Assist. Prof. Dr. Aamer .Y. Alchalaby
Medical Microbiology
Second class\ Env. Health
2024-2025

Cram positive spore forming Bacilli

Genus Bacillus:

Most imported species

- *Bacillus anthracis*
- *Bacillus cereus (type species)*
- *Bacillus mycoides*
- *Bacillus megaterium*
- *Bacillus thuringiensis*
- *Bacillus cytotoxicus*

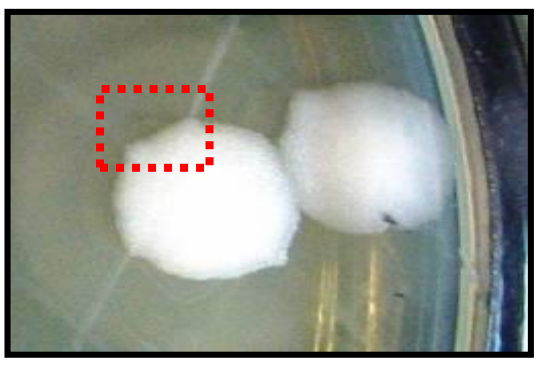
Bacillus anthracis. Is the most important pathogen.

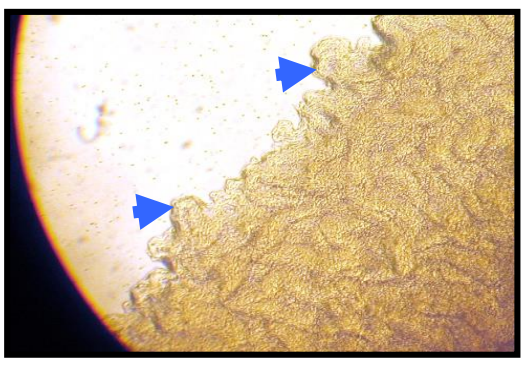
General characters.

1. *Bacillus* spp. are Gram-positive spore-forming bacteria. They are motile, non-capsule formation except *Bacillus anthracis* contains capsule and non- motile.

2. .Most Bacillus species are large, gram positive, Aerobic or facultative anaerobic, endospore-producing rods up to 10 µm in length.

3. Under low magnification, the colony edge appears as curl-like projections which give rise to a (medusa head) appearance.





4. In smears from tissues or cultures, cells occur singly, in pairs or in long chains. The genus is comprised of more than 50 species with diverse characteristic.
5. Bacillus species are catalase- positive and motile except of *Bacillus anthracis* and *B. mycoides*.
6. Most species are saprophytes with no pathogenic potential. they often contaminate clinical specimens and laboratory media. *B. anthracis* is the most important pathogen in the group.
7. Bacillus species are widely distributed in the environment mainly because they produce highly resistant endospores.
8. In soil, endospores of *B. anthracis* can survive for more than 50 years.
9. Some Bacillus species can tolerate extremely adverse conditions such as Desiccation and high temperature.

Pathogenesis and pathogenicity

1. The virulence of *B. anthracis* derives from the presence of a capsule and the ability to produce a complex toxin. Both virulence factors are encoded by plasmids and are required for disease production.
2. The capsule, composed of poly-D-glutamic acid, inhibits phagocytosis.
3. The complex toxin consists of three antigenic components:
   protective antigen, **oedema factor** and **lethal factor.**
   Individually each factor lacks toxic activity in experimental animals, although protective antigen induces antibodies, which confer partial immunity.

Clinical infections

B. anthracis:

(a serious disease usually caused by Bacillus anthracis bacteria. It's found naturally in soil around the world and commonly affects livestock and wild animals. People usually get sick with anthrax if they come in contact with infected animals or contaminated animal products. The incubation period of anthrax ranges from hours to days).

Humans: Three main forms of the disease (Anthrax) occur in man:

1) Skin or Cutaneous anthrax (malignant pustule), is the result of endospores entering abraded skin.
2) Pulmonary anthrax ('wool sorters' disease) follows inhalation of spores.
3) Intestinal forms of anthrax results from ingestion of infective material.

Assist. Prof. Dr. Aamer .Y. Alchalaby
Medical Microbiology
Second class\ Env. Health
2024-2025



Mode of transmission

1. Direct contact: animal tissue or products such as wool or hair (infecting organisms)
2. Trauma or insect bites: organisms or spores
3. Inhalation: spores; woolsorters' disease
4. Ingestion: contaminated meat
5. Injection: contaminated drugs

B. cereus

Causes diseases called Enterotoxaemia, Food poisoning and eye infections

• Differences between B. anthracis and B. cereus

	B. anthracis	*B. cereus*
Motility	Non-motile	motile
Capsule	capsulated	Non-encapsulated
Hemolysis	Non-hemolytic	β-hemolytic
Resistance to Penicillin	S	R (produce β-lactamase)

Assist. Prof. Dr. Aamer .Y. Alchalaby
Medical Microbiology
Second class\ Env. Health
2024-2025

Diagnosis

Identification criteria for isolation:

A- Colonial morphology
B- Microscopic appearance in a Gram- stained smear and spore stain.
C- Absence of growth on MacConkey agar
D- Cultural features and, if necessary, pathogenicity tests in laboratory animals.

E- Biochemical test profile.

Species	Motility	β haemolysis	Penicillin (10 – unit disc)	Gelatin Stab culture
B. anthracis	-	-	Sensitive	Inverted fir tree
B. cereus	+	+	Resistant	Rapid Liquefaction

The Ascoli test: (Serological test).

This is thermoprecipitation test used if viable B.anthracis can no longer be demonstrated in tissues. About 2-3 g of homogenized material in a little saline is briefly boiled and passed through filter paper. This filtrate is used as the antigen in a ring precipitation or gel diffusion test with known *B. anthracis* precipitating antiserum.

F- Immunological test like Agar gel immuno- diffusion test, complement fixation, ELISA and Immunofluorescence tests.

A rapid test, the Red Line Alert Test (Tetracore, Inc., Rockville, Maryland) is a Federal Food and Drug Administration (FDA)-cleared immunochromatographic test that presumptively identifies *B. anthracis* from blood agar within 15 minutes

G- New molecular diagnostic methods like PCR to amplify specific virulence plasmid markers.

Treatment

Administered early in the course of the disease, high doses of Penicillin G or Oxytetracycline may prove effective.