Atropine sulfate & 2-pralidoxime chloride auto-injector - Chempack

Required when distributed (EMR, EMT, AEMT)

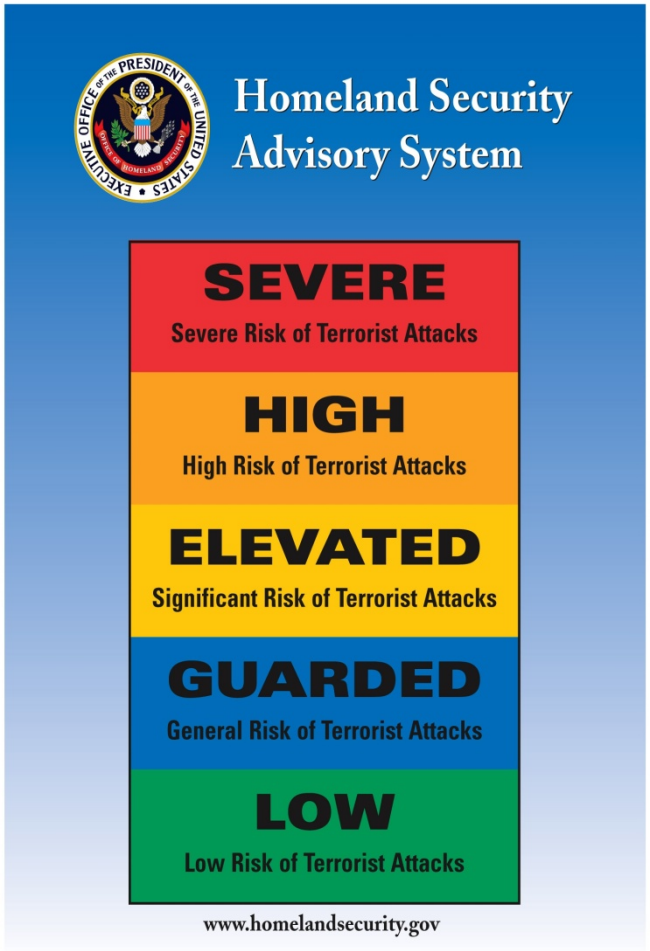
IDAHO
E·M·S

Objectives

- At the completion of this education module, the provider will have:
  - An understanding of scene safety and assuring responder safety.
  - An understanding of the physiological effects of nerve agents.
  - Will demonstrate with 100% accuracy the procedure to auto-injection administration.

Why Now?

