

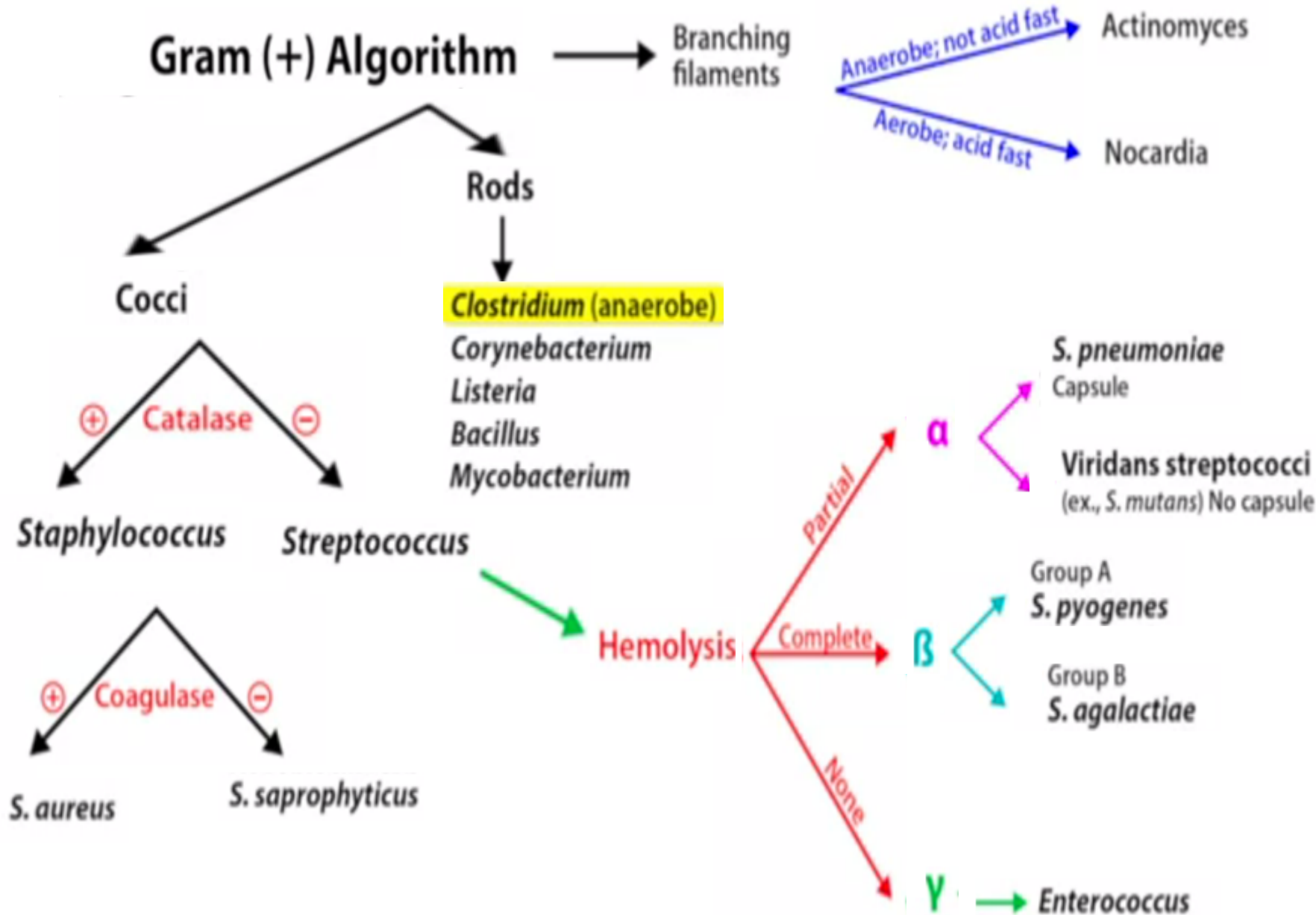
General Microbiology

2022-2023

Orientation to Gram Positive Bacteria of Medical Importance

Lecture 6

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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

