

Botulism

As a Bioterrorism Agent

Botulism History

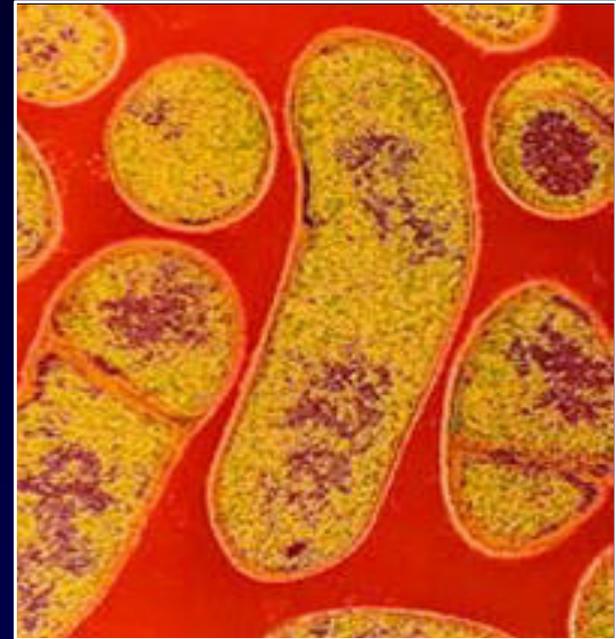
- **Germany (1793) earliest recorded human outbreak**
- **Organism isolated in 1895**
- **Mortality rate of 5-50%; long recovery period**
- **Weaponized by several nations including the U.S., Japan, and Soviet Union, beginning in the 1930's**
- **Iraq (1980's) produced 19,000 L of concentrated botulism toxin**
- **Japan (1990's) Aum Shinrikyo cult**

What Makes Botulism Toxin a Good Weapon?