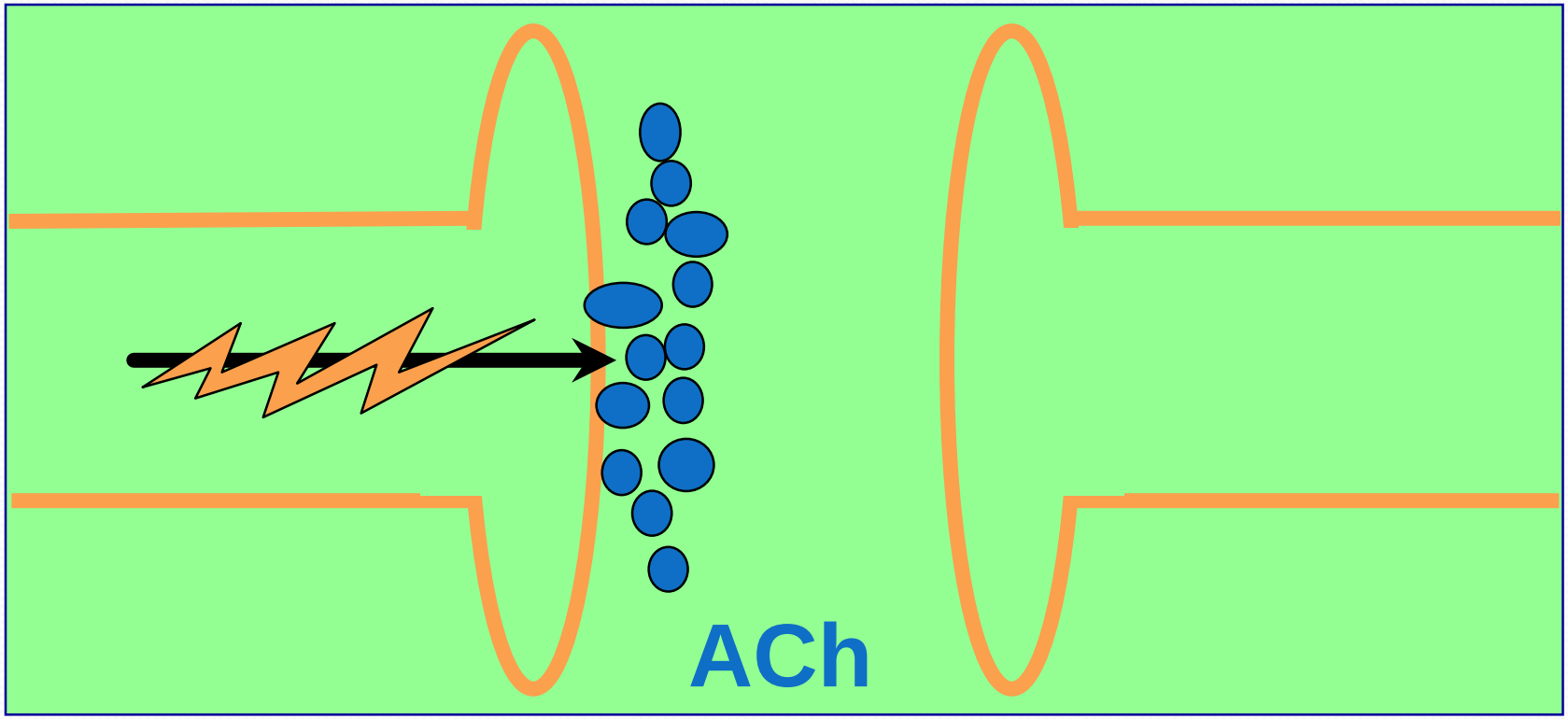
- Increased concern for terrorism
- Available in old munitions in US and elsewhere
- Have been successfully manufactured by other countries
- Very lethal



