



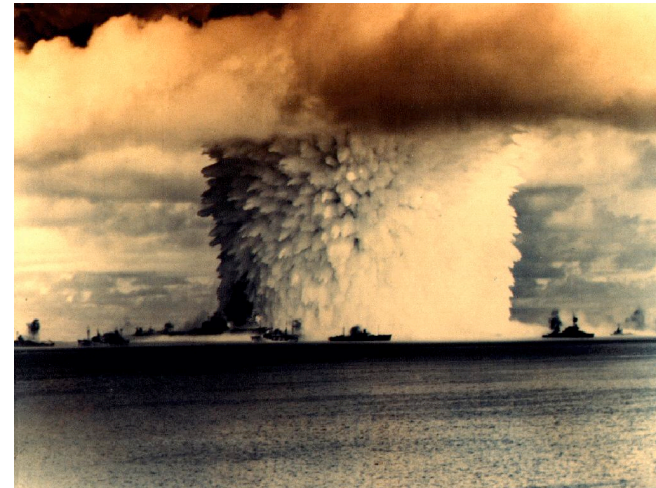
## Weapons

(NBC is not just a broadcast company!)

# Nuclear and Radiological Weapons



## Nuclear Weapons



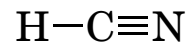
## Radiological Weapons



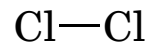
# Chemical Weapons



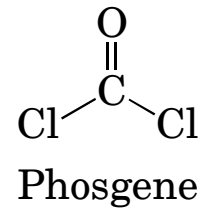
## General Toxins



Hydrogen Cyanide



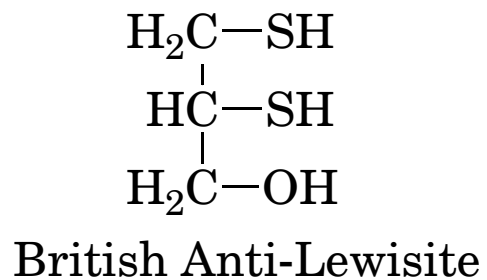
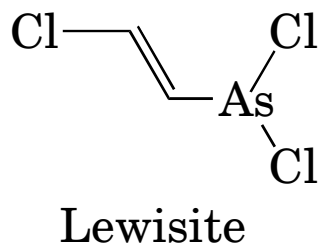
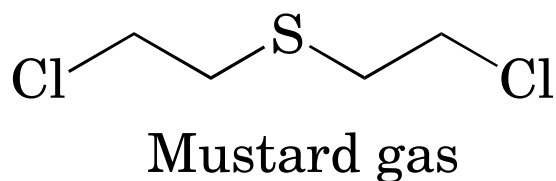
Chlorine



# Chemical Weapons



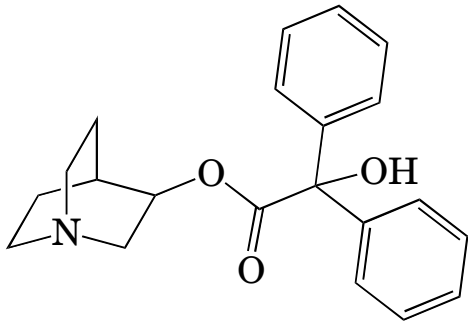
## Blistering Agents



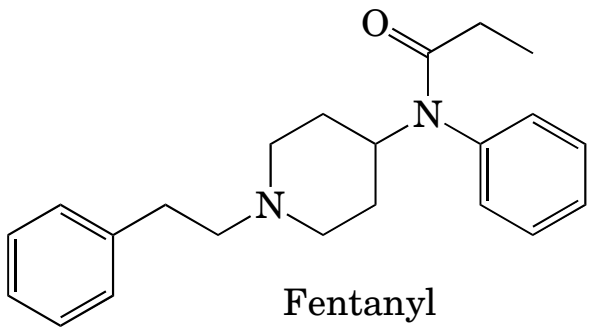
# Chemical Weapons



## Incapacitants



3-Quinuclidinyl  
benzilate (BZ)



