

# Medical Microbiology

## Gram-Positive Bacilli

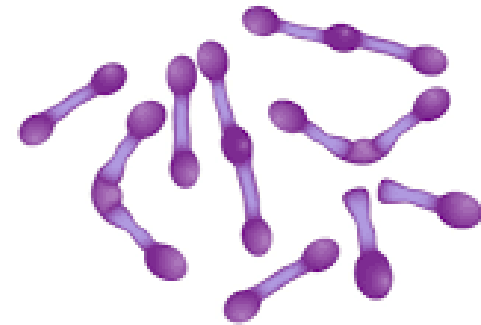
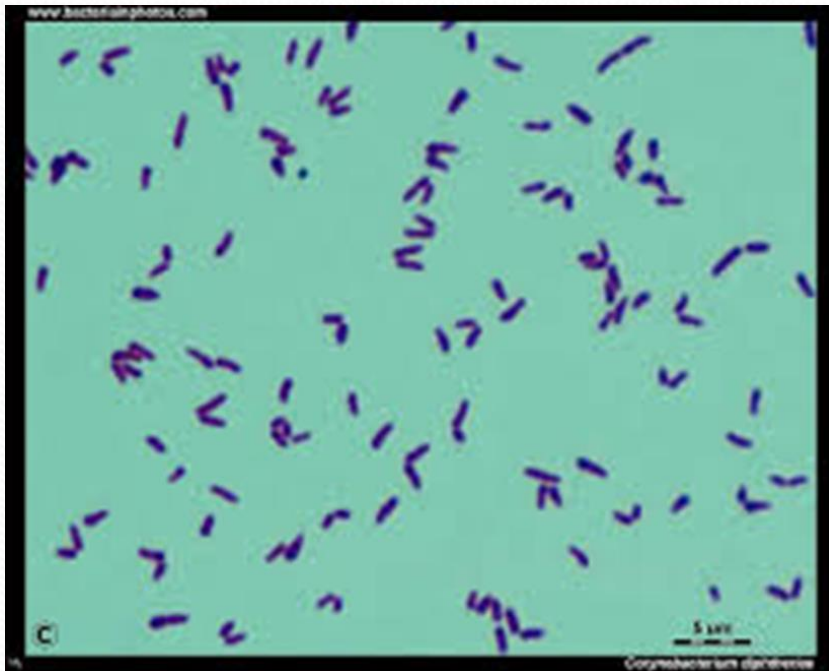
1- *Corynebacterium diphtheria*

2- *L. monocytogenes*: meningitis in newborn and immunocompromised

3- Spore Forming Bacilli

# Corynebacteria Group

- Pleomorphic Gram-positive Bacilli.
- *Diphtheroides*: Aerobic, Normal Flora - Respiratory-Urinary tract and Skin. Mostly Nonpathogenic.
- *Corynebacterium diphtheriae*:
  - Diphtheria is an acute, serious, highly infectious disease.
  - Strains are facultative aerobes,
  - Non-motile,
  - Non-spore forming pleomorphic
  - Gram positive bacilli,