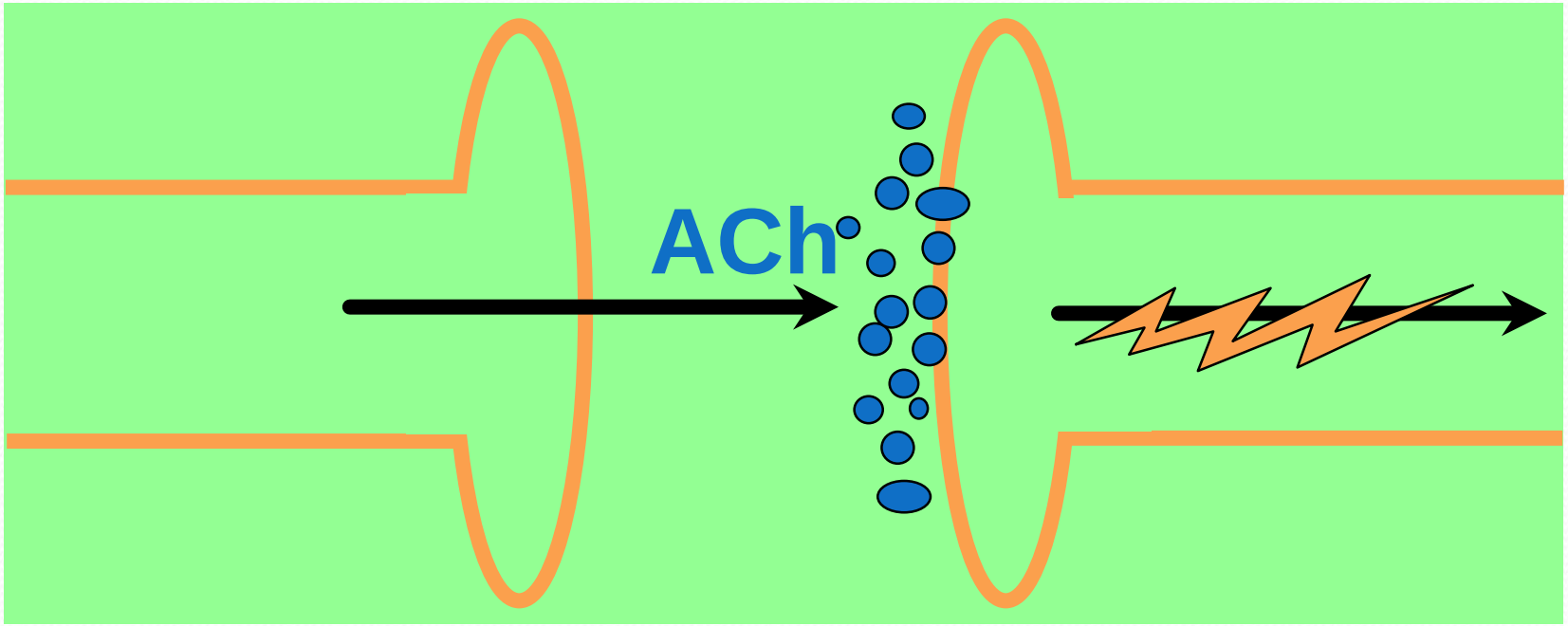
How it works

- Nerve agents block an enzyme called acetylcholinesterase.
- This enzyme is normally responsible for breaking down acetylcholine that has been used as a neurotransmitter to glands and smooth muscle.
- When it is blocked, the acetylcholine remains in the synapse, causing glands to secrete, and muscles to constrict.
- Death is due from lack of oxygen.

