Family Bacillaceae

Genus Bacillus

General character:

- ❖ Obligatory aerobic organism
- ❖ Catalase test +ve
- ❖ Usually found in long rods
- ❖ Forming rhizoid colonies
- ❖ All of them produce endospores

Genus bacillus

❖ *Bacillus anthracis* ❖ (Anthrax organism) ❖ Highly pathogenic ❖ For man and host animal ❖ It is non motile	❖ *Bacillus pseudoanthracis* ❖ (*Bacillus anthracoids*) ❖ Most of them are non pathogenic ❖ For man and animal numbers – dust air – soil, members of this group are highly motile with long peritrichous(flagella around microorganism)

B.anthracis

Morphology:

- One of the largest size pathogenic microorganisms
- Blood smears should be taken and stained by polychrome methylene blue (macfadyan's reation)

- The organism appears large size bacilli with truncate end in short chain, capsulated. The organism is stained violet and the capsule stained purple pinkish in colour.

- Spores are never seen in blood or tissue smears taken from infective animals

- Films from culture showing large bacilli either with truncate end in long chain (5-6 bacilli chain) Capsule is absent, spores are present the spores are oval in shape, non bulging and located near the center of the vegetative cell, the microorganism is Gram + ve non motile (which is an important differentiated feature from *Bacillus anthracoid*)

Culture character

- Aerobic and facultative anaerobic grow on all ordinary media, at temp (12-43º C) with optimum temp = 37 º C.

- Colonies on nutrient agar media is very characteristic; the colonies appear rough creamy or grayish white in pigmentation 2-3 mm in diameter with wavy or irregular margins resembling wavy curled locked hair with projection (short projection) resembling what is known as medusa head

- Most of the strains is non hemolytic into blood agar media.

- on 15 % gelatin stabbing culture, *B. anthracis* produced very characteristic type of liquefaction in which lateral line of growth produced from a central one the whole resemble inverted fir tree

Gelatin liquefaction

Maximum liquefaction on the surface than at the bottom

INVERTED FIR TREE APPEARANCE

In broth there is neither turbidity nor pellicle formation but flocular deposit appears in the bottom of broth resembling fluffy cotton wool in appearance.

Biochemical reaction:

- *B. anthracis* produces acid without gases in case of glucose – maltose – sucrose fermentation.
- Catalase test +ve
- Produce weak leathinase activity (nagler's reaction +ve)

Pathogenesis:

Anthrax

In animals: infection usually occurs through the digestive system by ingestion of contaminated spores present in the soil.

In man: infection may occur through wounded skin and disease is called malignant pustules, or by inhalation of dust contaminated with the spores in the hides (skin) or hairs or wool, therefore, the disease is known as wool sorter disease.

The disease is characterized by pulmonary lesion, enlargement of the spleen, also the disease is known as spleenic fever

Laboratory diagnosis:

1. Direct smear from the blood and stained by polychrome methylene blue
2. Culture character and biochemical reaction
3. Animal pathogensity

Suspension from the suspected sample or pure culture of m.o 0,5ml of 24 hrs young broth culture is injected s\c into guinea pig

- death usually occurs within 48hr and many bacilli are seen in blood
- Smears prepared from dead animals.

4. Ascoli's test (thermo precipitin test): Ag –Ab reaction test

This test is used on examined hides or wools or hair on putrefied carcasses, this test depend on the detection of polysaccharide Ag (Ag& Ab reaction) of *Bacillus anthracis* in examined sample :2cm of suspected sample is boiled with 10ml of sterile saline containing few drops of 0.5% acetic acid , boil for about 10min them filter , 0.5ml of filterate is put into a narrow or capillary test then add 0,5ml of antianthrox serum in +ve case ----- white ring or ppt appear at the function of the 2 fluids.

Immunization against anthraces

Active immunity passive immunity

1. Pasteur first vaccine
2. Pasteur second vaccine
3. Spore sterna vaccine

Difference between *B. anthracis and B. anthracoid*

	B. anthracis	*B. anthracoid*
Motility	Non motility	Motility
Capsule	Capsulated	Non capsulated
In nutrient broth	Fluffy Cotton wool without pellicle	Turbidity and pellicle formation but no fluffy Cotton wool
Stabbing in gelatin	Inverted fir tree	No Inverted fir tree
liquefaction Of gelatin	Occurs slowly from up to down	Liquefy gelatin rapidly
Fermentation of salicin	Ferment salicin slowly	Ferment it rapidly
Reduction of methylen blue in milk	Reduced methylen blue slowly	Rapidly reduce methylen blue
Penicillin agar media 10Mg\ml	No growth	Growth occurs rapidly