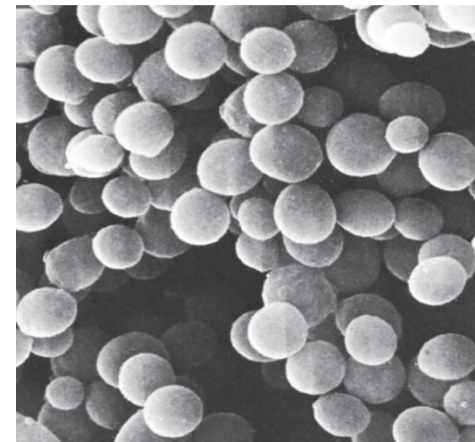
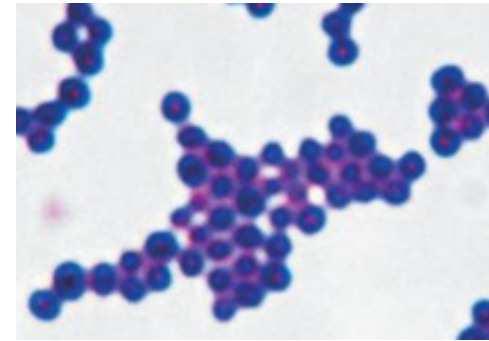
Gram Positive cocci

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

Medically Important Gram-Positive Cocci

Staphylococci General Characteristics

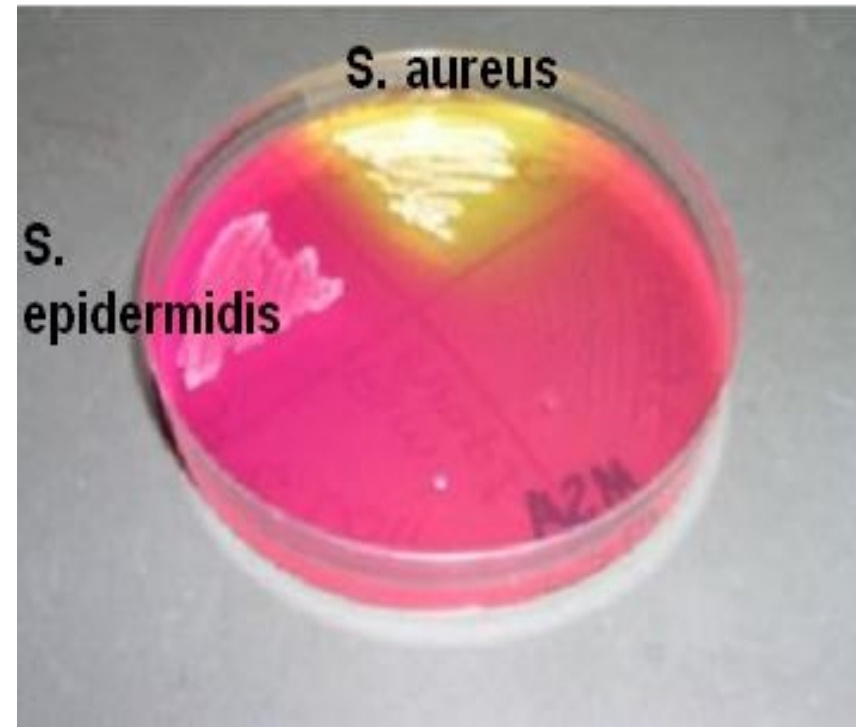
- Common inhabitant of the skin and mucous membranes.
- Spherical cells arranged in irregular clusters.
- Produces many virulence factors



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.

