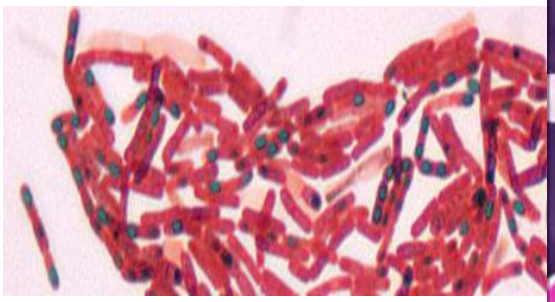
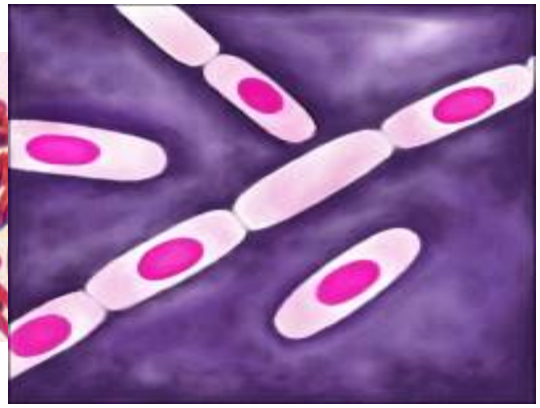
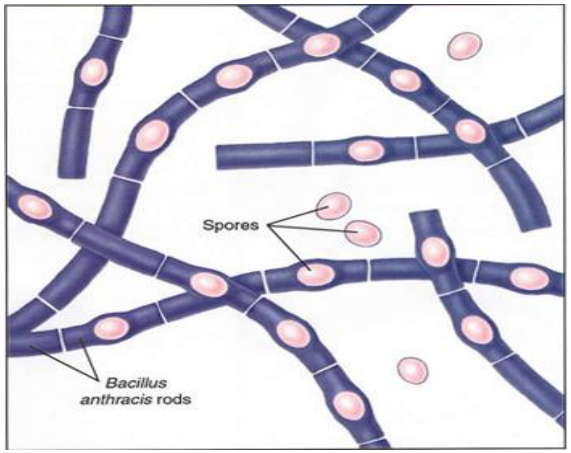
Medical Bacteriology- Lecture: 9

Bacillus





Bacillus anthracis



- very large, Gram-positive, spore forming rod.
- The bacteria can be cultivated in ordinary nutrient medium (nonselective & selective media) under aerobic or anaerobic conditions.
- found in soil habitats around the world

Non haemolytic on blood agar

Mucoid colonies of *Bacillus anthracis*.

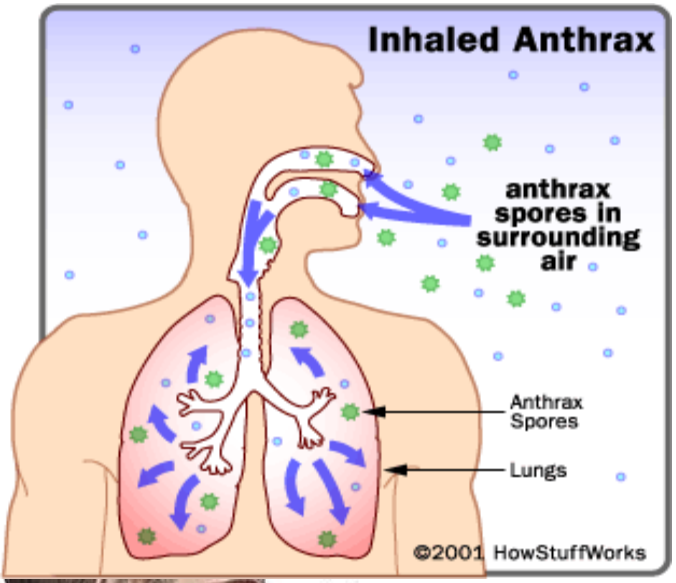
Anthrax

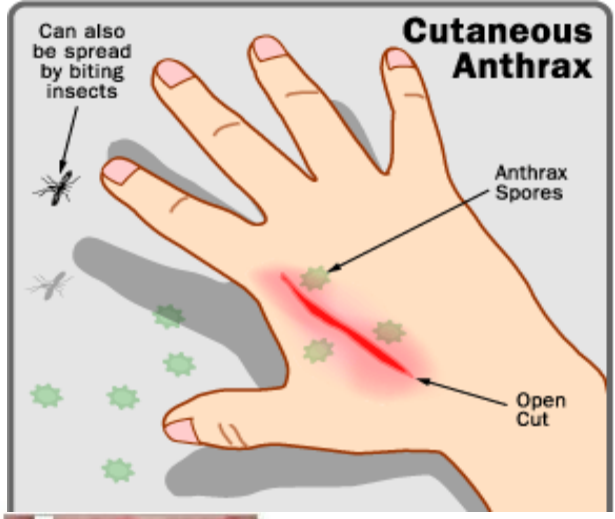
- Anthrax is primarily a disease of domesticated and wild animals, such as cattle, sheep, horses
- Humans become infected after contact with diseased animals, which includes their flesh, bones, hides, hair and excrement.
- The most common form of the disease in humans is **1- cutaneous anthrax:** acquired 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.