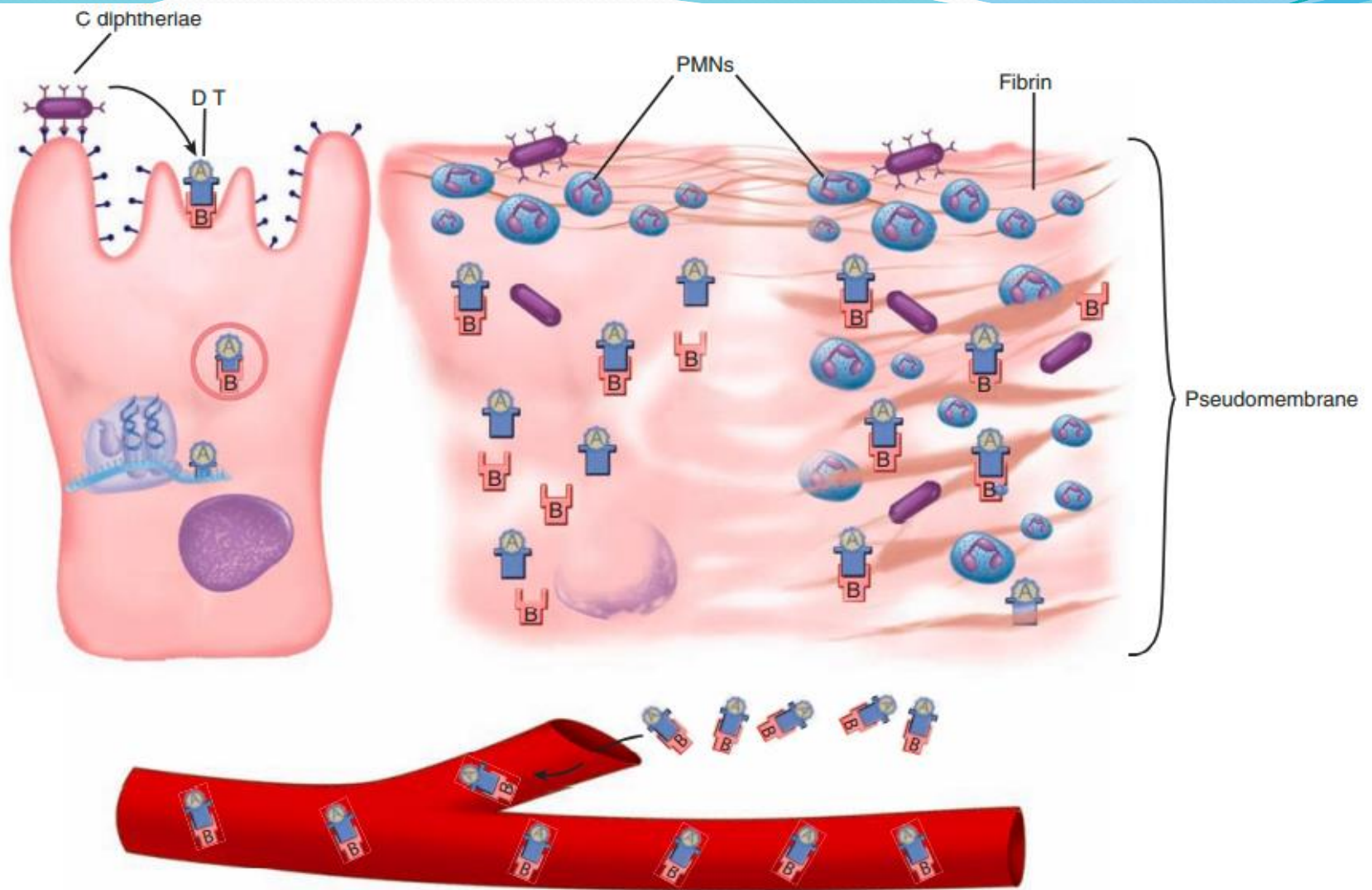


*Corynebacterium diphtheriae*

Producing Chinese-character arrangement (clubbed end to end, remain attached after division)

# Corynebacterium diphtheriae:

- Human Pathogen.
- Spreads by Droplets (larger than 5 microns in size)
- Clinical cases:
  - If toxogenic, Diphtheria (DT) (Lysogenic Strains) is released
  - DT: inhibit cytoplasmic protein synthesis irreversibly
  - Targeting elongation factor 2 (EF2)
  - Inflammation and Necrosis in the throat, pharynx and larynx (pseudomembranes).
  - myocarditis, High Fatality.



# Corynebacterium diphtheriae:

- 2-4 days incubation,
- Pharyngitis, tonsillitis
- Exudate or membrane
- Gray-white pseudomembrane
- Cervical adenitis (bull neck)
- Comp: mechanical obstruction, myocarditis (2-3w), cardiac enlargement, arrhythmias, CHF



*Corynebacterium diphtheriae*

- Diphtheria Toxoid (Triple Vaccine, DTP diphtheria, pertussis (whooping cough), and tetanus): given to children at 2, 4, and 6 months of age.
- Lab Diagnosis: Gram stain - Direct Smear and Throat culture on Blood Tellurite Medium
- Treatment: Diphtheria antitoxic serum and antibiotics (Peni,cepha,ery,tetra).