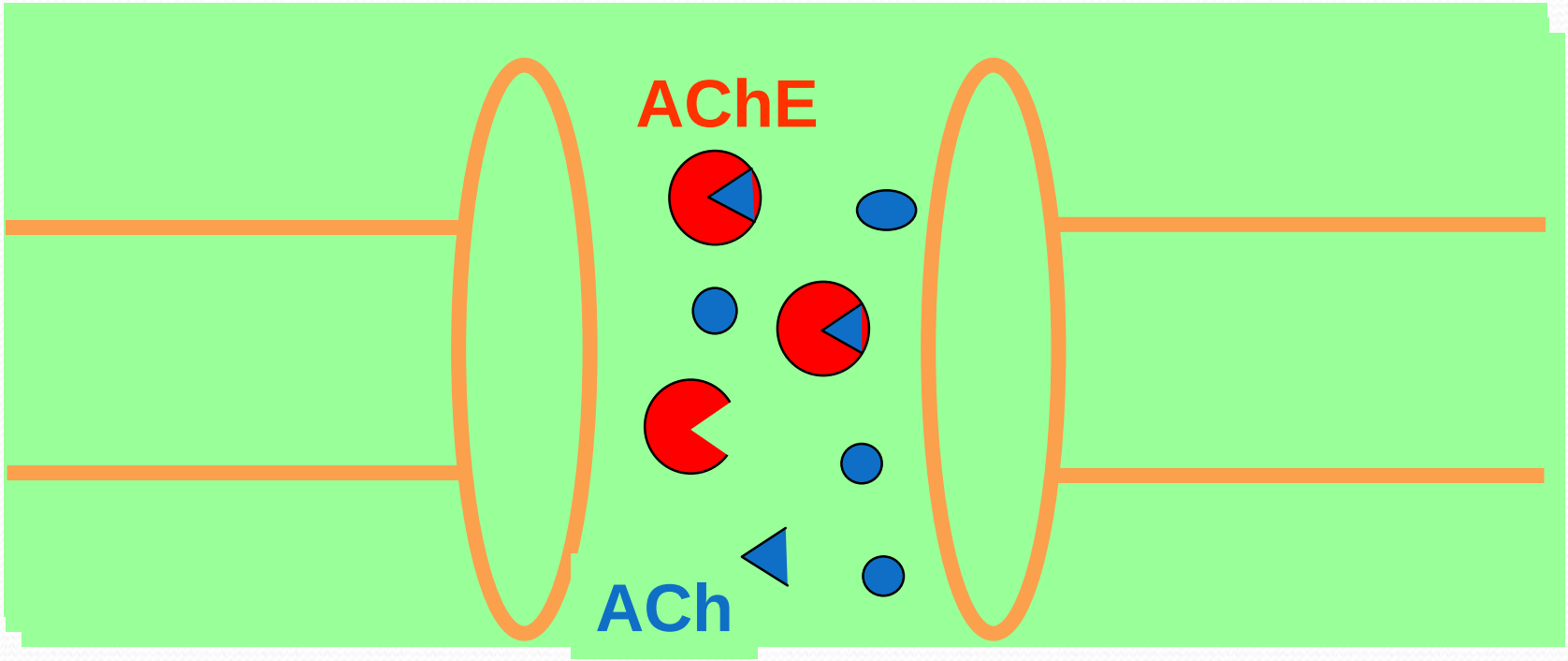
Normal Nerve Function



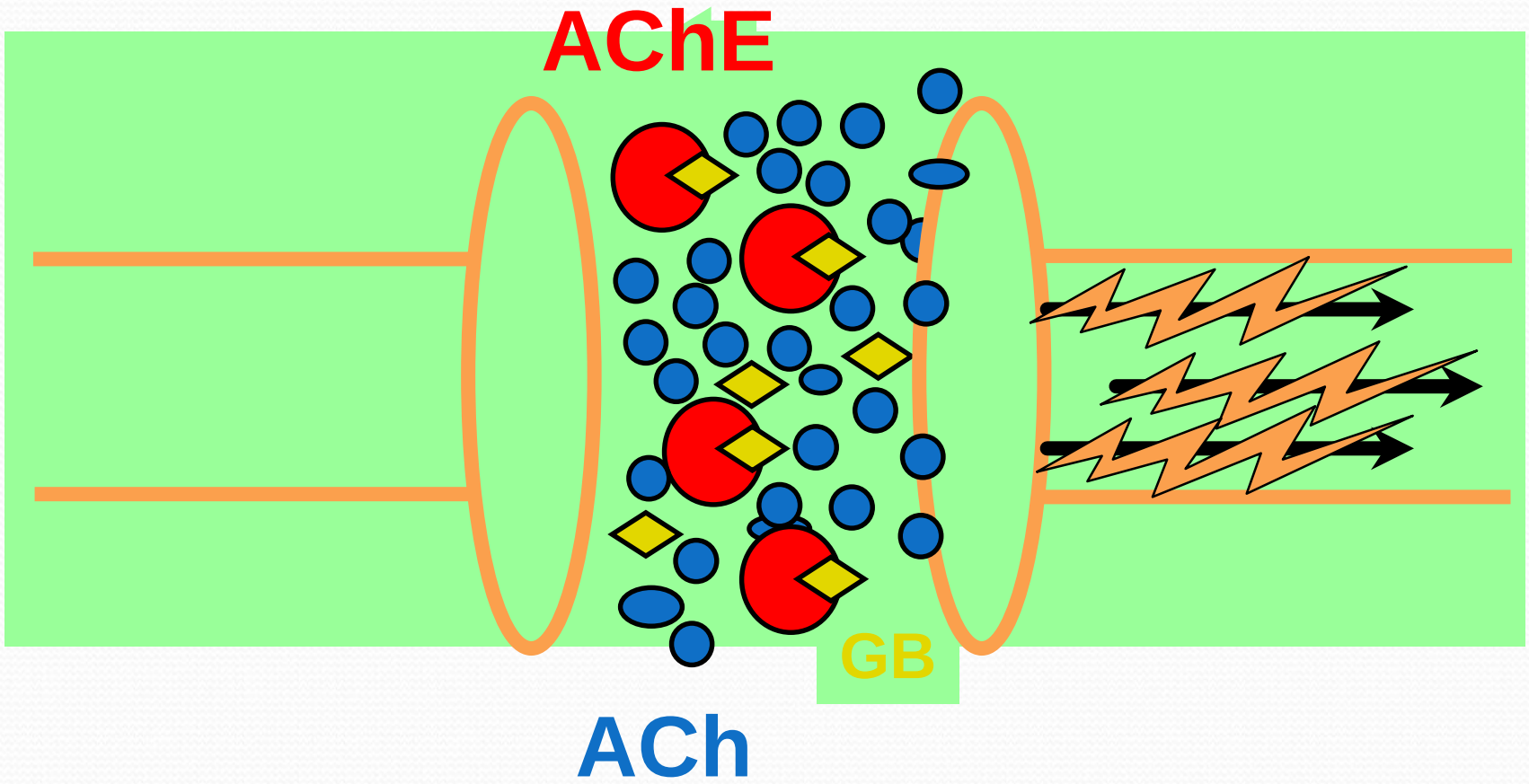
Normal Nerve Function



Normal Nerve Function



How Nerve Agents Work



Effects

- Acetylcholine is a transmitter in two kinds of synapses, meaning nerve agents function in two ways
- Muscarinic Receptors
  - Smooth muscle
  - Glands
- Nicotinic Receptors
  - Skeletal muscles
