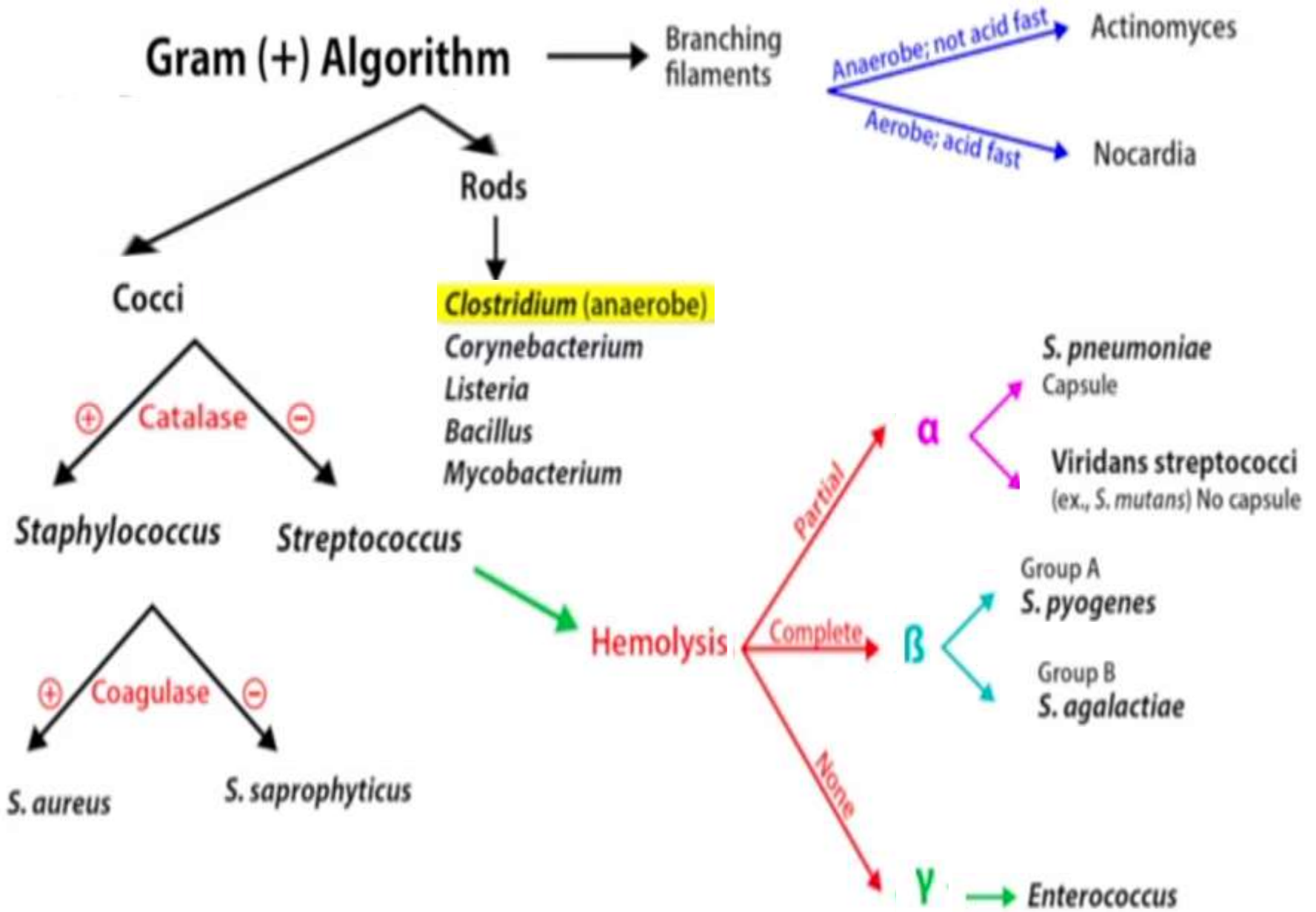


# **General Microbiology 2020-2021**

## **Orientation to Gram Positive Bacteria of Medical Importance**

**Dr. Mohammad Odibate  
Department of Microbiology and pathology  
Faculty of Medicine, Mutah University**



# **Orientation to Gram Positive Bacteria of Medical Importance**

# Shapes of Bacteria



Coccus



Coccobacillus



Bacillus



Vibrio



Spirillum



Spirochete

# Medically Important Gram-Positive Cocci

## Gram Positive



### Gram Positive Bacilli

- **Bacillus** :
  - anthracis (anthrax)
  - cereus
- **Clostridium**:
  - botulinum
  - difficile
  - perfringens
  - tetani
- **Non-spore forming**
  - *Listeria monocytogenes*
  - *Corynebacterium diphtheriae*
  - *Mycobacterium*