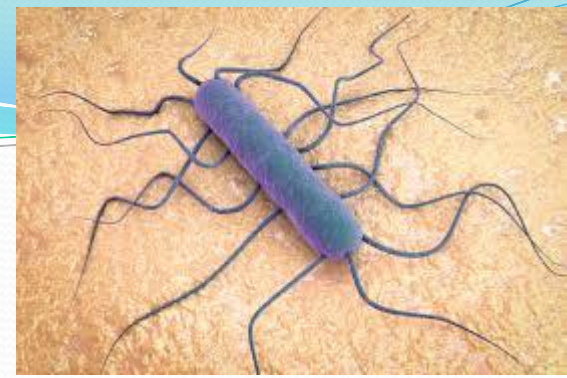


Albert stain is a type of differential stain used for staining the volutin granules also known as Metachromatic granules or food granules found in *Corynebacterium diphtheriae*.

*C. diphtheriae* produces large number of granules



- *Listeria monocytogenes*:



- Gram +ve Small Bacilli, **flagellated, motile** at 37°C , but active tumbling motility at 25°C.
- Catalase positive (differ from strep)
- Grow slowly in cold even below zero
- Foodborn transmission

It causes Invasive Infection (listeriosis), Septicemia, Meningitis and Abortion.



- *Listeria monocytogenes*:

- Transmitted transplacentaly
- Infect placenta
- Intrauterine infection
- Still birth
- Tt: Ampicillin, TMP-SMX

# Spore Forming Bacilli

- Gram+ve Spore-forming small/Large Bacilli,
- Survive for a long period in dryness.
- Common in Nature: Soil, Dust, water and air and on Vegetations.

# Spore Forming Bacilli

Bacillus (aerobic) and Clostridium species (anaerobic)

# Aerobic Spore Forming Bacilli

- *Bacillus cereus*
- *Bacillus subtilis*
- *Bacillus anthracis*

# Aerobic Spore Forming Bacilli

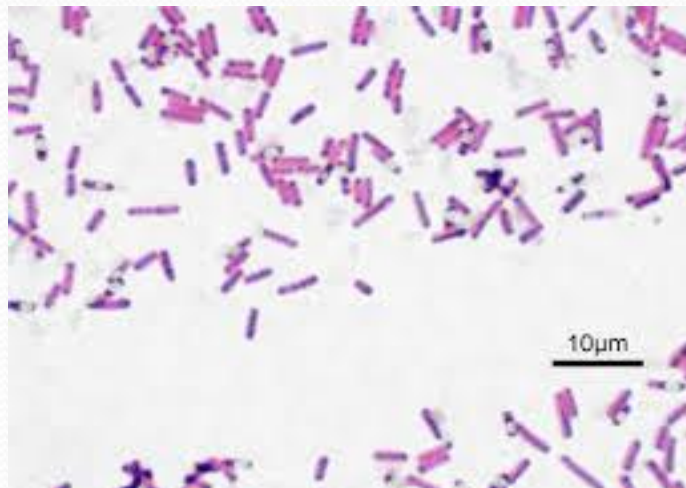
## *Bacillus cereus:*

- food-poisoning
- Vomiting & Diarrhea.

Treatment: conservative, no need for antibiotics.

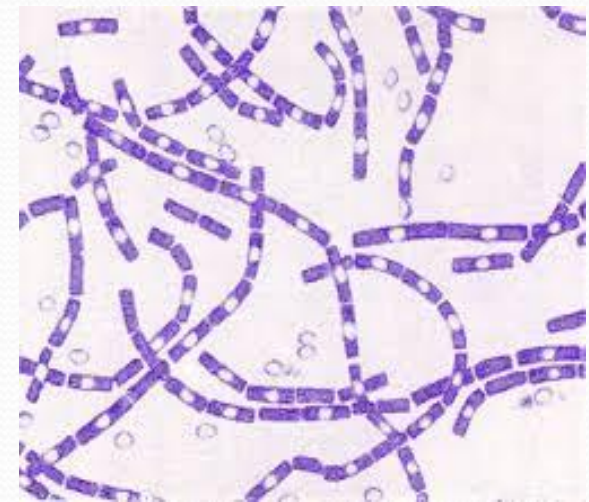
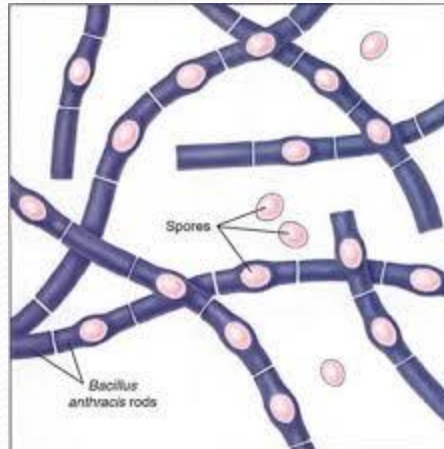
- *Bacillus subtilis*:

- Small, short, thin bacillus with rounded ends.
- Motile and non-capsulated.
- Opportunistic Pathogen, can cause wound infection and Sepsis in Infants and in Immunocompromised Patients.



- *Bacillus anthracis*:

- Gram-positive,
- Large, non-motile, rectangular bacilli, arranged in chains.
- Spores are oval and central.
- Aerobe and facultative anaerobe.
- Vegetative cells-readily destroyed by heat, Spores-highly resistant to heat.



- *Bacillus anthracis*:
- Man is infected from animals and its products:
  - Cutaneous Anthrax- Wound Infect,
- Hemorrhagic Pneumonia & Septicemia by Inhalation
- High Fatality. Biological War Agent.



- *Bacillus anthracis*:

- Polypeptide capsule
- Potent exotoxin complex
- Protein inactivation
- Tt: penicillin , doxy, Cipro
- **Cutaneous anthrax**: 2-5 day erythematous papule, 7-10 day ulcer(malignant pustule)
- **Pulmonary anthrax**: distress, cyanosis, 1-5 day, fever, cough, edema, hemorrhagic anthrax, meningitis



# Anaerobic Spore Forming Bacilli

## Clostridium

- C. botulinum
- C. tetani
- C. perfringens
- C. difficile


# C .botulinum:

- Food-borne botulism
- BT: resistance to GI enzyme
- No change in food
- Home canned, green bean, fish, mushroom
- The most potent toxin in nature (a Heat-Stable Exotoxins-Protein (20min /100C))
- Metaloprotease act on NM junction
- Block release of NTM Acetyhcoline at presynaptic membrane
- Flaccid paraysis of motor system

- *C .botulinum:*

Botulism: Clinical symptoms begin 18-36 hours after toxin ingestion with:

- weakness, dizziness, dryness mouth, Nausea, Neurologic features.. blurred vision, inability to swallow, difficulty in speech, weakness of skeletal muscles and Respiratory Paralysis
- .. Inhibition of the release of the neurotransmitter acetylcholine.. No Fever.
- Diagnosis: Clinical Features.. Rare Toxin Detection

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- Infant botulism: honey
  - Tt: ABC, antitoxin
  - Spore survive 121

# Clostridium tetani

- Tetanus is a highly fatal disease with a High Mortality rate,
- Localized infection/Surface or Deep in Tissues,
- Wound: puncture wound with a splinter
- Unskilled abortion, female circumcision
- Release potent neurotoxin (**Tetanus toxin / tetanospasmin**)  
produced when spores germinate and vegetative cells grow in necrotic tissues.
- The organism multiplies locally and symptoms appear remote from the infection site.

# Tetanus toxin

- NTM: glycine and gamma aminobutyric acid
- Effect inhibitory neuron
- Unopposed firing of active motor neuron
- Spasm, spasmodic paralysis (botulism: flaccid paralysis)
- Dx clinical
- Incubation 4 day
- 1st: masseter muscle : unable to open mouth (lock jaw) or trismus

- Death: exhaustion and resp failure

- Mortality 15-60% if not treated

- **Neonatal tetanus:**

Fatal.. Common in developing countries.. failure of aseptic technique during the delivery of babies.. Umbilical Stump.



# Clostridium perfringens

- Gas gangren:
  - Traumatic wound and muscele damage
  - Compound wound and bullet wound
- Food poisoning (spore survival at 100) (Enterotoxin)
  - Intense Watery diarrhea, but No Fever.



# *Clostridium difficile*

- **AntibioticAssociated diarrhea (10 Days after antibiotic)** (Lincomycin-Clindymicin, Cephalosporines)
- Pseudomembraneuse Colitis..Bloody Diarrhea (lethal inflammation of colon, toxic megacolon)..
- Treatment: Stop Antibiotics, Give metronidazol  
Vancomycin.