  - Autonomic ganglion

How it works cont.

- The interruption in communication causes overstimulation of these organs or muscles causing hyperactivity
- Effects are seen in the skeletal muscles and smooth muscles (GI tract)

How it works cont.

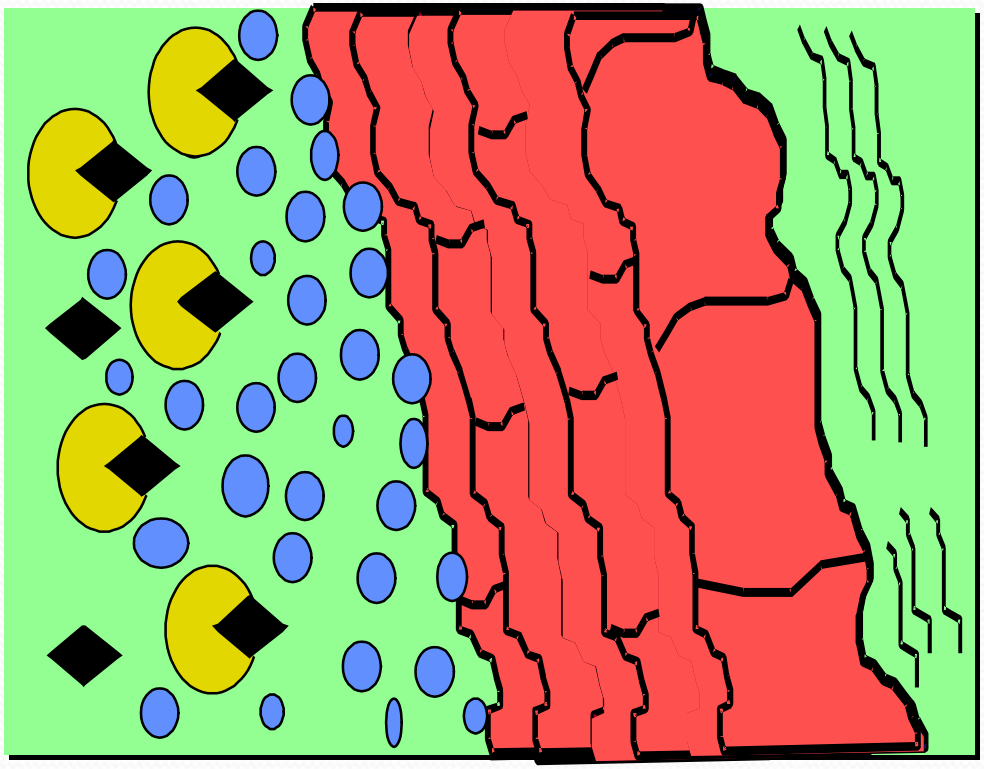
- The glands affected:
  - nose (rhinorrhea)
  - mouth (salivation)
  - eyes (tearing-lacrimation)
  - skin (sweating)

