Gram Positive Bacteria Clostridium

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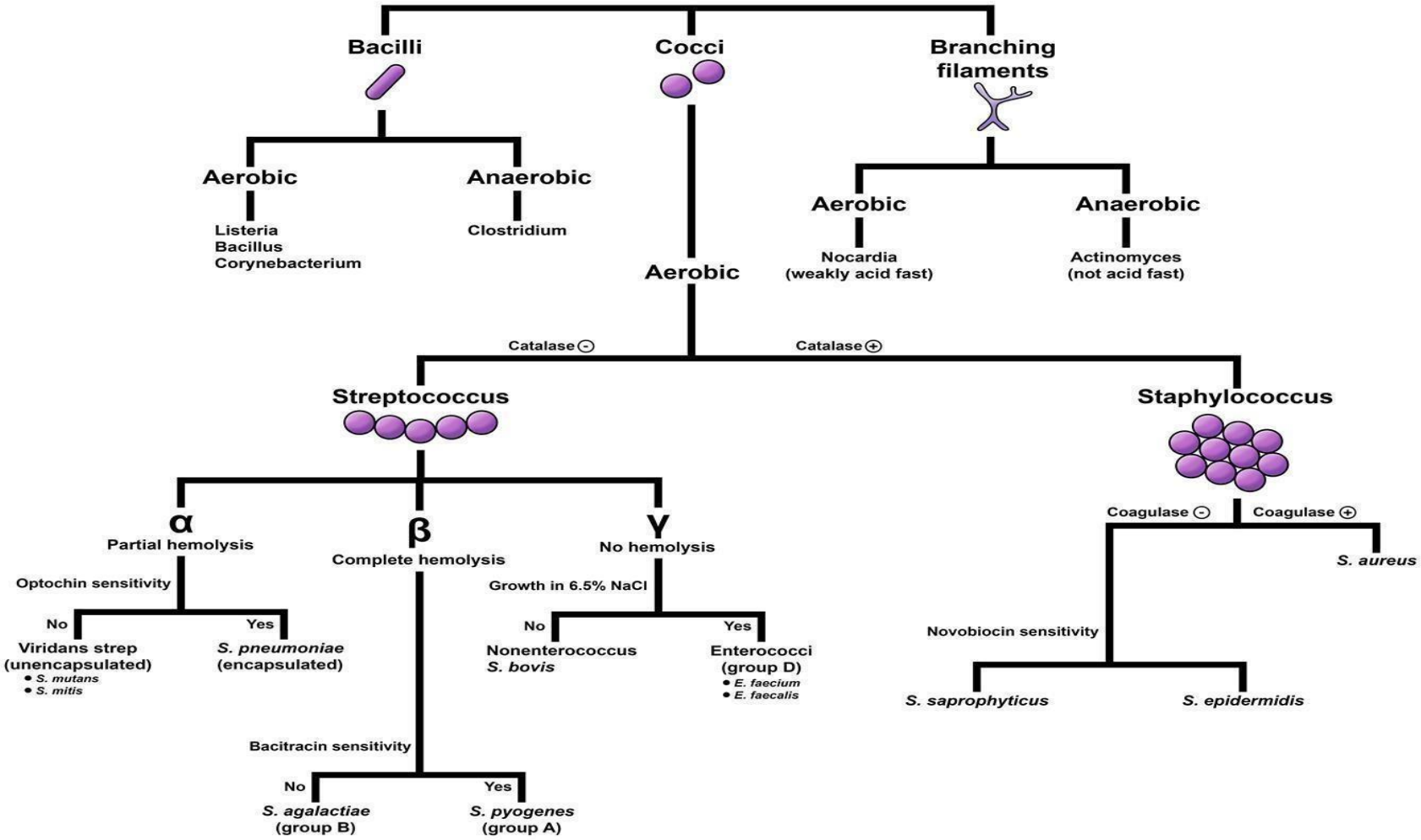
Course: Medical Microbiology (MA 212)