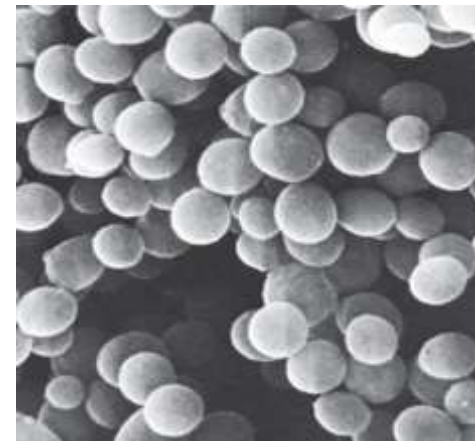
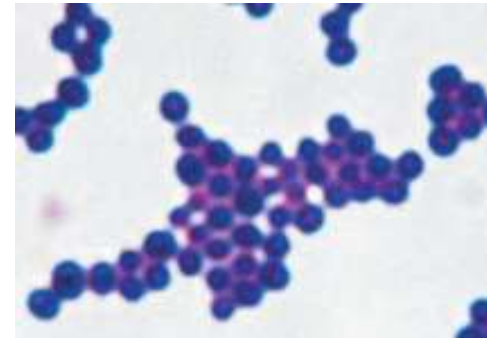
### Gram Positive cocci

- **Staphylococcus aureus**
- **Streptococcus** :
  - Group A: *pyogenes*
  - Group B: *agalactiae*
- **pneumoniae (diplococci)**

# Medically Important Gram-Positive Cocci

## Staphylococci General Characteristics

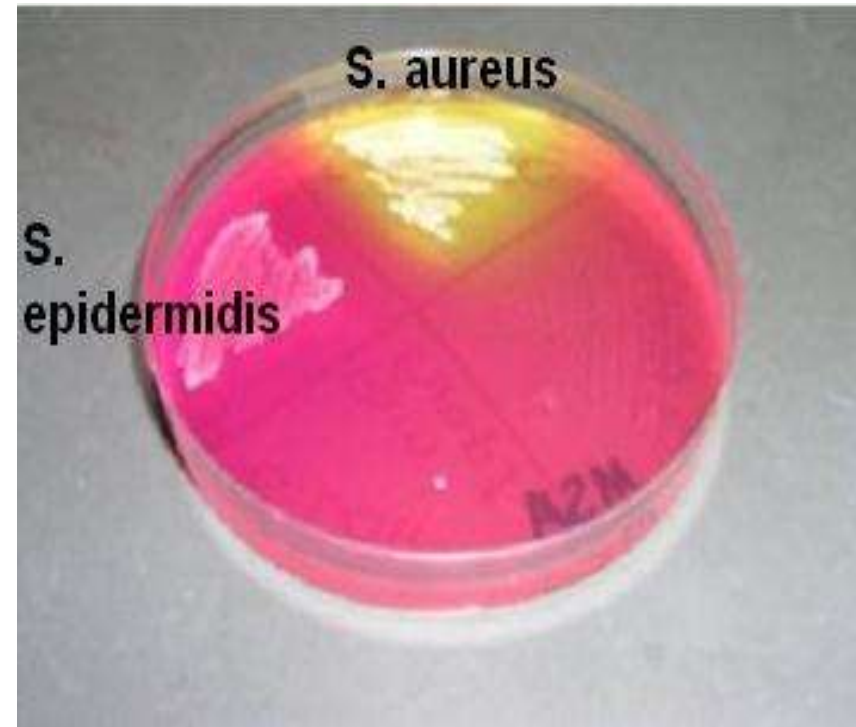
- Common inhabitant of the skin and mucous membranes.
- Spherical cells arranged in irregular clusters.
- Produces many virulence factors



# Medically Important Gram-Positive Cocci

## Staphylococci aureus

- Diseases:
  - Food poisoning.
  - Localized infections (Abscess formation).
  - Spreading infections.
  - Necrotizing infections.
  - Systemic infections (ex. Osteomyelitis).



# Medically Important Gram-Positive Cocci

## Coagulase-negative staphylococcus

- Frequently involved in nosocomial and opportunistic infections.
- *S. epidermidis* – lives on skin and mucous membranes; endocarditis, bacteremia, UTI.
- *S. saprophyticus* – infrequently lives on skin, intestine, vagina; UTI.



