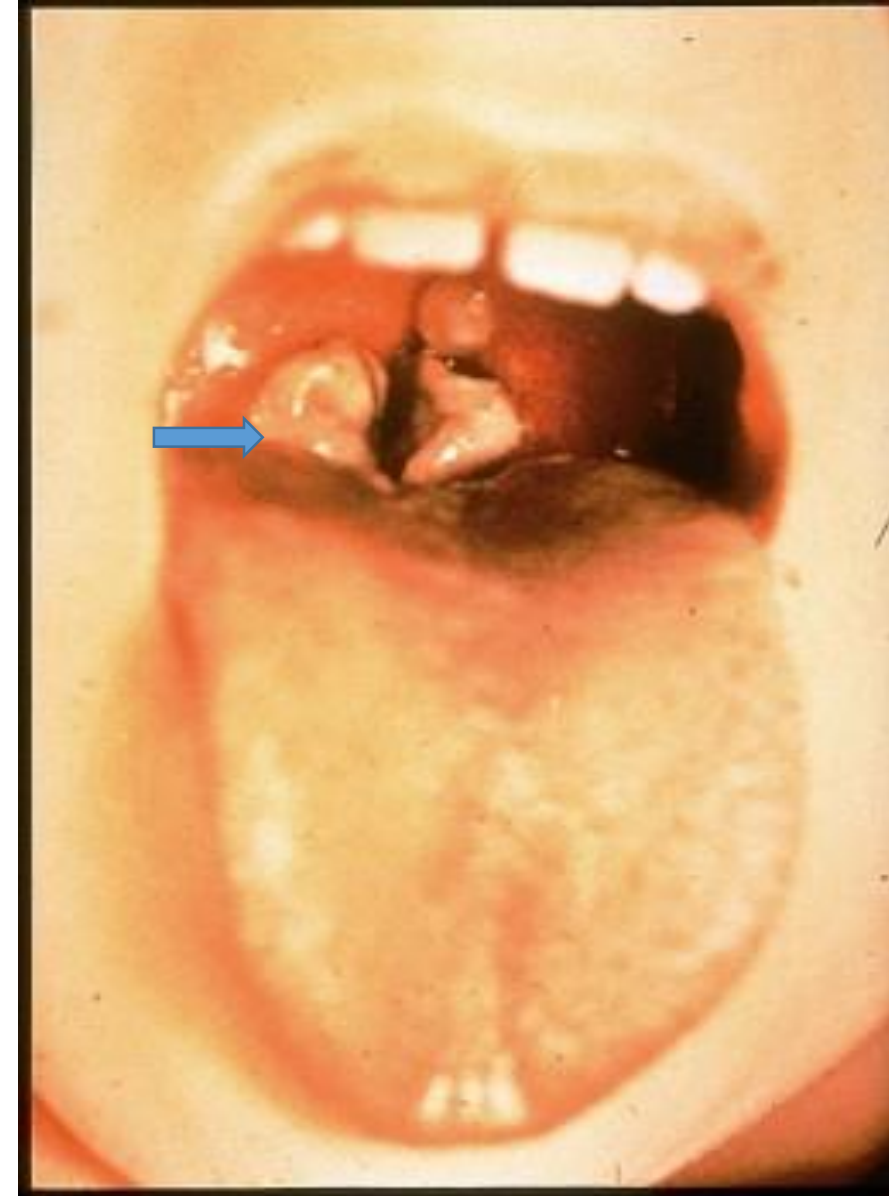
larynx



Respiratory obstruction



Death



# *Systemic effect*

Toxin absorb into blood & lymphatics



Toxaemia



Myocarditis

demyelination of  
peripheral nerves



Cardiac failure



Polyneuritis



Death



## CF

- ▶ IBP      2-6 d

### *Nasal diphtheria*

- ▶ Thick nasal discharge
- ▶ Crust around external nares
- ▶ No intoxication

## Pharyngeal diphtheria.

- ▶ Pharyngitis.
- ▶ Tonsillitis.

### *Develop*

- ▶ Sore throat
- ▶ Fever
- ▶ Malaise
- ▶ Fatigability



Clinically

Microbiologically

- ▶ Microscopy alone is not enough as,
  - Presence of non pathogenic spp
  - May not have enough organisms
  
- ▶ Isolation & identification
  - To diagnose toxigenic diphtheria

## Rx

- ▶ Start Rx immediately after specimen collection
- ▶ Patient isolation
- ▶ Bed rest
- ▶ Early administration of antitoxin
- ▶ Correction of airway obstruction  
Eg: Ventilation
- ▶ Drugs
  - Penicillin
  - Erythromycin
  - Clindamycin