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Medically Important Gram-Positive Cocci

Streptococci

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

α -hemolytic: partial hemolysis of RBCs

β -hemolytic: complete hemolysis of RBCs

γ -hemolytic: no hemolysis of RBCs



Medically Important Gram-Positive Cocci

Streptococci

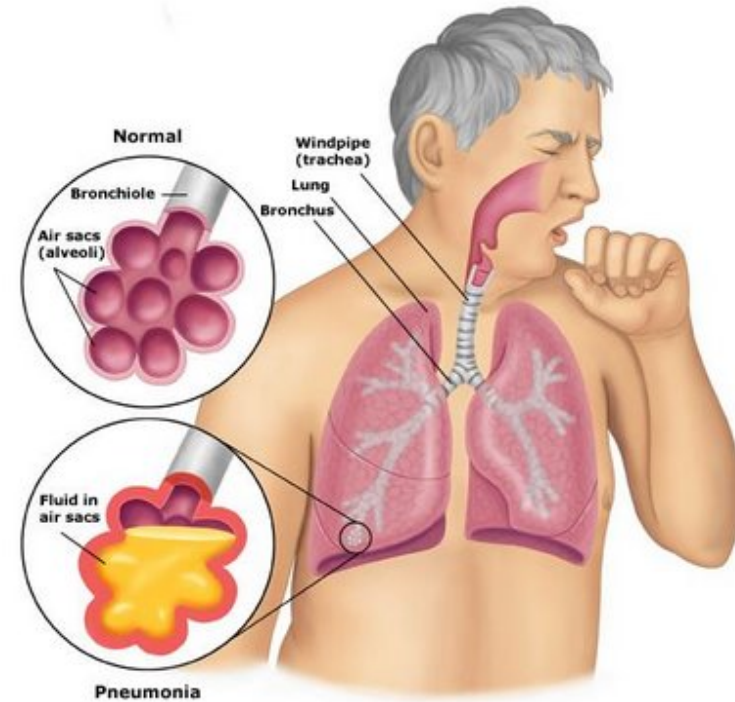
S. pyogenes (Group A strep):

- Group-A streptococci (GAS).
- β - 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).



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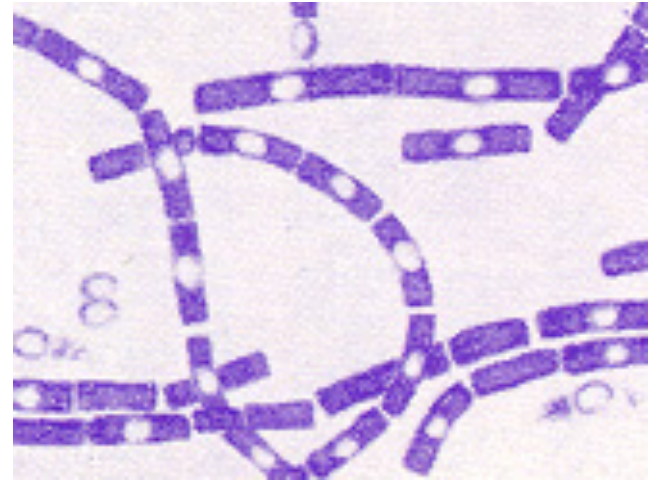
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Medically Important Gram-Positive Bacilli

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.

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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)

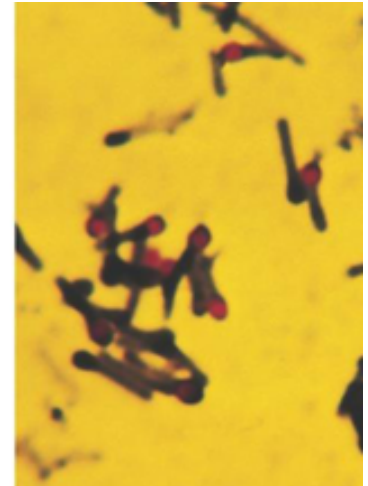
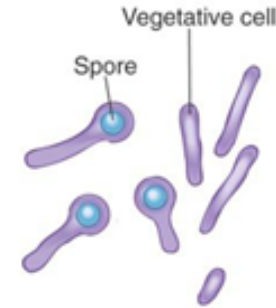
- Soft tissue :wound infections: myonecrosis
- Predisposing factors: infection of all types of wounds.
- Virulence factors (lytic enzymes)
- Treatment: antibiotics/amputation