# Medically Important Gram-Positive Cocci

## Gram Positive



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# Medically Important Gram-Positive Cocci

## Streptococci

- Gram-positive cocci
- Catalase & Coagulase negative
- Sensitive to drying, heat, and disinfectants
- Classification

$\alpha$ -hemolytic: partial hemolysis of RBCs

$\beta$ -hemolytic: complete hemolysis of RBCs

$\gamma$ -hemolytic: no hemolysis of RBCs



# Medically Important Gram-Positive Cocci

## Streptococci

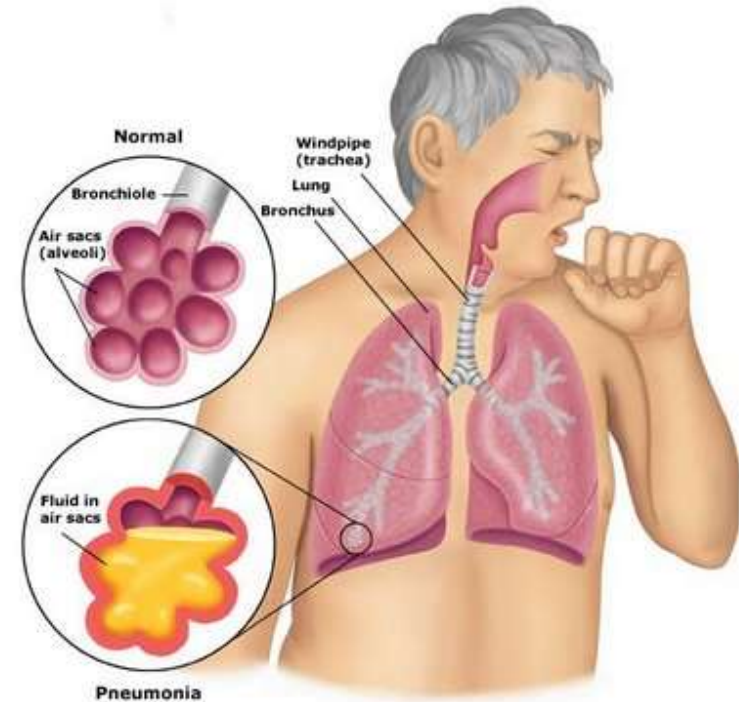
### *S. pyogenes (Group A strep):*

- Group-A streptococci (GAS).
- $\beta$ - hemolytic.
- Most serious streptococcal pathogen.
- Inhabits throat, nasopharynx, occasionally skin.
- Diseases:
  - Pharyngitis.
  - Skin infections.
  - Necrotizing infections.
  - Systemic infections

# Medically Important Gram-Positive Cocci

## Streptococcus pneumoniae

- ✓ Pneumonia-inflammatory condition of the lung.
- ✓ Inhabits nasopharynx of healthy people.
- ✓ May also infect brain: (pneumococcal meningitis) and blood stream (pneumococcus septicemia).



# Medically Important Gram-Positive Cocci

## Gram Positive



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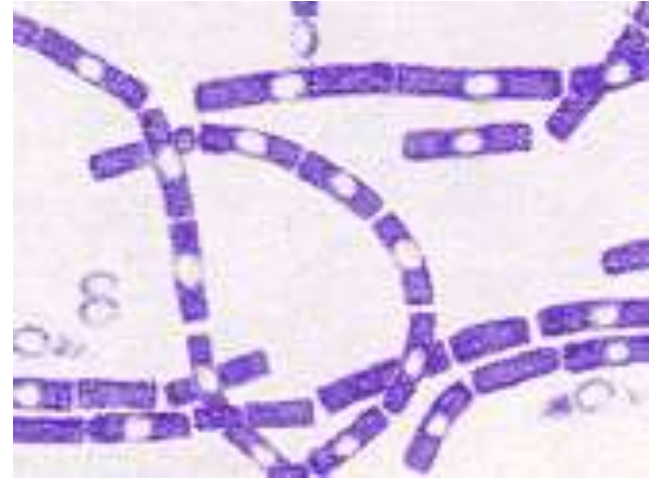
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# Medically Important Gram-Positive Bacilli

## *Bacillus anthracis*

- Large, block-shaped rods
- Central spores
- Virulence factors – polypeptide capsule/exotoxins
- 3 types of anthrax:
  - ✓ Cutaneous – spores enter through skin, black sore; least dangerous.
  - ✓ Pulmonary – inhalation of spores.
  - ✓ Gastrointestinal – ingested spores.



