
Gram Positive Rods (*Bacillus*, *Clostridium*, *Corynebacterium*)

There are four medically important genera of gram-positive rods: *Bacillus*, *Clostridium*, *Corynebacterium*, and *Listeria*. *Bacillus* and *Clostridium* form spores, whereas *Corynebacterium* and *Listeria* do not. Members of the genus *Bacillus* are aerobic, whereas those of the genus *Clostridium* are anaerobic.

Spore Forming Gram Positive Rods

Bacillus

There are two medically important *Bacillus* species: *Bacillus anthracis* and *Bacillus cereus*.

1- B. anthracis

Important Properties

B. anthracis is a large gram-positive rod with, frequently found in chains. In cultures, the bacilli are arranged end to end in long chains. The ends of the bacilli are truncated or often concave and somewhat swollen so that a chain of bacilli presents a '**bamboo**' appearance. Its antiphagocytic capsule is composed of d- glutamate. (This is unique). capsules of other bacteria are polysaccharides.) It is nonmotile, whereas other members of the genus are motile. *Bacillus* are catalase positive.

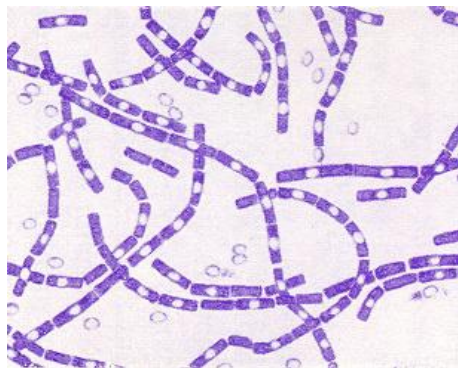
The spore is oval (ellipsoidal), central in position and of the same diameter as the bacillus and not swelling the mother cell. Spores seen as unstained spaces in Gram-stained bacilli

B. anthracis causes anthrax, which is common in animals but rare in humans. Human disease occurs in three main forms:

Cutaneous, Pulmonary (inhalation), and Gastrointestinal.

Diagnosis

Smears show large, gram-positive rods in chains. **Spores** In Gram-stained preparations, the developing spores appear as unstained areas within the cell. With malachite green/safranin (or malachite green/basic fuchsin) staining, the spores are stained green and the vegetative forms are pink.



Cultural Characteristics

1. **Nutrient agar:** On **nutrient agar**, colonies are irregularly round, 2-3 mm in diameter, raised, opaque, grayish white, with a frosted glass appearance. The edge of the colony is composed of long, interlacing chains of bacilli; resembling '**Medusa head appearance**'



2. **Blood agar:** After overnight incubation at 35–37 °C on horse or sheep blood agar (BA), colonies of freshly isolated *B. anthracis* are white, or grey-white and non-hemolytic, 2–4 mm in diameter, again with a slightly moist, matt appearance.



3. **In broth:** Growth develops as silky strands, a surface pellicle floccular deposit.
4. **Selective agars – PLET**

A selective medium (PLET medium), consisting of polymyxin, lysozyme, ethylene diamine tetra acetic acid (EDTA) and thallos acetate added to heart infusion agar, has been devised to isolate *B. anthracis* from mixtures containing other spore-bearing bacilli.

B. Cereus

Bacillus cereus or *B. cereus* is a type of bacteria that produces toxins. These toxins can cause two types of illness:

- (1) one has a short incubation period (4 hours) and consists primarily of nausea and vomiting, similar to staphylococcal food poisoning;
- (2) the other has a long incubation period (18 hours) and features watery, non-bloody diarrhea, resembling clostridial gastroenteritis.

These bacteria are present in foods and can multiply quickly at room temperature.

Characteristics	Properties
Catalase	Positive (+ve)
Gram Staining	Positive (+ve)
Hemolysis	Positive (+ve) (beta)
Motility	Positive (+ve)
Oxidase	Negative (-ve)
Shape	Rod
Spore	Positive (+ve)
Indole	Negative (-ve)
MR (Methyl Red)	Negative (-ve)
VP (Voges Proskauer)	Positive (+ve)
Citrate	Positive (+ve)

On blood agar

B. cereus colonies are dull gray and opaque with a rough matted surface. Colony perimeters are irregular and represent the configuration of swarming from the site of initial inoculation, perhaps due to *B. cereus* swarming motility. Zones of beta-hemolysis surround the colony morphology.