How it works cont.

- If the agent is inhaled, bronchoconstriction occurs
- Sudden loss of consciousness and convulsions may follow

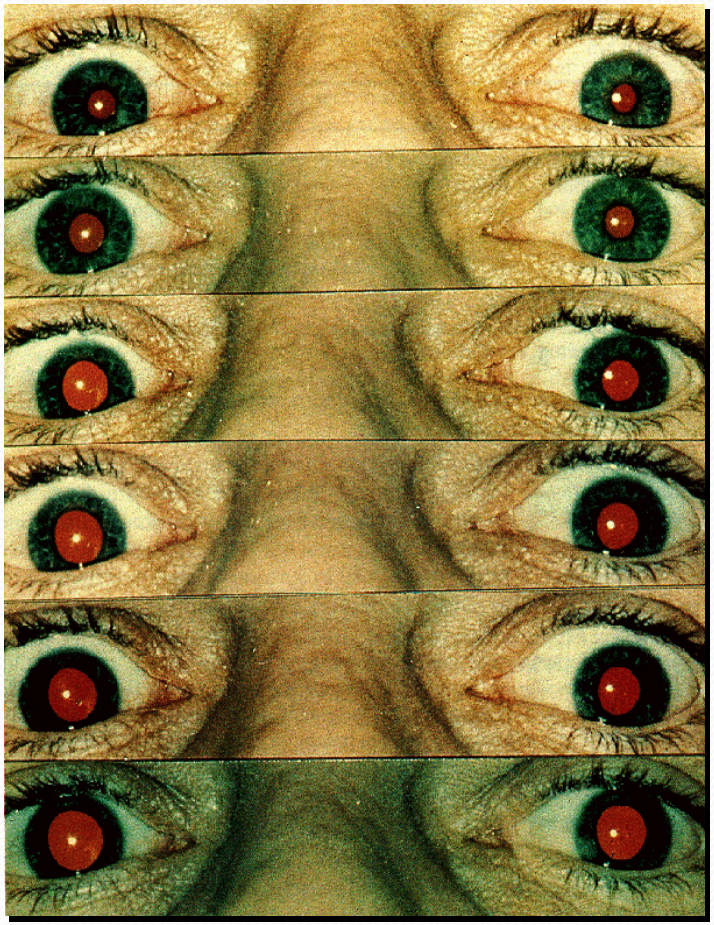
Effects: Nicotinic

- Skeletal muscle
  - Fasiculations
  - Localized twitching
  - Leads to flaccidity
- Ganglion
  - Tachycardia
  - Hypertension



Effects: Muscarinic

- Smooth muscle contraction
  - Eyes: miosis-constriction
  - Airway: SOB
    - Severe bronchoconstriction
  - GI: vomiting & diarrhea
- Secretions
  - Saliva, Tears
  - Runny nose (rhinorrhea)
  - Bronchorrhea
  - Sweating



Overall Effects

- Heart Rate: tachy or brady
- Can get arrhythmias
- Central Nervous System
  - Acute
    - Loss of consciousness
    - Seizures
    - Apnea

Remember SLUDGEM

- Salivation
- Lacrimation
- Urination
- Defecation
- Gastric upset
- Emesis
- Miosis (pupil constriction), muscle twitching