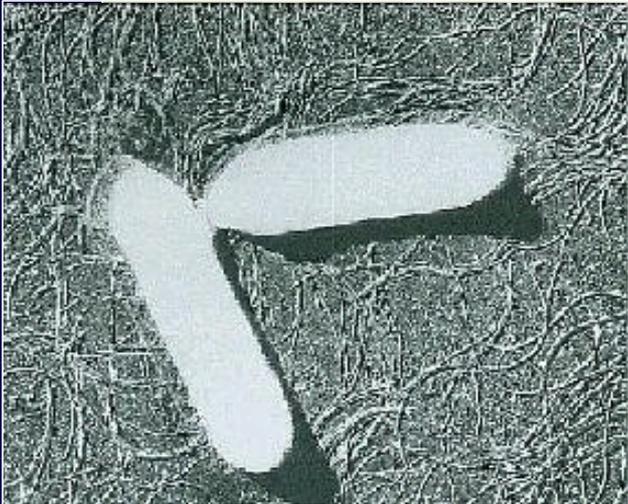
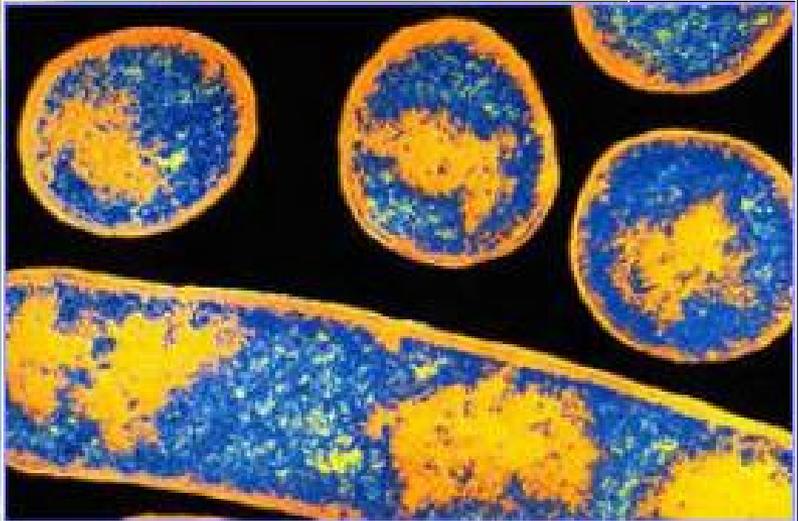
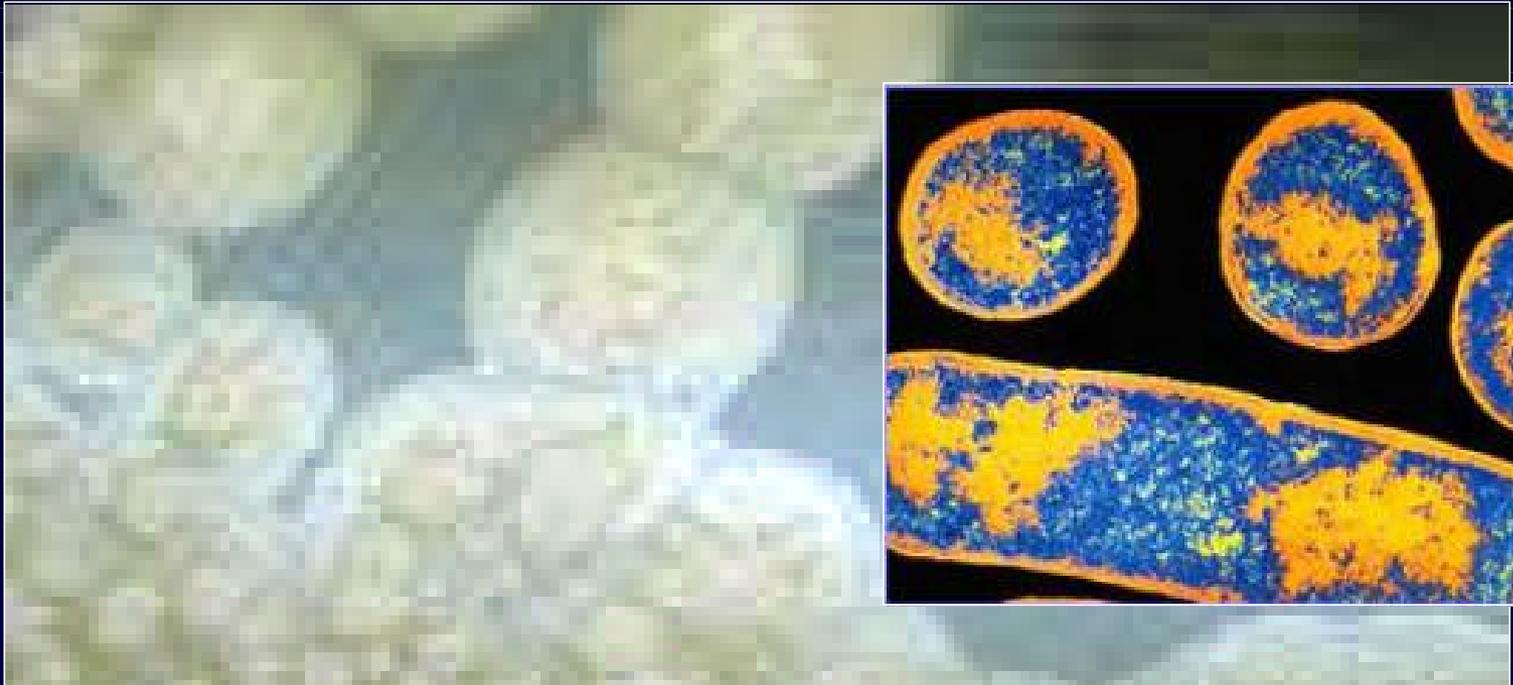
- Botulism toxin is the most poisonous substance known
- High lethality: 1 aerosolized gram could potentially kill 1 million people
- Isolated fairly easily from soil
- Could be released as an aerosol or as a contaminant in the food supply
- Expensive, long-term care needed for recovery

Botulism Microbiology

- Toxin produced by the bacterium *Clostridium botulinum*
- Anaerobic, gram positive, rod-shaped bacteria
- Bacteria are 0.5 to 2.0 μm in width and 1.6 to 22.0 μm in length
- Create spores that can remain dormant for 30 years or more
- Spores extremely resistant to environmental stressors, such as heat and UV light



C. botulinum



Clostridium botulinum

- **7 types of botulism A through G, based on the antigenic properties of the toxin produced**
 - **toxins A, B, E and F cause illness in humans**
 - **toxins C and D cause illness in birds and mammals**
 - **toxin G**