Medically Important Gram-Positive Bacilli

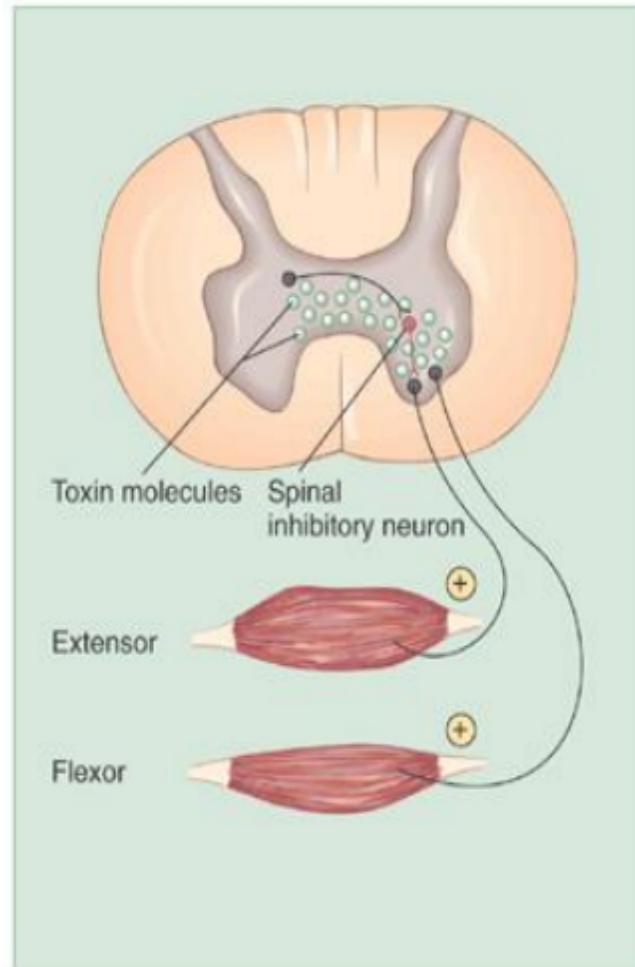
Clostridium tetani: Tetanus

- 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

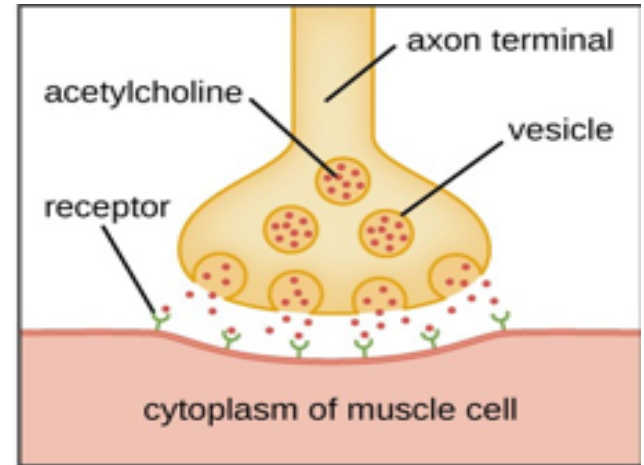
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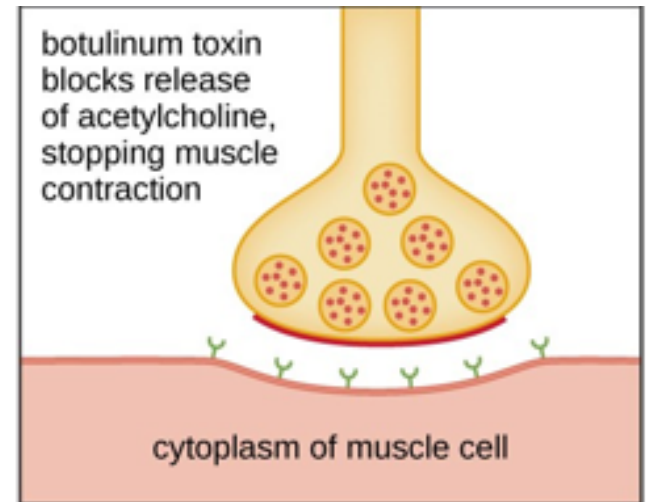
Medically Important Gram-Positive Bacilli

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

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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.