# Prevention

Immunization

- Part of EPI

# Listeria

# Listeria

## *Listeria monocytogenes*

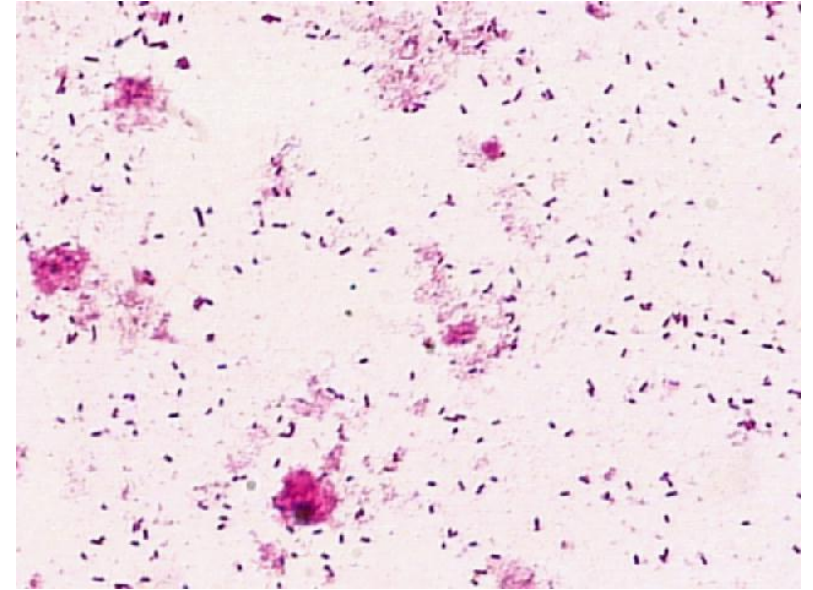
human pathogen

### Susceptible individuals

- ▶ Pregnant mothers
- ▶ Neonates
- ▶ Immunosuppressed individuals
- ▶ Elderly patients

## Morphology

- ▶ Short GPB
- ▶ **Feebly** motile at **37°C**.
- ▶ **Tumbling mortality** at **25°C**.
- ▶ Some spp are  $\beta$  haemolytic & others are non-haemolytic





## Epidemiology

- ▶ Primary animal pathogen
- ▶ Widely distributed in the environment
- ▶ Not a common human pathogen

# **Transmission**

## **Fetus**

Transplacental

## **Neonates**

Contact

Direct

From patient to patient

Indirect

Via unsterilized resuscitation equipment

## **Adults**

Consumption of contaminated chicken, cheese, milk

# Clinical manifestations

## ▶ *Intrauterine infection of the fetus*

Aborted fetus

Still birth

## ▶ *Neonates*

Septicemia

Neonatal meningitis

## ▶ *Immunosuppressed individuals*

Septicemia

## ▶ *Pregnant mothers*

Premature labor

# Lab Δ

## Specimens

- ▶ CSF
- ▶ Blood
- ▶ Amniotic fluid
- ▶ HVS (from mother)

# ***Actinomyces***

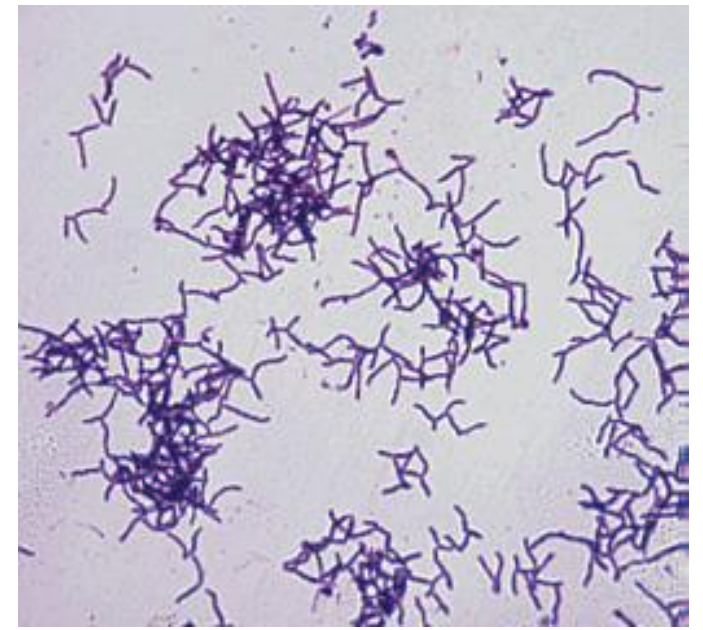
**Actinomyces**

**Disease**

**Actinomycosis**

# Actinomyces

- ▶ Anaerobic bacteria
- ▶ Previously considered as fungi due to presence as branching filaments
- ▶ Most are **soil** saprophytes
- ▶ Member of **normal flora** (mouth, GUT, vagina)
- ▶ **Slow growing** organisms
- ▶ Important spp
  - A. israelii* - in man.
  - A. bovis* - in cattle.
- ▶ Cause **chronic granulomatous infection** in man & animal



# Acinomycosis

- ▶ Following a local trauma, organisms gain access from normal flora / contamination
- ▶ Chronic disease characterized by multiple,
  - Abscess
  - Granulomas
  - Sinuses
  - Fibrosis
  - Tissue destruction



- ▶ Mass of bacterial filaments in pus visible to naked eye as light yellow granules.