Categories of Botulism

- **Foodborne botulism**
 - caused by eating foods that contain botulism toxin
- **Intestinal botulism (infant and child/adult)**
 - caused by ingesting spores of the bacteria which germinate and produce toxin in the intestines
- **Wound botulism**
 - *C. botulinum* spores germinate in the wound
- **Inhalation botulism**
 - Aerosolized toxin is inhaled
 - does not occur naturally and may be indicative of bioterrorism

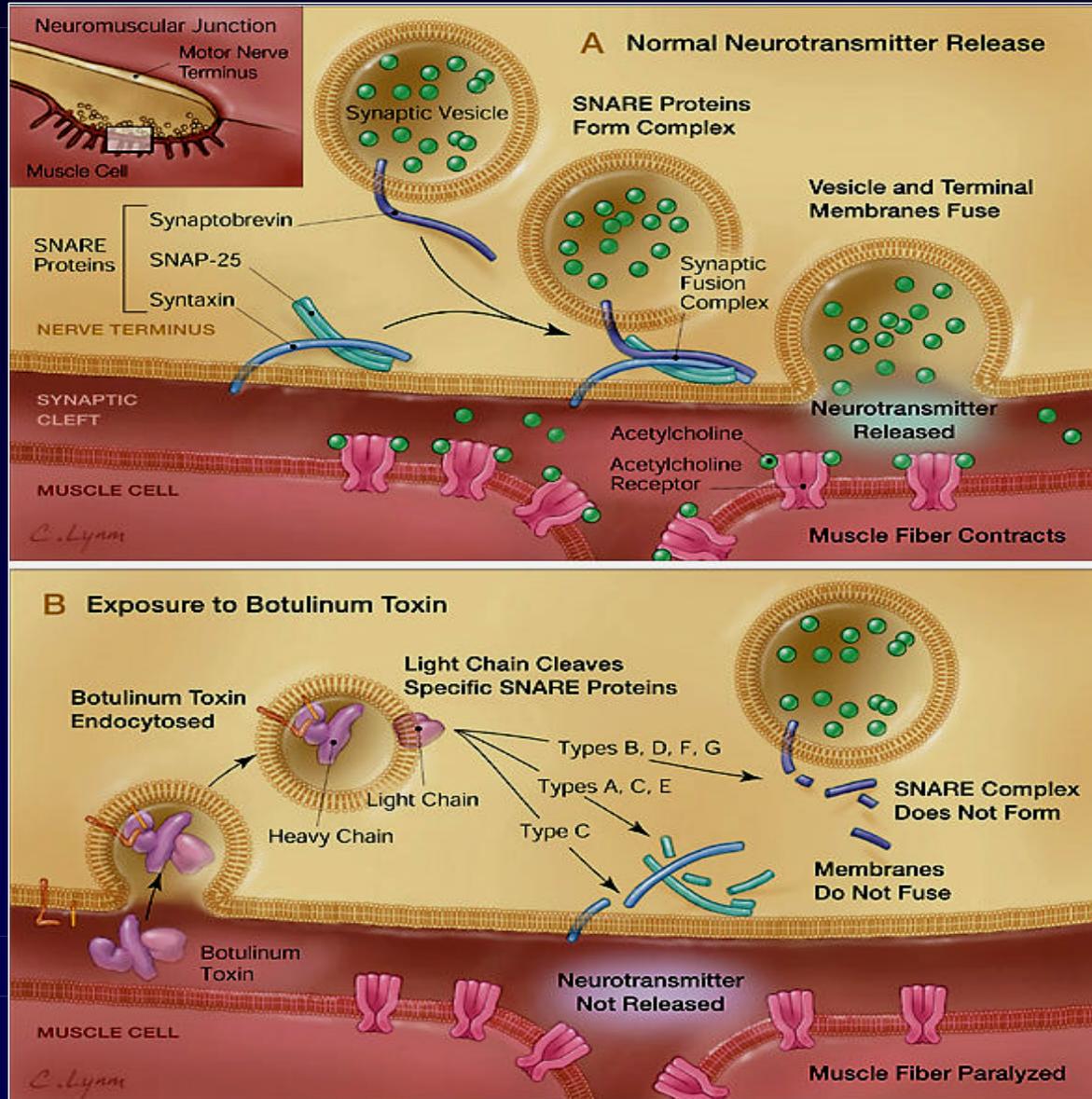
Botulism Pathogenesis

- **Incubation period**
 - **ingestion: unknown**
 - **foodborne: 6 hours-8 days**
 - **wound: 4-14 days**
 - **inhalation: (estimated) 24-36 hours**
- **Toxin enters bloodstream from mucosal surface or wound**
- **Binds to peripheral cholinergic nerve endings**
- **Inhibits release of acetylcholine, preventing muscles from contracting**
- **Symmetrical, descending paralysis occurs beginning with cranial nerves and progressing downward**

