ENDOSPORES

Endospores: A vegetative bacterial cell produces endospores when nutrients are low, or conditions are crowded, dry, etc. An endospore is a highly durable, dehydrated "resting" cell that is able to wait (indefinitely) until environmental conditions are appropriate for germination and return to the vegetative state.

- Stress stimulates sporulation. Stress might include:
  - Too cold or too hot
  - Overcrowding
  - Lack of nutrients
  - Too dry
- Sporulation involves enclosing the DNA in a very thick protein coat. Essential proteins for "start-up" and ribosomes are also inside the endospore.
- A mature endospore is ejected from the vegetative cell, which kills the vegetative cell.
- The endospore is able to survive extremely inhospitable circumstances indefinitely (possibly centuries!).
- Good conditions stimulates germination of the endospore into a functional vegetative cell.

Clinically important Clostridium endospores resist freezing, drying, boiling. They are able to survive in undercooked meat, or on countertops, etc. They are very difficult to eradicate from hospital settings.

Nitrates in hot dogs, etc. prevent botulism spores from germinating.

Autoclaving (high steam heat) destroys endospores after ~15 min.

1. *Clostridium:* will be discussed on the next page
2. *Bacillus*: Gram positive, facultative anaerobe
   - *Bacillus cereus* –
     - causes food-poisoning because it grows well on rice and other cereal grains.
     - Emetic toxins cause vomiting; enterotoxins cause diarrhea.

If you put a large quantity of food (e.g. rice) in the refrigerator, it will cool very slowly and give *Bacillus cereus* a chance to multiply to populations large enough to cause food poisoning. Refrigerate foods in small amounts to preserve them the longest.

   - *Bacillus anthracis* –
     - Three different forms: cutaneous, inhalation, and GI (depends on where endospores gain entry to the body).
     - Edema toxin upsets water balance
     - "Lethal" toxin destroys macrophages.

1. *B. anthracis* was the first bacterial causative agent to be identified using Koch's Postulates (1880's). 2. *B. anthracis* used to be a big problem for farmers if their cows got it—because of the endospores, the disease could spread rapidly through a herd and wipe a farmer out. 3. In recent years, Anthrax has gained more attention because of its use as a biological warfare agent.