# Medically Important Gram-Positive Bacilli

## *Bacillus cereus*

- Grows in foods, spores survive cooking/reheating.
- Ingestion of toxin-containing food causes nausea, vomiting, abdominal cramps, diarrhea; 24 hour duration.
- No treatment.
- Increasingly reported in immunosuppressed.

# Medically Important Gram-Positive Cocci

## Gram Positive



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# Medically Important Gram-Positive Bacilli

## *Clostridium difficile*

- Normal flora colon, in low numbers.
- Causes antibiotic associated colitis
- Due to treatment with broad-spectrum antibiotics that kills other bacteria: *C. difficile* overgrowth
- Enterotoxins that damage intestines.
- Major cause of diarrhea in hospitals.
- Treatment: stop antimicrobials/fluid electrolyte replacement.

# Medically Important Gram-Positive Bacilli

## *Clostridium perfringens* (Gas Gangrene)

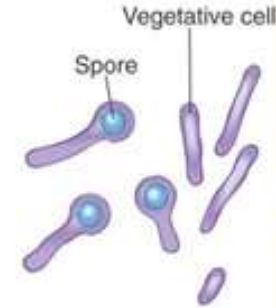
- Soft tissue :wound infections: myonecrosis
- Predisposing factors: infection of all types of wounds.
- Virulence factors (lytic enzymes)
- Treatment: antibiotics/amputation



# Medically Important Gram-Positive Bacilli

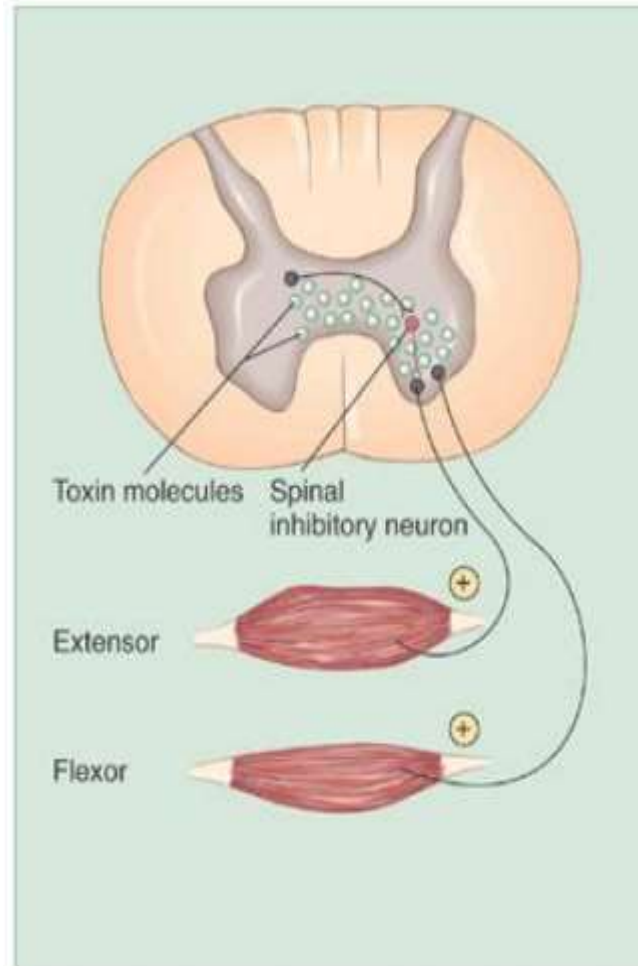
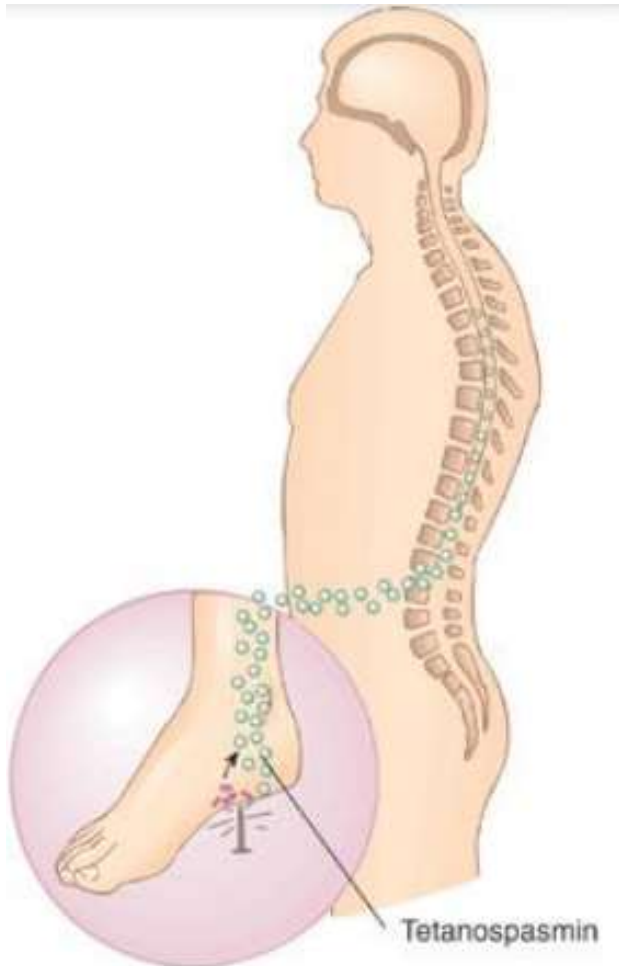
## *Clostridium tetani*: Tetanus

