**Spore-forming bacteria**

Some bacteria are capable of forming spores around themselves. They are Gram-positive and usually rod-shaped. Bacterial spores are made of a tough outer layer of keratin that is resistant to chemicals, staining and heat. The spore allows the bacterium to remain dormant for years, protecting it from various traumas, including temperature differences, the absence of air, water and nutrients. There are two medically-important genera of spore-forming bacteria are: ***Bacillus****,* whose species are aerobic spore formers of soils, and ***Clostridium****,* whose species are anaerobic spore formers of soils, sediments and the intestinal tracts of animals.

***Bacillus***

It is aerobic, G+ non-motile rods arranged in chains, spores are located in the center of the cell. Most members of this genus are saprophytic organisms prevalent in soil, water, and air and on vegetation. . Two species are considered medically significant:

*-B.anthracis*, which causes anthrax

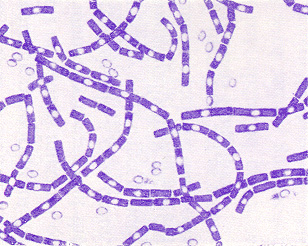
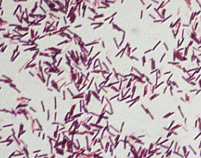
- *B.cereus* which causes food poisoning similar to that caused by *staphylococcus*.

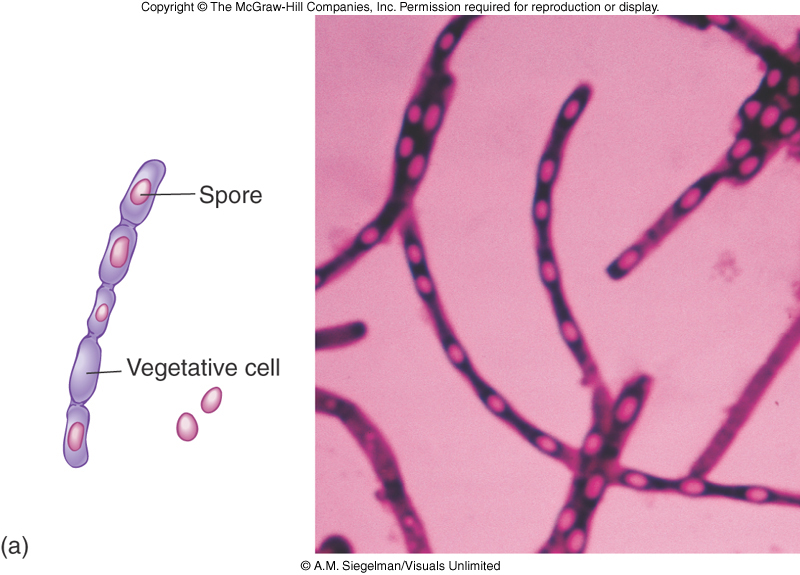
The other species of bacillus are:

*- B.thuringiensis*, is an important insect pathogen, and is sometimes used to control insect,

*- B. subtilis* it is a notable food spoiled and

*- B. Stearothermophilus* used for efficiency testing of an autoclave.