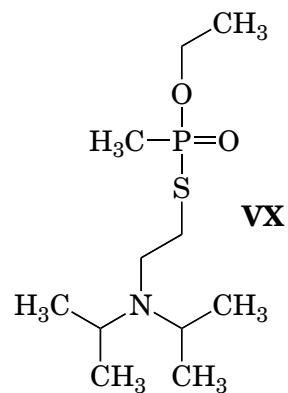
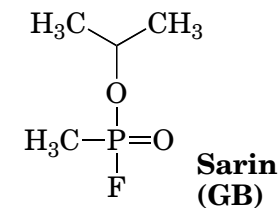
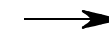
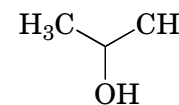
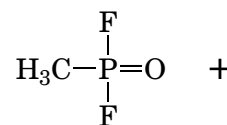
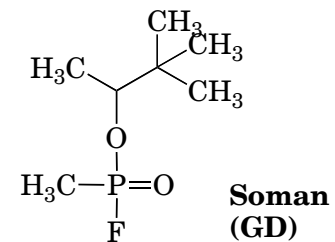
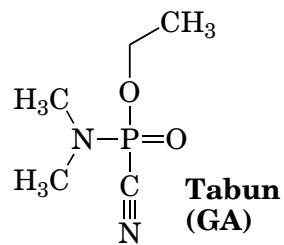
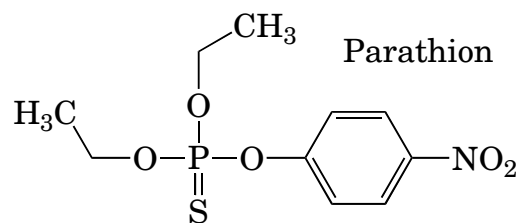
Fentanyl



# Chemical Weapons



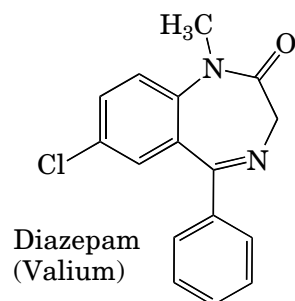
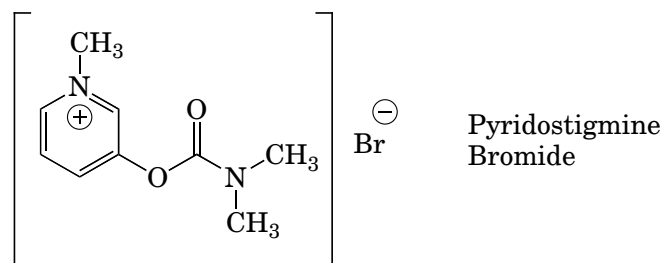
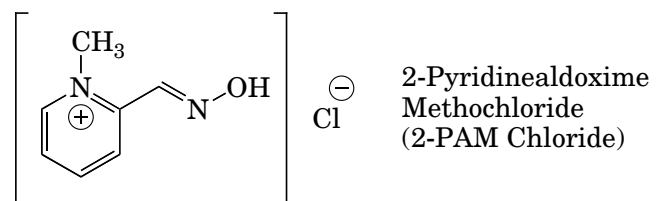
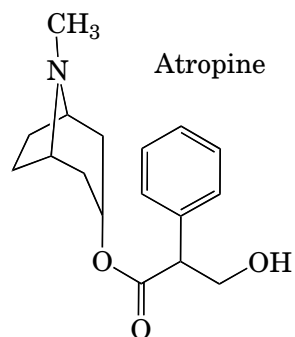
## Nerve Agents