- Common resident :of soil and GI tracts of animals.
- Causes tetanus or lockjaw, a neuromuscular disease.
- Most commonly among IV drug abusers and neonates in developing countries.



# Medically Important Gram-Positive Bacilli

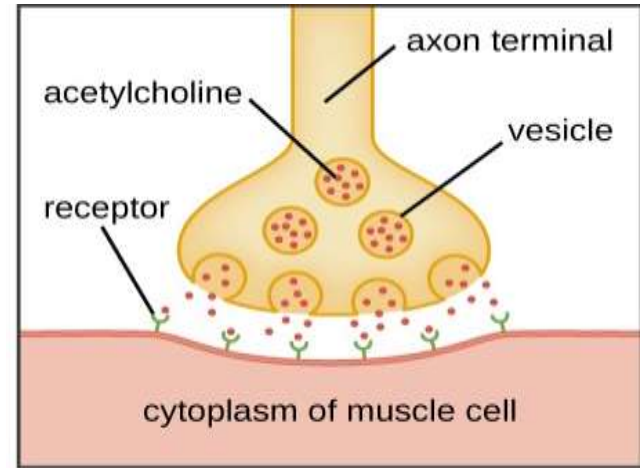
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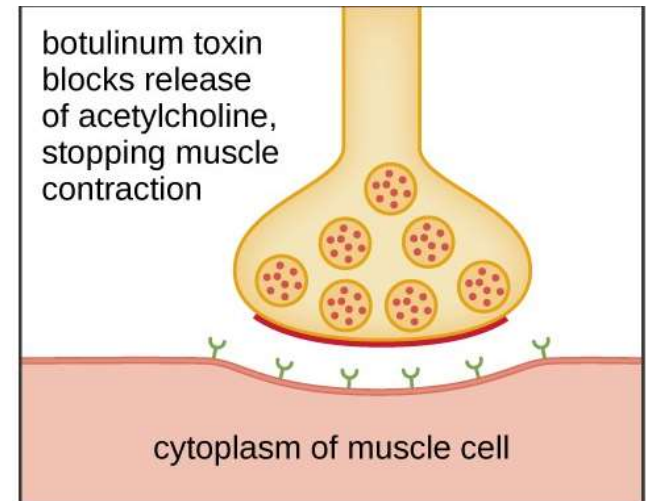
# Medically Important Gram-Positive Bacilli

## *Clostridium Botulinum*: Flaccid paralysis

- Botulism—intoxication associated with inadequate food preservation
- Toxin carried to neuromuscular junctions: blocks the release of acetylcholine: necessary for muscle contraction to occur.
- Clinically
  - Double or blurred vision
  - Difficulty swallowing
  - Neuromuscular symptoms



normal mechanism



abnormal mechanism

# Medically Important Gram-Positive Cocci

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# Medically Important Gram-Positive Bacilli

## Gram Positive Non-Spore-Formers

### *Listeria monocytogenes*:

- Found in soil, water, luncheon meats, hot dogs, cheese.
- Resistant to long storage and refrigeration, heat, salt, pH extremes and bile.



# Medically Important Gram-Positive Bacilli

## Gram Positive Non-Spore-Formers

### *Corynebacterium diphtheriae*:

- Virulence factors: diphtherotoxin.
- Vaccine (DPT).
- Causes a pseudomembrane which can cause asphyxiation.
- Acquired via respiratory droplets from carriers or actively infected individuals.





# Medically Important Gram-Positive Bacilli

## Gram Positive Non-Spore-Formers

### *Mycobacterium*:

- Gram-positive irregular bacilli.
- Acid-fast staining: mycolic acids.
- Strict aerobes.
- Grow slowly.
- Virulence factors -contain complex waxes that prevent destruction by lysosomes or macrophages.

