

# *Clostridium botulinum*

**Compiled By:** Julie A. Albrecht, Ph.D., Associate Professor

## **The Organism:**

*Clostridium botulinum* is an anaerobic, spore forming bacteria that produces a neurotoxin. The bacteria can exist as a vegetative cell or a spore. The spore is the dormant state of the bacteria and can exist under conditions where the vegetative cell cannot. When conditions are right, the spore will grow into the vegetative cell. When the vegetative cells grow to high numbers, this bacteria produces the toxin. The vegetative cells of *Clostridium botulinum* are destroyed by heat but the spore is very resistant to heat. Temperatures well above 100°C (212°F) are needed to destroy the spore. The bacteria and the spore are inhibited from growing in acid environments.

### Sources of the organism:

Soil (types A and B toxins)                      Oceans and lakes (type E toxin)

### Sources of the spore:

Vegetables, Fish, Meat, Poultry

### Associated foods:

Home canned low acid foods                      Honey (infant botulism)  
Baked Potatoes                                      Fried onions  
Garlic in oil mixtures

**Microorganism Characteristics:** Gram positive rod-shaped spore forming anaerobic bacteria that forms a neurotoxin. Seven toxin types are known and designated A,B,C,D,E,F, and G.

### Growth conditions:

Temperature range: 3-48 °C (38-118°F)  
Type A and B: 10-50 °C (50-122 °F)  
Type E: 3-45 °C ((38-113 °F)  
Optimum Temperature for toxin development: 35°C (95°F)  
pH range: 4.6 – 8.9  
Lowest reported  $A_w$  for growth: 0.95

## **The Disease:**

Botulism results from consumption of foods contaminated with the preformed toxin. Toxin types A, B, and E most often are associated with botulism in humans. Type A and B are most often associated with the soil and Type E is associated with water (seafood).

Infant botulism results from the growth and toxin production of *Clostridium botulinum* in the intestinal tract of infants rather than from eating foods containing the preformed toxin.

### Symptoms include:

Double vision                                      Difficulty speaking and swallowing  
Difficulty with breathing                      Paralysis                                      Droopy eyelids

### Onset time:

12-36 hours

### Infective Dose:

Humans are so susceptible to botulism that if very small amounts of the toxin are consumed, they will become ill.

### Duration of symptoms:

Can be fatal.

## **Control:**

- Proper preservation methods for canning low acid foods (vegetables, meat, poultry).
- Acidification of foods below pH 4.6.
- Reduction of water activity to 0.85 or below.
- Avoid the use of honey with infants.
- Do not temperature abuse vacuum packaged food or MAP (modified atmosphere packaged) food.