Symptoms[4,5]

Mild

- Blurred vision, miosis (excessive constriction of the pupils)
- Excessive, unexplained teary eyes
- Excessive, unexplained runny nose
- Increased salivation, such as sudden drooling

Moderate

- Chest tightness or difficulty breathing
- Tremors throughout the body or muscular twitching
- Nausea and/or vomiting
- Unexplained wheezing, coughing, or increased airway secretions
- Acute onset of stomach cramps
- Tachycardia or bradycardia (abnormally fast or slow heartbeat)

Severe Symptoms[4,5]

- Strange or confused behavior
- Severe difficulty breathing or copious secretions from lungs/airway
- Severe muscular twitching and general weakness
- Involuntary urination and defecation
- Convulsions
- Loss of consciousness
- Respiratory arrest (possibly leading to death)

Atropine only treats Muscarinic Effects.

No amount of atropine will stop seizures.

Treatment endpoint is airway improvement with decreased salivation and rhinorrhea

Signs and Symptoms of Vapor Exposure

- Mild exposure
  - Miosis (dim vision, eye pain), rhinorrhea, slight dyspnea
- Moderate exposure
  - Pronounced dyspnea, nausea, vomiting, diarrhea, weakness
- Severe exposure
  - Immediate loss of consciousness, seizures, apnea, and flaccid paralysis
- Vapor effects occur within seconds, peak within minutes; no late onset

Signs and Symptoms of Liquid Exposure

- Mild exposure (up to 18 hours)
  - Localized sweating
  - Fasciculations
  - No miosis
- Moderate exposure (to 18 hours)
  - Gastrointestinal effects
  - Miosis uncommon
- Severe exposure (<30 minutes)
  - Sudden loss of consciousness
  - Seizures, apnea
  - Flaccid paralysis
  - Death

Nerve Agents are highly lethal.

No treatment should be undertaken unless proper PPE is worn, or the patient is decontaminated.

Types of Nerve Agents

- Sarin (GB)
- Soman (GD)
- Tabun (GA)
- V agent (VX)

Physical Properties

- Gas vs. liquid
- 4-6x denser than air
- soluble in water
- G agents disperse within several hours
- VX will persist for weeks
- VX>GD>GB>GA lethality

Persistency

- Term used to describe how long the agent will stay on a surface before it evaporates
- Persistent agents remain on a surface usually longer than 24 hours.

Volatility

- the ease with which a chemical changes from a liquid to a gas; the tendency of a chemical agent to evaporate.

Name	Code Name	Odor	Features	Onset of Symptoms	Volatility	Route of Exposure
Tabun	GA	Fruity	Easy to manufacture	Immediate	Low	Contact; vapor
Sarin	GB	None	Will off-gas while on victim's clothing	Immediate	High	Primarily resp vapor hazard; extremely lethal if skin contact
Soman	GD	Fruity	Ages rapidly, making it difficult to treat	Immediate	Moderate	Contact with skin; minimal vapor hazard
V agent	VX	None	Most lethal chemical agent; difficulty to decon	Immediate	Very Low	Contact with skin; no vapor hazard

Transporting Contaminated Patients

- EMS personnel must be wearing PPE.
- If necessary, different triage categories of contaminated patients may be transported together.
- Helicopters do not transport contaminated patients.
- Once an ambulance has been used to move contaminated patients, it may only be used for contaminated patients until decontamination is verified.

Nerve agents form a vapor, and may be present downwind from a release site.

- Request specific staging information.
- Maintain safe location upwind and uphill.
- Pay strict attention to hot, warm and cold zones.
- Activate ICS.