# Chemical Weapons



## Nerve Agents



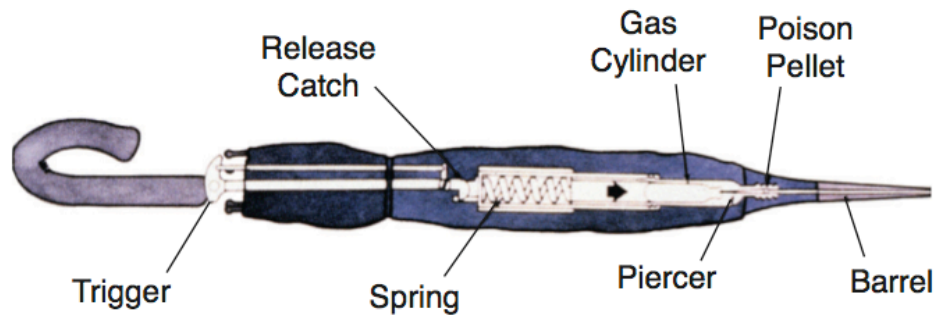
# Biological Weapons



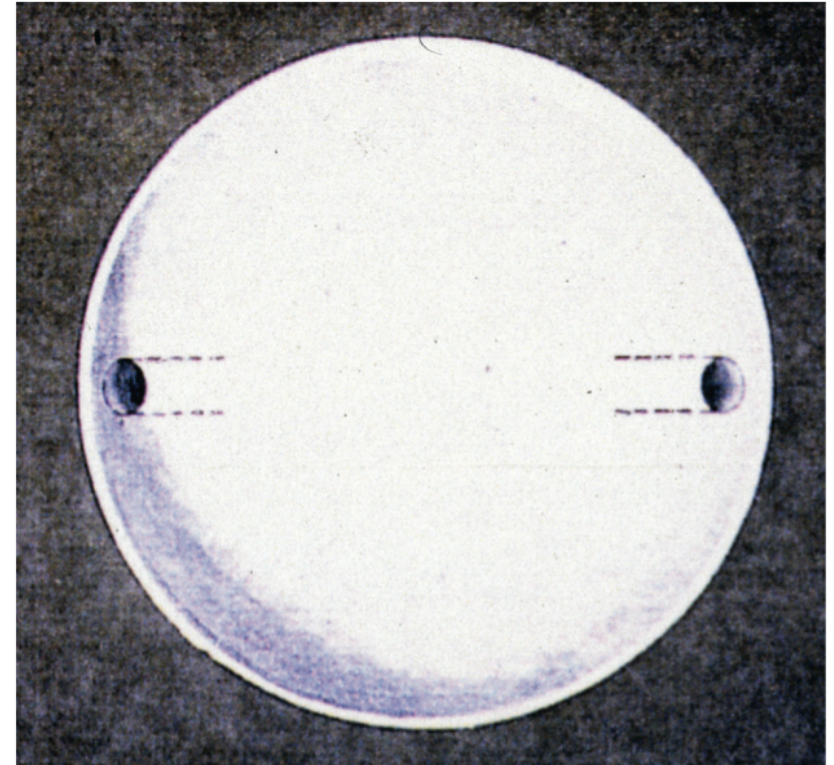
## Potential Toxin Weapons

Toxin	Estimated LD <sub>50</sub> ( $\mu\text{g}/\text{kg}$ of body weight)	Exposure method	Source	Action
Botulinum toxin	0.001	Injection	<i>Clostridium botulinum</i>	Inhibition of acetylcholine release
Botulinum toxin	0.003	Inhalation		
Tetanus toxin	0.002		<i>Clostridium tetani</i>	Interference with nerve transmission
Diphtheria toxin	0.1		<i>Corynebacterium diphtheriae</i>	ADP-ribosylation of eEF-2
Ricin	3.	Inhalation	Castor beans ( <i>Ricinus communis</i> )	23S rRNA inactivation
Ricin	20,000.	Ingestion		
Tetrodotoxin	8.	Ingestion	Tetraodontidae species ( <i>e.g.</i> , puffer fish)	Sodium channel blocker
VX	15.	Inhalation		Acetyl cholinesterase inhibition
Sarin	100.	Inhalation		Acetyl cholinesterase inhibition
NaCN	10,000.	Inhalation		Cytochrome oxidase inhibition

# Umbrella Gun



**Fig. 1-1.** An umbrella gun of this type was the clandestine weapon used to assassinate Bulgarian exile Georgi Markov in London in 1978. The weapon consisted of a spring-loaded piston, which would drive a carbon dioxide cartridge forward into a firing pin. The gas would then propel a poison projectile out of the hollow tip of the umbrella gun, through the clothing, and into the flesh of the intended victim. Reproduced from van Keuren RT. *Chemical and Biological Warfare, An Investigative Guide*. Washington, DC: Office of Enforcement, Strategic Investigations Division, US Customs Service; October 1990: 89.



**Fig. 1-2.** A pellet of this type, designed to contain ricin toxin, was used to assassinate Georgi Markov in London and in the attempt on the life of Vladimir Kostov in Paris. The tiny, platinum-iridium pellet—the size of the head of a pin (0.068 in. diameter)—was cross-drilled with 0.016-in. holes in which ricin (or another toxin) could be placed. Reproduced from van Keuren RT. *Chemical and Biological Warfare, An Investigative Guide*. Washington, DC: Office of Enforcement, Strategic Investigations Division, US Customs Service; October 1990: 90.