*** ***





**Clinical Manifestations**

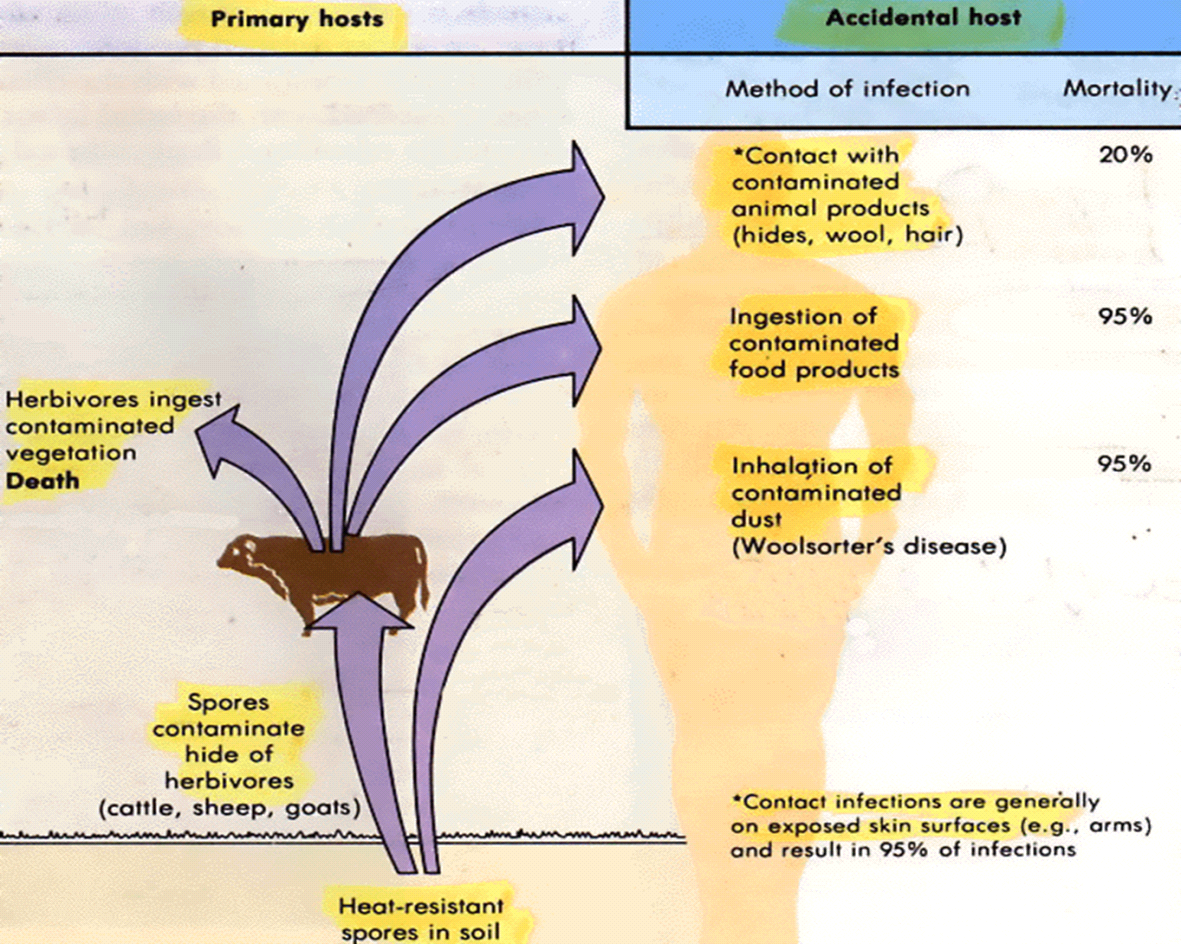
**A- Anthrax**

Anthrax zoonotic disease. Its primarily disease of herbivore, the portal of entry is the mouth and the gastrointestinal tract. Human acquire it as a result of contact with infected cattle and sheep. In human the disease takes one of three forms, depending on the route of infection:

1- Cutaneous anthrax

2-Intestinal anthrax

3-Pulmonary anthrax





**B-Food poisoning *Bacillus***

*B.cereus* can cause two distinct types of food poisoning by producing

either an enterotoxin or an emetic toxin:

1- The diarrheal type is characterized by diarrhea and abdominal pain 8-16 hours after consuming the contaminated food. It is associated with a variety of food, including meat,vegetable, sauces, pastas and diary products.

2- The emetic diseases are characterized by nausea and vomiting begin 1 to 5 hours after contaminated food is eaten. Boiled rice that is held prolonged periods at ambient temperature and then quick-fried before serving is the usual offender, although dairy products or the other foods are occasionally responsible.

**Pathogensis**

A- *B.anthraci*

Pathogencity of *B.anthracis* depended on two virulence factors:

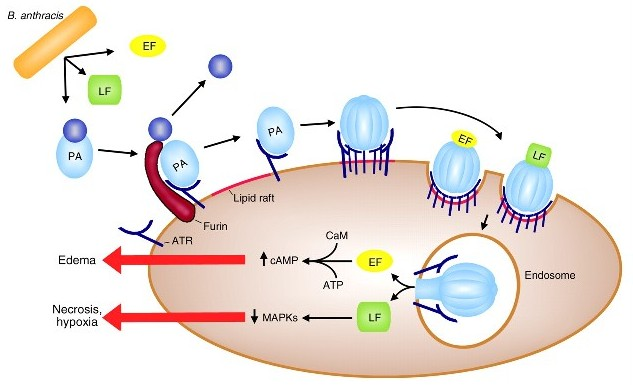
* 1- A glutamic acid polypeptide capsule, which protect its from phagocytosis
* 2-Toxin produced. This toxin consists of three proteins

( Protective antigen (PA)-

Factor(LF) Lethal - L

* Factor(EF) -Edema -

Host protease in the blood and on the eukaryotic cell surface activate protective antigen by cutting off a 20-kDa segment exposing binding site for LF and EF. The activated polypeptide bind to specific receptor on the host cell surface, thereby creating a secondary binding site for which LF and EF complete. The complex (PA +LF or PA+EF) is internalized by endocytosis and, following acidification of the endosome, the LF or EF cross the membrane into the cytosol . This is analogous to the A-B structure function model of cholera toxin . EF, responsible for the characteristic edema of anthrax, is a calmodulin- dependent adenylate cyclase. LF plus PA form lethal toxin, which is a major virulence factor and cause of death in infected animals and humans



B- *B.cereus*

The only other Bacillus species for which virulence factor have been identified is *B.cereus*. A 38 to 46 KDa protein complex has been shown in animals model cause necrosis of the intestinal mucosa to induce fluid accumulation in the intestine, and to be lethal toxin.

*B. cereus* produced also two hemolysins. One of these, cereolysin it is a potent necrotic and lethal toxin. Little is known about the other hemolysin at present. Phospholipases produced by *B. cereus* may act exacerbating factors be degrading host cell membranes following exposure to phospholipid substrate in wounds and other infections.

**Diagnosis**

- Cutaneous anthrax is diagnosed on the basis of the characteristics papule(early) or eschar (later) with extensive surrounding edema, baked by a history of exposure to animals or their products. Diagnosis is confirmed by observation of characteristic encapsulated bacilli in polychrome methylene blue-stained smears of blood, exudate, lymph and cerebro-spinal fluid and/or by culture