Botulism Pathogenesis (cont.)

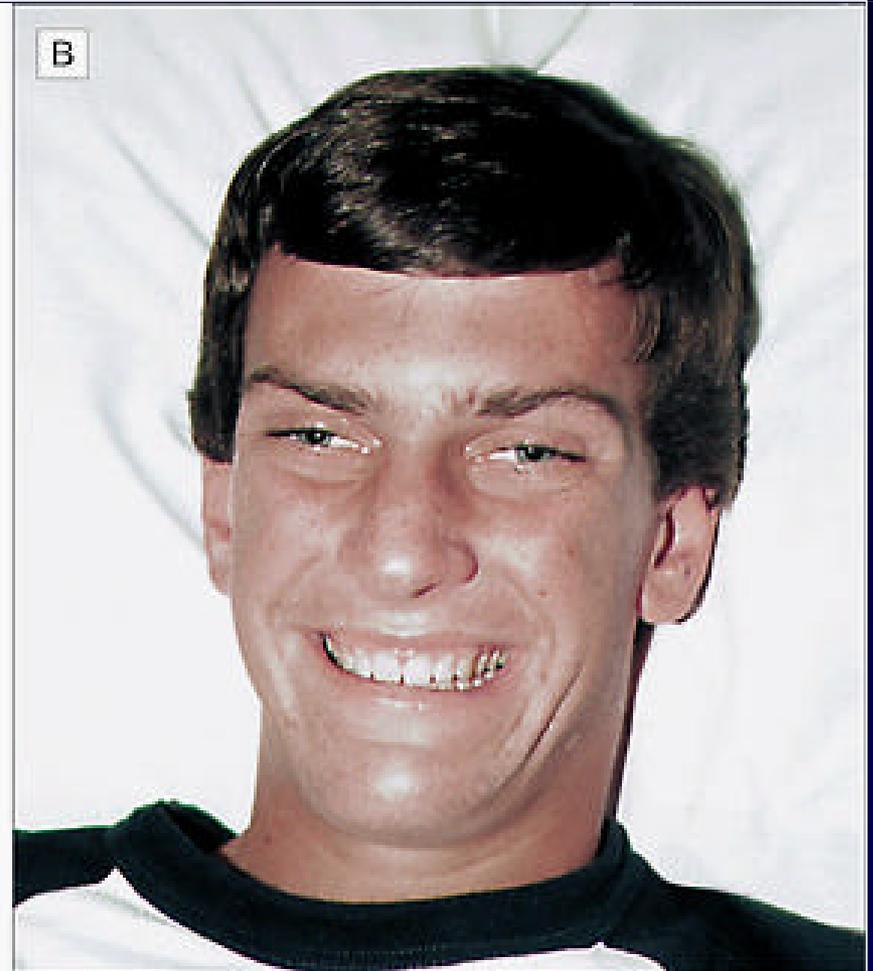
- Can result from airway obstruction or paralysis of respiratory muscles
- Secondary complications related to prolonged ventilatory support and intensive care

Botulism Toxin Mechanism



Botulism Clinical Presentation

- **Classic symptoms of botulism poisoning include:**
 - blurred/double vision
 - muscle weakness
 - drooping eyelids
 - slurred speech
 - difficulty swallowing
 - patient is afebrile and alert
- **Infants with botulism will present with:**
 - weak cry
 - poor feeding
 - constipation
 - poor muscle tone, “floppy” baby syndrome



Possible Case of Botulism

- Call MDH immediately (24/7) at 612-676-5414 or 1-877-676-5414 if a case of botulism is suspected.