**“Sulphur granules”**



# Human infections

## ■ Cervicofacial Actinomyces

More common

Jaw is involved

organism spread following dental  
extractions or other dental procedures.



# Rx

## ▶ Surgical drainage

## ▶ Rx with antibiotics

DOC- Penicillin

Erythromycin

Tetracycline

## ▶ Prolong Rx is necessary

# **Nocardia**

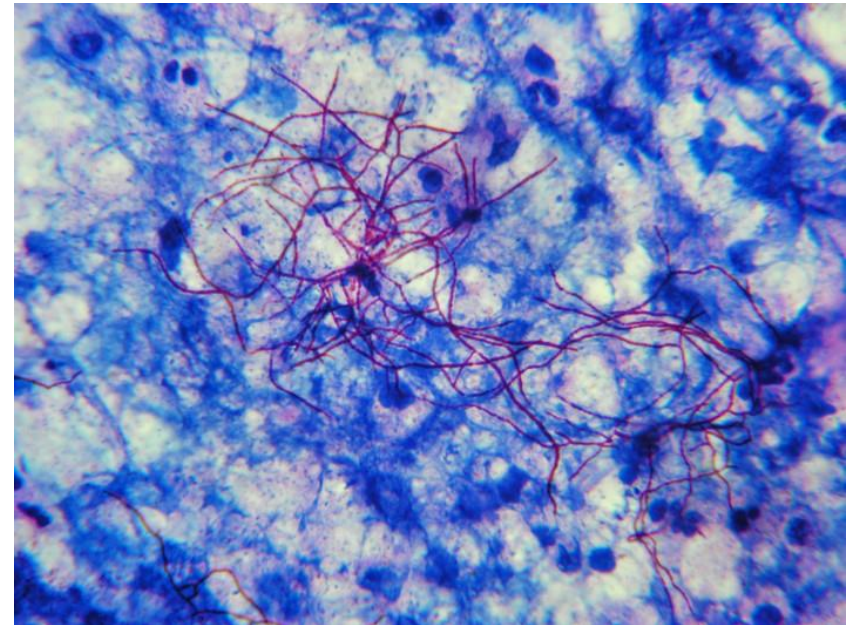
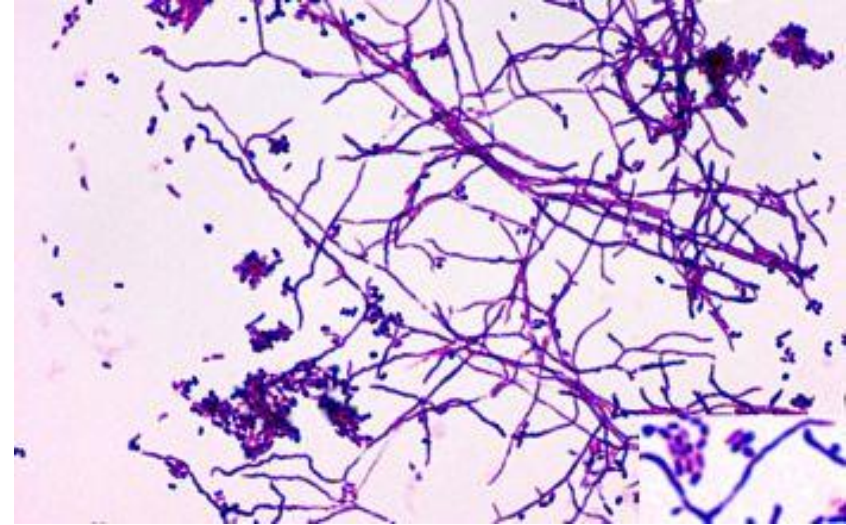
Disease : Nocardiosis

## Features:

- ▶ **Aerobic**
- ▶ Saprophyte
- ▶ Often **acid fast**
- ▶ Human pathogens

*N. brasiliensis*

*N. asteroides*



# Nocardiosis

## Cutaneous infection

- Primarily caused by *Nocardia brasiliensis*
- Infection occur when foot injuries contaminated with soil derived Nocardia
- Clinical forms include
  - subcutaneous abscess
  - cellulites
  - mycetoma

