

# Bacillus anthracis

*Bacillus anthracis* is the cause of **anthrax**.

It is gram-positive, aerobic, **sporulating** bacteria. They form spores in the soil, tissue and exudates of dead animals, but not in the blood or tissues of living animals. Spores remain viable in the soil for several decades.

## Epidemiology, transmission and symptoms

Anthrax is and will always be a greater threat to herbivores (cattle, sheep, goats, wild horses).

People get infected through the **skin** (direct contact with an infected animal, industrial production processing rawhide, wool, etc.), **by inhalation** (pulmonary anthrax, *woolsorter's disease*) or by **ingesting the meat** of infected animals.

1. **Skin form** manifests as reddish brown papule, which turns into a pustula (**pustula maligna**) or carbuncle (**carbunculus contagiosus**), later with ulceration and the formation of the black eschar. There is usually a reaction of the nodes and general symptoms.
2. **Pulmonary form** it is caused by the spread of the original skin infection or by inhalation of anthrax bacillus; it has a severe course with pulmonary edema and respiratory failure. The thoracic nodes are affected and the inflammation has a hemorrhagic character.
3. **Gastrointestinal form** is very rare; hemorrhagic necrosis, mesenteric node reaction and sepsis occur in the intestinal wall.

## Pathogenesis

Virulence factors of *B. anthracis* include many exotoxins and the envelope.

**Exotoxins:** Plasmid-encoded thermolabile and heterogeneous protein complex consisting of 3 parts:

- *Edema Factor* (EF)
- *Lethal Factor* (LF)
- *Protective Antigen* (PA)

In vivo, these 3 factors act synergistically. PA binds to eukaryotic cell surface receptors and is progressively cleaved by cellular proteases. The larger C-terminal portion of PA remains bound to the receptor and then binds either EF or LF, which enter the cell by endocytosis. EF acts as an adenylate cyclase. LF activates macrophages and cytokine production, which leads to necrosis, fever, shock and death.

**Envelope:** The capsule is a D-glutamic acid polypeptide that has an anti-phagocytotic effect.

## Diagnosis

For diagnosis we use direct microscopy, cultivation, animal experiment, eventually serology. A professional anamnesis is important.

## Therapy

For the treatment we use antibiotics, megadoses of penicillin, streptomycin or erythromycin. Furthermore corticoids. General care is required. The mild topical form may not always require antibiotics. **Prognosis** of pulmonary and intestinal forms are uncertain, with late treatment can be fatal. Anthrax bacilli are being misused to make **biological weapons**.

## Links

### Related articles

- Repetitorium mikrobiologie

### References

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Monkey spleen tissue with inhaled anthrax in an electron microscope. Yellow *Bacillus anthracis*, red erythrocyte.



Cutaneous form of anthrax.