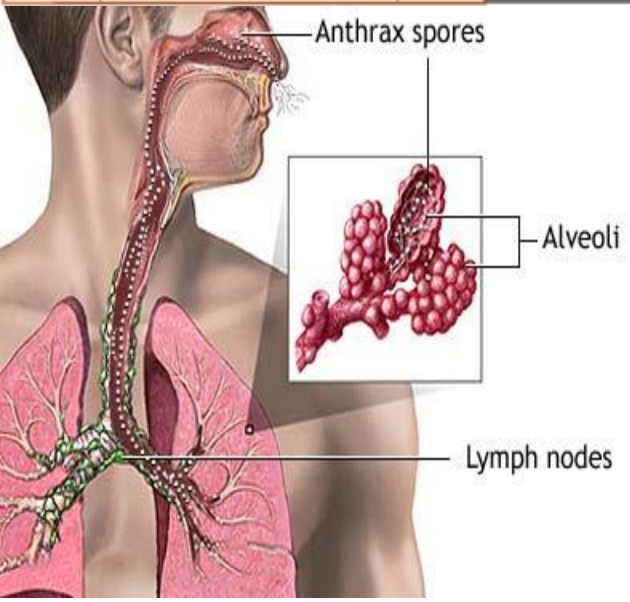
- **2- inhalation anthrax (woolsorters' disease),** results from inhalation of spore-containing dust where animal hair or hides are being handled. The disease begins with high fever and chest pain. It progresses rapidly to a systemic hemorrhagic pathology and is often fatal if treatment cannot stop the invasive aspect of the infection.

- **3- Gastrointestinal anthrax** is analogous to cutaneous anthrax but occurs on the intestinal mucosa. As in cutaneous anthrax, the organisms probably invade the mucosa through a preexisting lesion. The bacteria spread from the mucosal lesion to the lymphatic system. Intestinal anthrax results from the ingestion of poorly cooked meat from infected animals**. Gastrointestinal anthrax is rare** but may occur as an outbreaks associated with ingestion of infected animals. **Intestinal anthrax has an extremely high mortality rate.**

Anthrax Diseases







B. anthracis virulence factors

It has two major determinants of virulence:

- 1- the formation of a **poly-D-glutamyl capsule**, which mediates the invasive stage of the infection.
- 2- the production of the multi component **anthrax toxin** (Edema factor, Lethal factor, Protective factor.) which mediates the toxigenic stage.

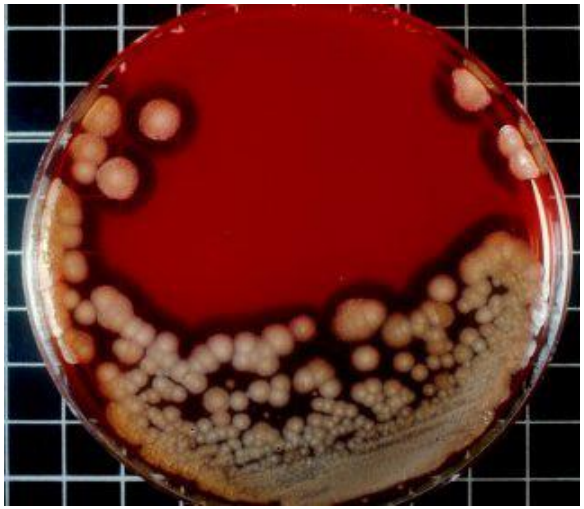
Bacillus cereus Food Poisoning

- Normal inhabitant of the soil, but it can be isolated from foods such as grains and spices **(cause fried rice syndrome).** *B. cereus* produces one emetic toxin (ETE) and 3 different enterotoxins: HBL, Nhe and EntK.

- *B. cereus* causes two types of **food-borne illnesses**.
- **1- short-incubation" or emetic form:** is 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 following an 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**

***Bacillus cereus* gram stain**



***Bacillus cereus* colonies on blood agar (Beta haemolytic)**

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

Characteristic	*B. anthracis*	*B. cereus*
growth requirement for thiamin	+	-
hemolysis on sheep blood agar	-	+ (beta haemolytic)
glutamyl-polypeptide capsule	+	-
Motility	-	+

Review Questions

- What is the virulence factors of *B. anthracis*?
- Compare between two forms of *Bacillus cereus* food boisining?
- Compare between *B. anthraic* & *B. cereus*?
- What is the types of anthrax (points), what is the most contagious type, rarely type?