From: *Medical Aspects of Biological Warfare*

# Anthrax (*Bacillus anthracis*)



## Anthrax:

Capsule

Anthrax Toxin

Protective Antigen

Lethal Factor

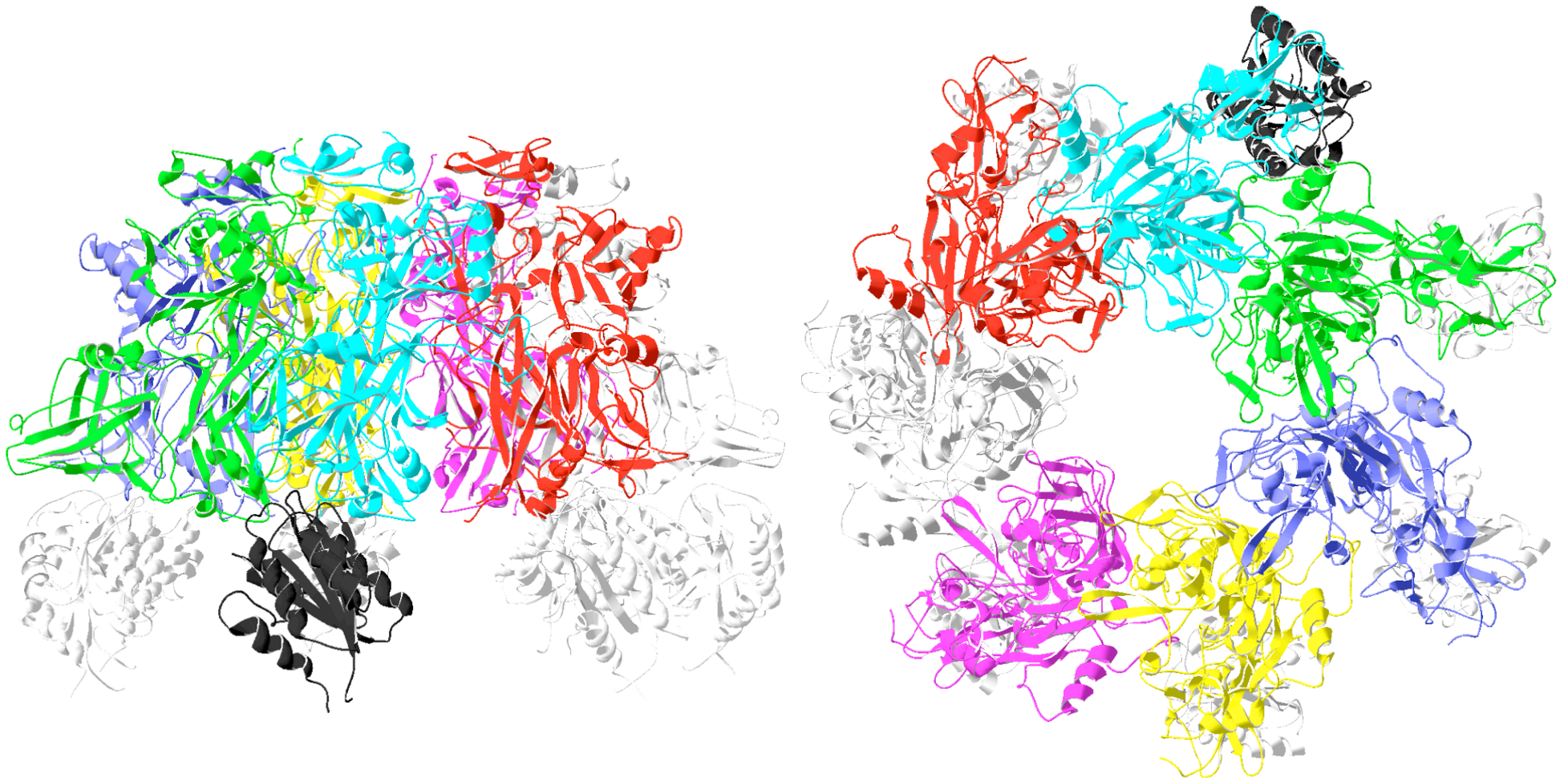
Edema Factor



# Anthrax (*Bacillus anthracis*)



Anthrax Toxin:  
Protective Antigen



# Anthrax (*Bacillus anthracis*)



Anthrax Toxin:  
Lethal Factor



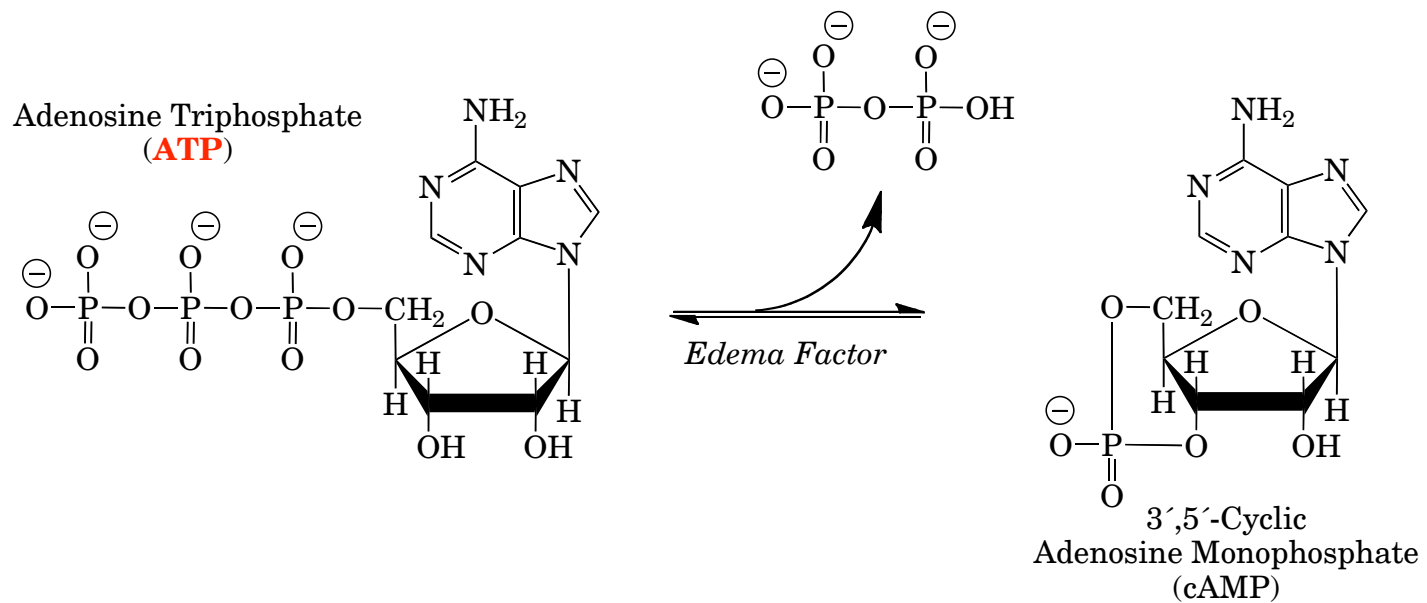
Protective  
Antigen  
Binding

Catalytic  
Domain

# Anthrax (*Bacillus anthracis*)



## Anthrax Toxin: Edema Factor



# Biological Weapons



## Plague (*Yersinia pestis*)



Fig. 5-6. A femoral bubo (a) the most common site of an erythematous, tender, swollen, lymph node in patients with plague. This painful lesion may be aspirated in a sterile fashion to relieve pain and pressure; it should not be incised and drained. The next most common lymph node regions involved are the inguinal, axillary (b), and cervical areas. Bubo location is a function of the region of the body in which an infected flea inoculates the plague bacilli. Photographs: Courtesy of Kenneth L Gage, PhD, Centers for Disease Control and Prevention Laboratory, Fort Collins, Colorado.