Botulism Clinical Treatment

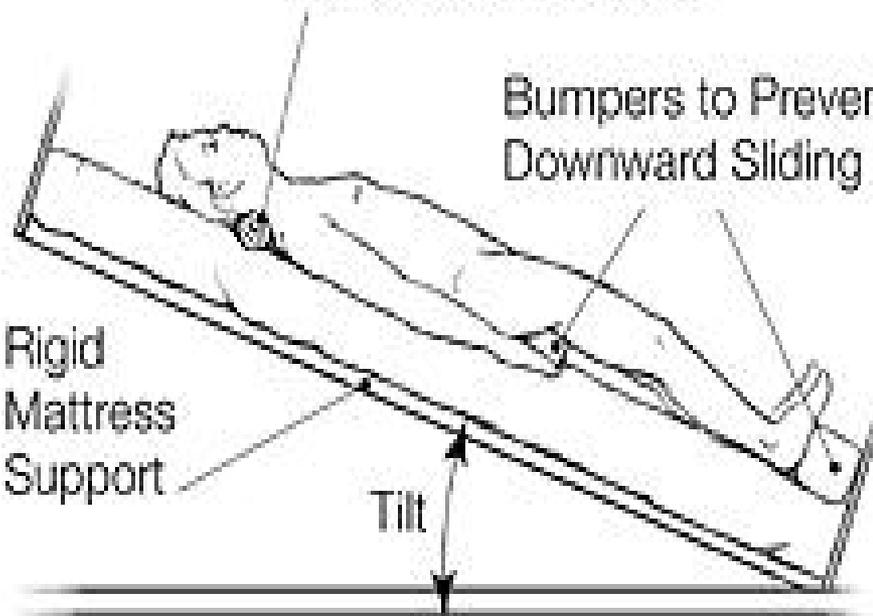
- **Antitoxin administration**
- **Supportive Care**
 - **mechanical ventilation**
 - **body positioning**
 - **parenteral nutrition**
- **Elimination**
 - **Induced vomiting**
 - **High enemas**

Tightly Rolled Cloth
for Cervical Support

Bumpers to Prevent
Downward Sliding

Rigid
Mattress
Support

Tilt



CL

Botulism Transmission

- Home-canned goods (foodborne)
 - particularly low-acid foods such as asparagus, beets, and corn
- Honey (ingestion)
 - can contain *C. botulinum* spores
 - not recommended for infants <12 months old
- Crush injuries, injection drug use (wound)



Botulism Infection Control

- **Botulism cannot be transmitted person-to-person**
- **Standard precautions should be taken when caring for botulism patients**

Botulism Laboratory Procedures

- Toxin neutralization mouse bioassay
 - serum, stool, gastric aspirate, suspect foods
- Isolation of *C. botulinum* or toxin
 - feces, wound, tissue



Botulism Antitoxin

- **Equine antitoxin**
 - **Trivalent and bivalent antitoxins available through the CDC**
 - **Licensed trivalent antitoxin neutralizes type A, B, and E botulism toxins**
 - **Effective in the treatment of foodborne, intestinal, and wound botulism**
 - **Effectiveness for inhalation botulism has not been proven**
 - **Does not reverse current paralysis, but may limit progression and prevent nerve damage if administered early**

Botulism Antitoxin (cont.)

- **Hypersensitivity to equine antitoxin**
 - **9% of people experience some hypersensitivity**

Botulism Differential Diagnoses

- Guillain-Barré syndrome
- Myasthenia gravis
- Stroke
- Tick paralysis
- Lambert-Eaton syndrome
- Psychiatric illness
- Poliomyelitis
- Diabetic Complications
- Drug intoxication
- CNS infection
- Overexertion

Botulism Vaccine

- **A toxoid vaccine (antigen types A, B, C, D, and E) is available for laboratory workers at high risk of exposure**
- **Limited supplies of this vaccine available**

Therapeutic Uses of Botulism Toxin

- **Focal dystonias - involuntary, sustained, or spasmodic patterned muscle activity**
- **Spasticity - velocity-dependent increase in muscle tone**
- **Nondystonic disorders of involuntary muscle activity**
- **Strabismus (disorder of conjugate eye movement) and nystagmus**
- **Disorders of localized muscle spasms and pain**
- **Smooth muscle hyperactive disorders**
- **Cosmetic use**
- **Sweating disorders**