Spores

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MODULE 2

Spore formation

Some bacteria can form spores, which can survive unfavourable conditions such as:

- **High temperature**
- **Dehydration**
- **Disinfectants**

- **Cooking provides a heat shock which may induce germination of spores during cooling**
- **Spores are modified bacteria with a protective layer or "shell"**
- **Can survive for many years**
- **Do not require food or water to survive**
- **Some can survive boiling for up to 5 hours**
- **During canning a core temperature of 121°C for 3 minutes is necessary to reduce the chance of survival of *Clostridium botulinum* spores to 1 in 10^{12} in low-acid foods such as vegetables**
- **When conditions become favourable they germinate**
- **Toxins can be released during sporulation, e.g. *Clostridium perfringens* and *Bacillus cereus* (emetic) and germination in intestine e.g. *Bacillus cereus* (diarrhoeal)**
- **If favourable conditions persist multiplication of vegetative bacteria begins**

Toxins

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Toxin production

- **Toxins are poisonous chemicals produced by certain bacteria as waste**

- **Only a few types of bacteria produce waste poisonous to humans**

- **These are known as pathogens**

Neurotoxins

Affect the nervous system e.g. *Clostridium botulinum*
Examples of symptoms:

- **Blurred and double vision**
- **Nerve paralysis**
- **Collapse**

Exotoxins

- **Produced in food (or in the intestine in case of *Clostridium perfringens*) during multiplication. (see: Microbiological Food Poisoning by Adrian Eley, Chapman and Hall, Page 49)**

- **Many are heat resistant e.g. *Staphylococcus aureus* and *Bacillus cereus*. If cooking destroys bacteria, exotoxins may remain**

- **Usually results in a short incubation period with vomiting**

Endotoxins

- **Usually produced in intestines of person consuming e.g. Salmonella**
- **Toxin forms part of bacterial cell wall**
- **Released on death of bacteria or during sporulation**
- **Usually longer onset period than exotoxins**
- **Diarrhoea normally one of main symptoms**

Enterotoxins

- **Exotoxins which affect gastrointestinal tract**