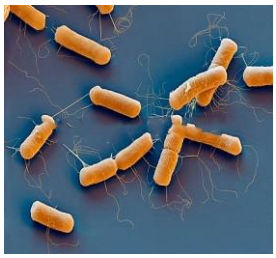
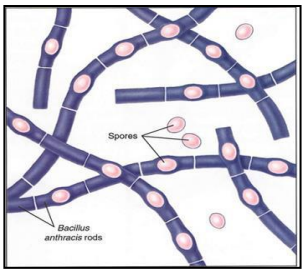
Medical Bacteriology - Lecture 7

Spore- forming Gram Positive Rods

Bacillus





Bacillus

Characteristics

- Gram positive
- Large rod.
- Arranged in long chain
- **Spore forming**
- Aerobic or facultative anaerobic
- Found in soil habitats around the world
- Can be cultivated in ordinary nutrient medium (nonselective & selective media)

B. anthracis

- Large, square- ended rods
- **Non motile**
- **Capsulated**
- **Non hemolytic on blood agar**

B. anthracis Diseases (Anthrax):

- Anthrax is primarily **zoonotic (occupational) disease** of domesticated and wild animals, such as cattle and sheep.

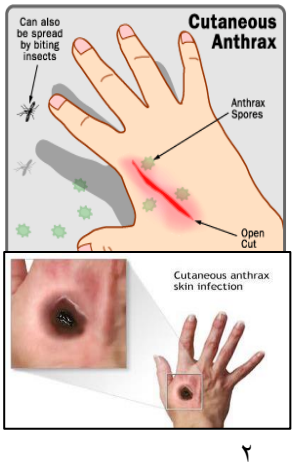
- Transmitted to human after contact with infected animals or their products.

In Animal:

- Most commonly occurs following ingestion of the organism, also can occur by acquisition of the organism in aerosols or via wounds
- Septicemia

In Human: The forms of the disease in humans are;

- **Cutaneous anthrax (malignant pustule) ----- (Skin)**
- **Pulmonary anthrax (Wool sorter's disease) ---- (inhalation)**
- **Gastrointestinal anthrax ------ (contaminated food)**



1- Cutaneous anthrax; acquired via **injured skin**.

A minor scratch, usually on an exposed area of the face or neck or arms, is inoculated by spores from the soil or a contaminated animal. The spores germinate, vegetative cells multiply, and a characteristic **gelatinous edema** develops at the site. This develops into **papule** within 12-36 hours after infection. The papule changes rapidly to a

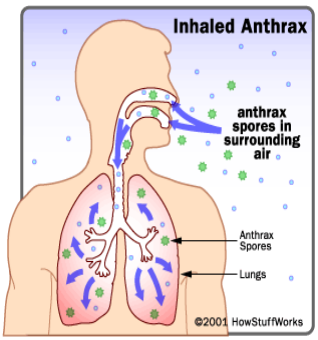
vesicle, then a pustule **(malignant pustule)**, and finally into a **necrotic ulcer** from which infection may disseminate, giving rise to **septicemia**. Lymphatic swelling also occurs within 7 days. In severe cases, where the blood stream is eventually invaded, the disease is frequently fatal.

2- Inhalation anthrax (woolsorter's disease); results from inhalation of spore-containing dust where animal hair or hides are being handled.

The disease begins with high fever and chest pain. It progresses rapidly to a systemic hemorrhagic pathology and is often fatal if treatment cannot stop the invasive aspect of the infection.

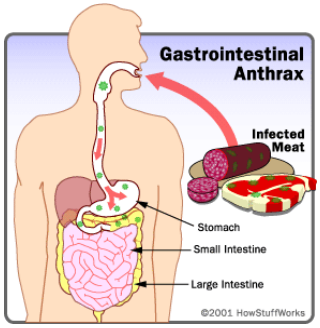
Most contagious

Most severe and high mortality rates



3- Gastrointestinal anthrax; Intestinal anthrax results from the ingestion of poorly cooked meat from infected animals**.**

Similar to cutaneous anthrax but occurs on the intestinal mucosa. The organisms probably invade the mucosa through a preexisting lesion. The bacteria spread from the mucosal lesion to the lymphatic system. **Intestinal anthrax is very rare** but may occur as an outbreaks associated with ingestion of infected animals.



Virulence Factors:

1- **Poly-D-glutamyl Capsule**; antiphagocytic, mediates the invasive stage of the infection

(major virulence factor)

2- production of the multi component **anthrax exotoxin** (Edema factor, Lethal factor, Protective factor.) which mediates the toxigenic stage.

Treatment:

Penicillin, ciprofloxacin

Immunization

Animal…..

live attenuated spores vaccine (sterne strain)

Workers at risk of exposure……

Anthrax vaccine absorbed (AVA) (Alum precipitated toxoid)

B. cereus

- It can be isolated from foods such as grains and spices **(cause fried rice syndrome).**
- **Produces one emetic toxin (ETE) and 3 different enterotoxins:** HBL, Nhe and EntK.
- **Motile**
- **Beta hemolytic**
- **Non capsulated**

- ***B. cereus* causes two types of food-borne illnesses;**

1- Short-incubation" or emetic form

- characterized by **nausea, vomiting and abdominal cramps**.
- It has an incubation period of **(1 to 6 hours).**
- It resembles ***S. aureus* food poisoning** in its symptoms and incubation period.
- It is caused by **heat-stable emetic toxin, ETE**

2- Long-incubation" or diarrheal form;

- manifested primarily by **abdominal cramps and diarrhea**
- incubation period of **(8 to 16 hours)**. Diarrhea may be a small volume or profuse and watery.
- It resembles food poisoning caused by ***Clostridium perfringens***.
- It is mediated by the **heat-labile diarrheagenic enterotoxin Nhe** and/or **hemolytic enterotoxin HBL**

Treatment:
Tetracycline, Erythromycin

Differential Characteristics of *B. anthracis* & *B. cereus*

Characteristic	*B. anthracis*	*B. cereus*
Thiamine requirement for growth	+	-
Hemolysis on blood agar	Non-hemolytic	beta hemolytic
capsule	+ (glutamyl polypeptide)	-
Motile	-	+
Produce enterotoxins	-	+
Gelatin hydrolysis	-	+

Review Questions

- What are virulence factors of *B. anthracis*?
- Compare between two forms of *Bacillus cereus* food poisoning?
- Compare between *B. anthracis* and *B. cereus*?
- What is the types of anthrax (points), what is the most contagious type, rarely type?
- Give an example of zoonotic (occupational) disease, name of the bacteria?