Summer semester

Outline

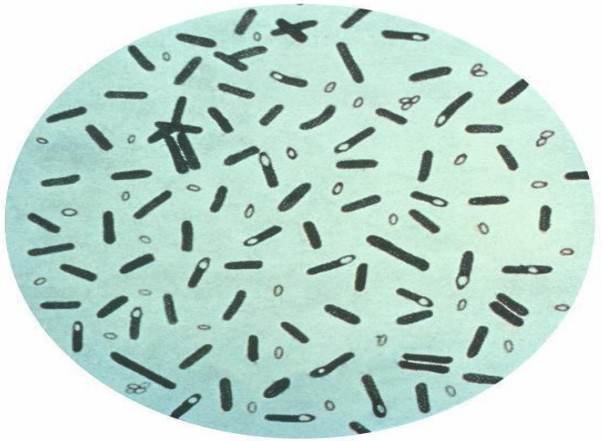
- Gram Positive Bacteria
- ***Clostridium (general Characteristics)***
- ***Endospores***
- ***Clostridium Group***

Gram-Positive Bacteria

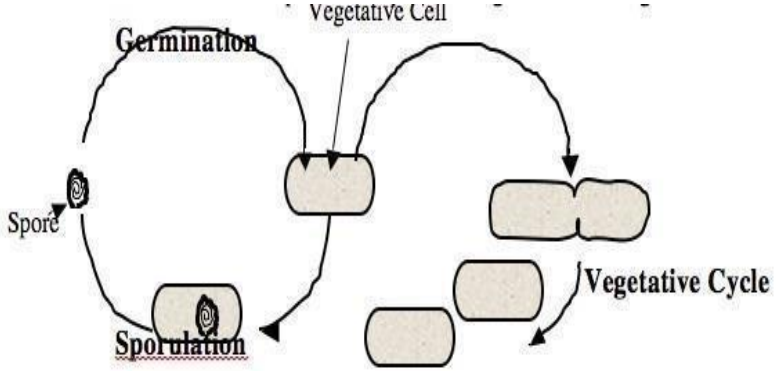


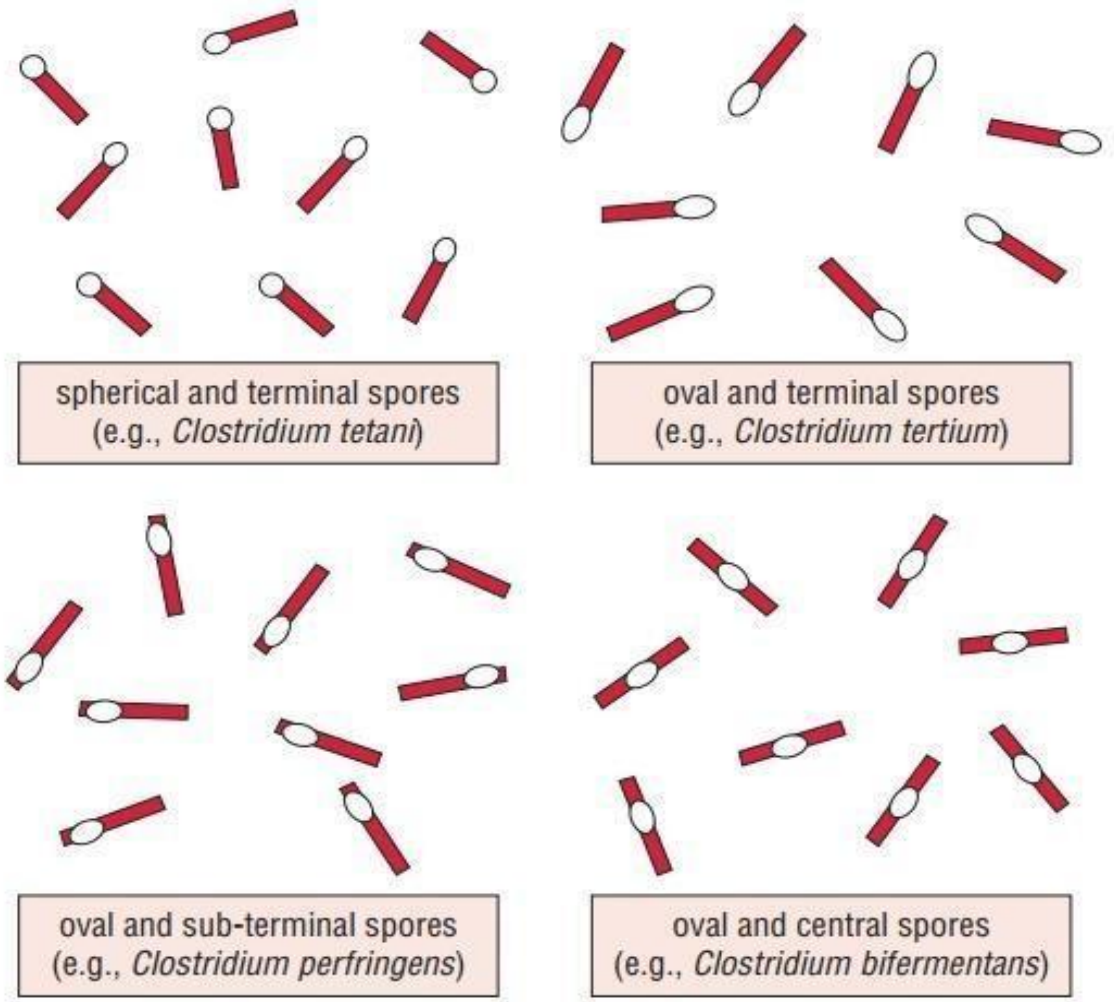
Clostridium :