Fig. 5-7. Purpuric lesions can be seen on the upper chest of this girl with plague. The bandage on her neck indicates that a bubo has been aspirated. Photograph: Courtesy of Kenneth L Gage, PhD, Centers for Disease Control and Prevention Laboratory, Fort Collins, Colorado.

# Biological Weapons



Smallpox (*Variola virus*)



# Biological Weapons



## Engineering Weapons

### **Do it yourself viruses (Influenza)**

1. Produce cDNA of viral RNA with appropriate transcription initiation and termination signals
2. Construct vectors that express viral proteins
3. Cotransfect cDNA and expression vectors into cell.
4. The supernatant from the culture will contain active viral particles.
5. Increased pathogenicity?

### **Do it yourself viruses (Smallpox)**

1. Start with smallpox
2. Start with monkeypox or other poxvirus, and introduce modifications that result in virulence using homologous recombination.
3. Increased pathogenicity? – IL-4 in mousepox

# Biological Weapons



## Dealing with an Outbreak

### 1. Recognition

- a. What is causing the illness? (Early stages of smallpox are non-specific; later stages are easily confused with chickenpox.)
- b. What strain is involved?
- c. Is the strain modified?

### 2. Response

- a. Vaccination, if possible.
  - i. Ring vaccination
  - ii. Targeted vaccination
  - iii. Mass vaccination
- b. Isolation
- c. Anti-viral drugs