➢ General Characteristics



- Gram Positive Bacteria
- Bacilli shape bacteria
- Mostly obligate anaerobic bacteria
- Mostly motile (except ***C. perfringens)***
- Mostly are catalase negative
- oxidase negative
- They produce highly resistant **endospore: which is a highly resistant dormant structure (inactive) formed in response to adverse environment**



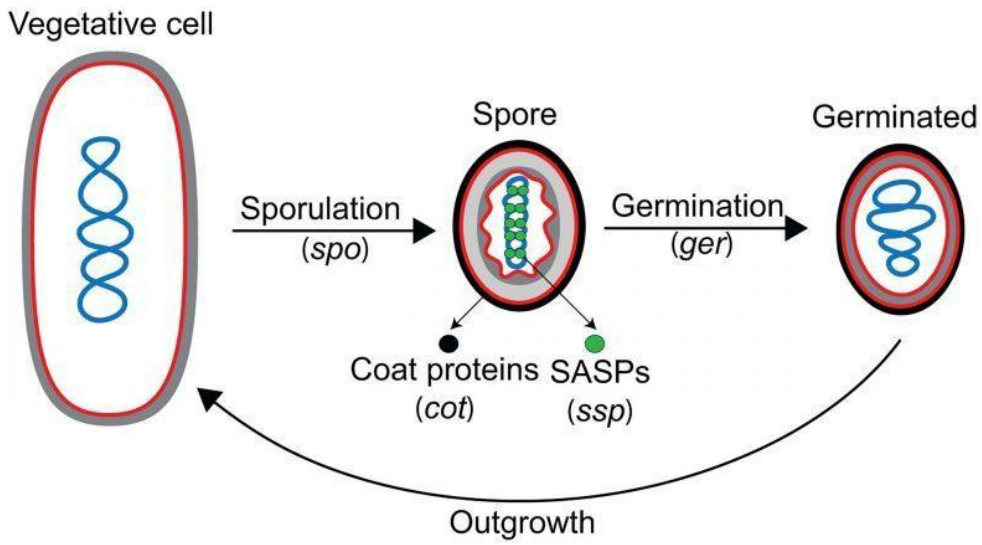


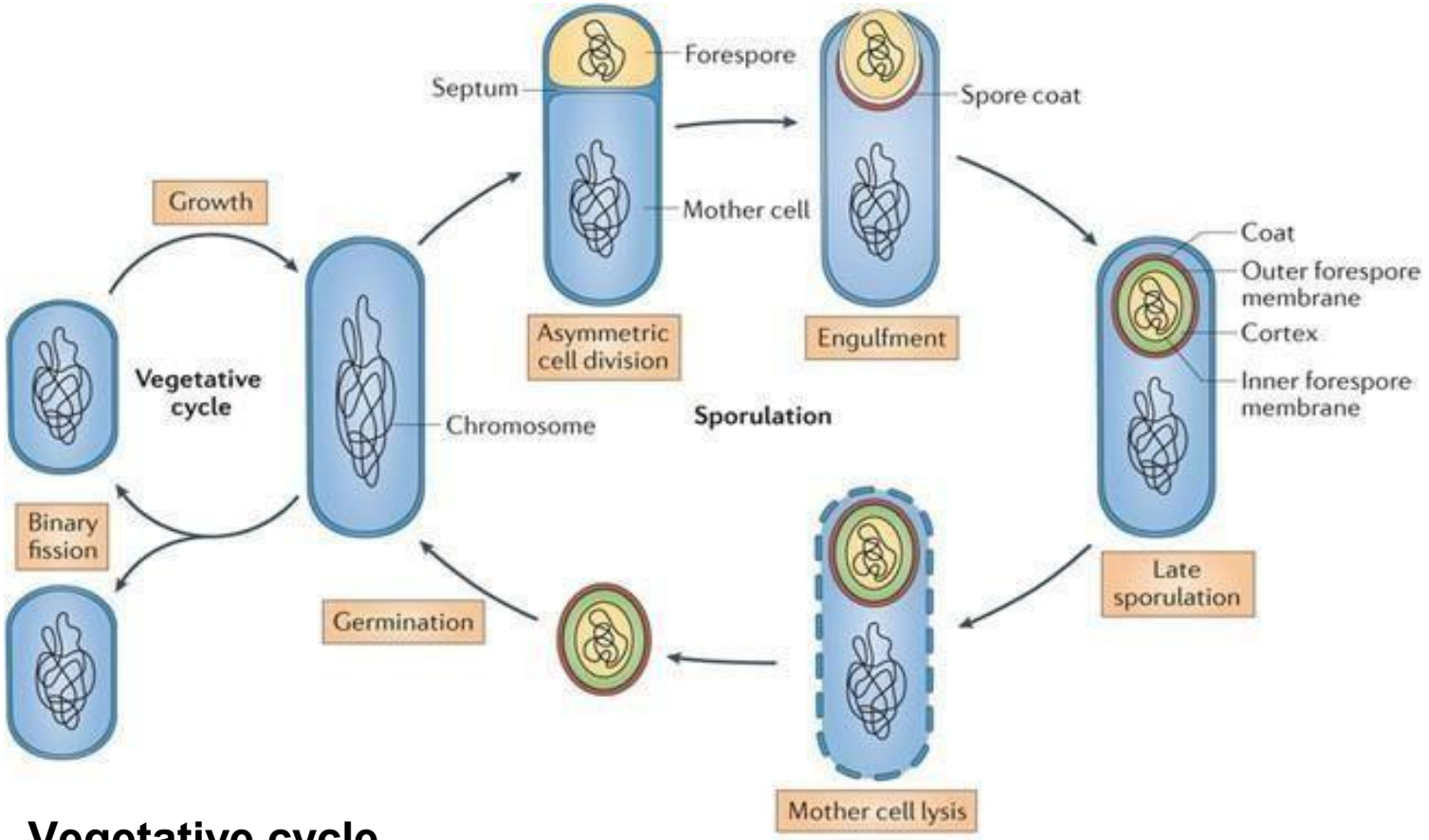
Types of spore position in *Clostridium*

What is the difference between vegetative cell and Endospores ?

- Endospores are only formed by a few gram-positive bacteria and provide the cell with resistance to a wide variety of harsh conditions, such as starvation, extremes in temperature, exposure to drying, UV light, chemicals, enzymes, and radiation.

- While the **vegetative cell** is the **active** form for bacterial cells (growing, metabolizing, etc), the endospore can be thought of as a dormant (inactive) form of the cell. It allows for survival of adverse conditions, but it does not allow the cell to grow or reproduce.

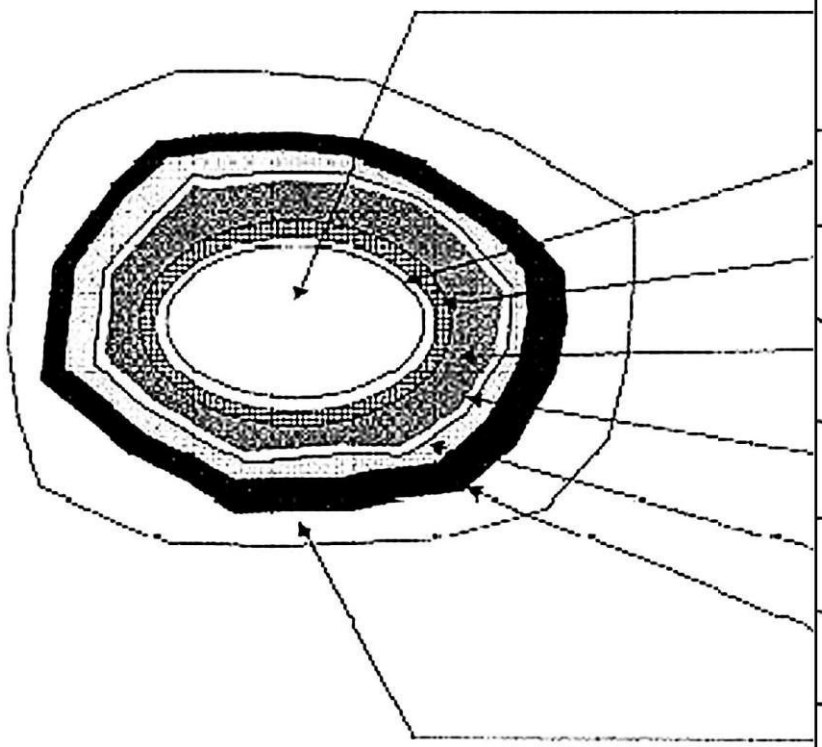




Vegetative cycle

Endospore formation Steps
Sporulation

Structure of spore



Core	DNA, RNA, Proteins, SASPs, DPA, Ca^{2+}
Inner membrane	Lipid/Protein
Germ cell wall	Peptidoglycan
Cortex	Modified peptidoglycan
Outer membrane	Lipid/Protein
Inner spore coats	Proteins
Outer spore coats	Proteins
Exosporium	Proteins

Most important pathogenic species of *Clostridium*

1- Neurotoxic Group **2- Histotoxic group** **3- Enterotoxigenic**

1- Neurotoxic Group (affect nervous system interfere with normal nerve function)

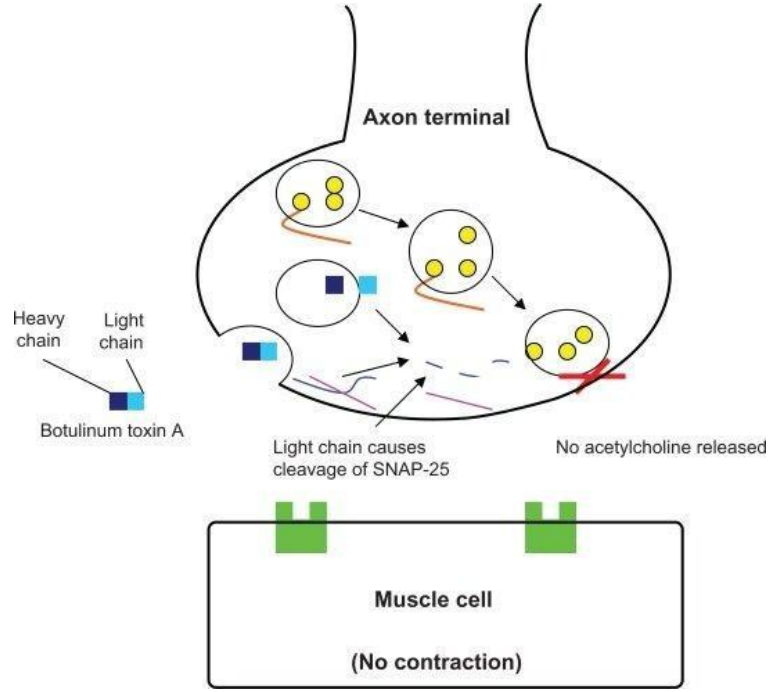
Examples: (A- ***Clostridium botulinum , B- Clostridium tetani)***

- ***A- Clostridium botulinum*** can produce botulinum toxin in food or wounds and can cause **botulism infection**.
- This same toxin is known as Botox and is used in cosmetic surgery to paralyze facial muscles to reduce the signs of aging; it also has numerous other therapeutic uses.

- Botulism is a rare but severe illness caused by a toxin that affects the nervous system. It can lead to breathing problems, muscle paralysis, and, in some cases, death.

Types of botulism

a. Foodborne (intoxication,1-2days incubation period)
b. Infant (ingestion of spores in honey)
c. Wound (symptoms similar to foodborne, but 4 or more days incubation)



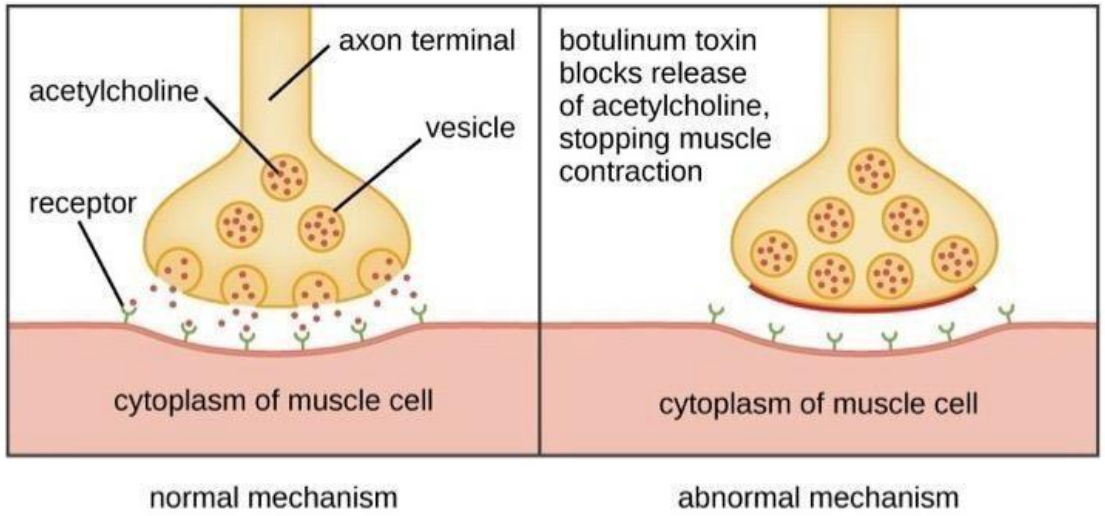
B- Clostridium tetani causes **tetanus** **infection .**

- Tetanus is a severe nervous system condition caused by a bacterium that produces toxins. It leads to **muscle spasms**, especially in the jaw and neck areas.

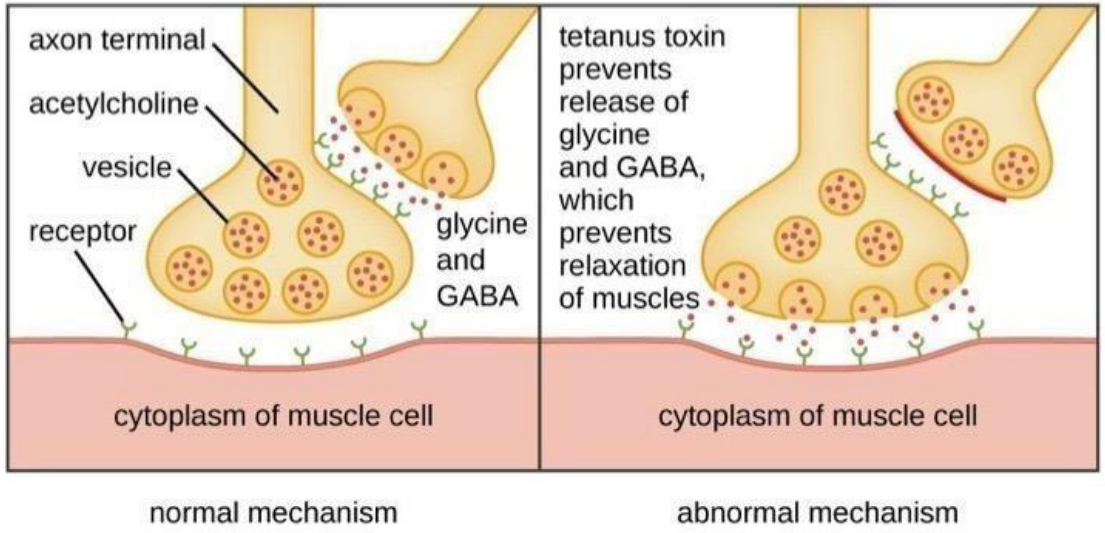
- What is the difference between Botulism and Tetanus?

Tetanus infection

Mechanism of Botulinum Toxin



Mechanism Tetanus Toxin



Mechanism of Neurotoxin (Tetanus and Botulism Toxin)

2- Histotoxic group

(The "histotoxic group" refers to a type of toxin that harms the body's tissues)

Example: Clostridium perfringens causes a wide range of symptoms, from **food poisoning** to **cellulitis**, and
gas gangrene.

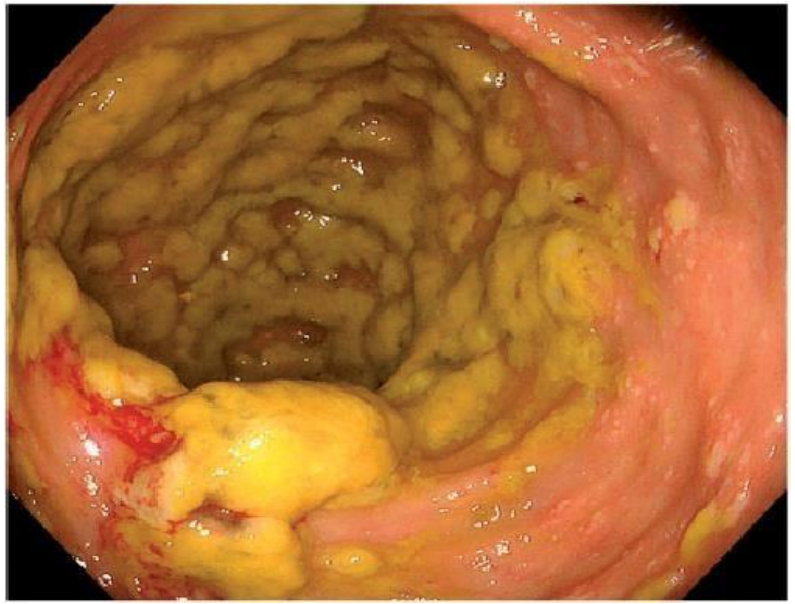
3- Enterotoxigenic group

Example: Clostridium difficile: causes **diarrhea** and **colitis** (an inflammation of the colon)

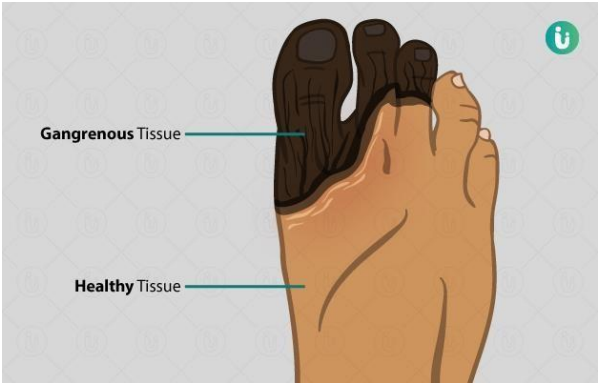
a. Clostridial foodborne disease (8-24h after ingestion of large numbers of organisms on con-taminated meat products, spores germinate, enterotoxin produced (***C. perfringens*** **type A**)

b. Necrotizing enteritis (beta toxin-producing ***C.perfringens*** **type C**)

Necrotizing enteritis ***Clostridium difficile***



Pseudo membrane colitis ***Clostridiumdifficile***



Gas Gangrene (***Clostridium perfringens***)