Triage

- Immediate: 2 or more body systems involved- airway, convulsing, decreased consciousness, no spontaneous respirations
- Delayed: no immediate life threat, patient without symptoms OR has been given >4mg Atropine and is recovering… observe at least 18 hours
- Minimal: walking and talking, may only have dim vision, pinpoint pupils… observe 18 hours
- Expectant: inadequate resources, complete arrest

Treatment

- Airway support
- Antidotes
  - Atropine
  - 2-PamChloride
  - (pralidoxime Chloride)
  - Diazepam (valium)

- DuoDote™
  - Has one auto-injector
  - 2mg Atropine and
  - 600mg 2-PamCl

Atropine

- Works on muscarinic effects
- Dose until airway sx resolve, and secretions are drying
- Do not rely on heart rate or pupil size

Pralidoxime (2PAM)

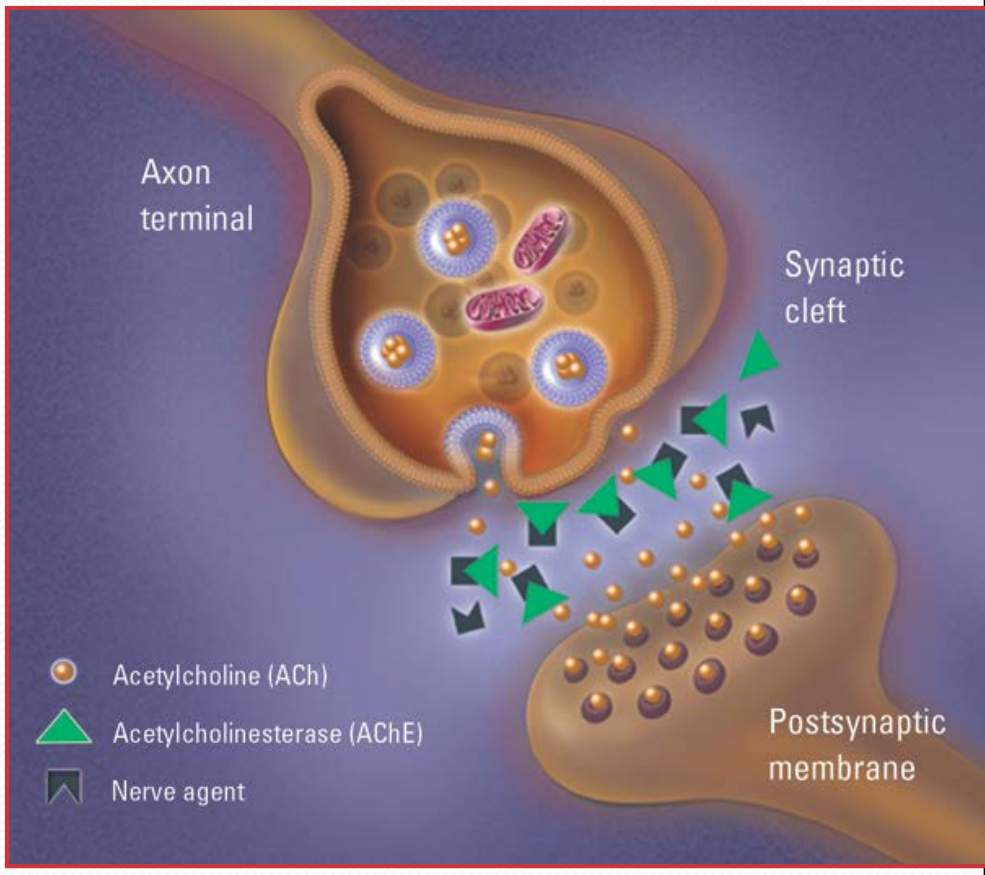
- Works like a "crowbar" by removing nerve agent from acetylcholinesterase
- More effective if given early, as some of the nerve agents bond "ages" to permanent in under 2 minutes

What is DuoDote™?

- Developed by Meridian Medical Technologies as a streamlined, easy-to-use replacement for the Mark I Kit
- FDA-approved for emergency medical services (EMS) use in the treatment of organophosphorus nerve agent and organophosphorus insecticide poisoning
- Contains 2 antidotes in 1 auto-injector:
  - 2.1 mg of atropine in a 0.7-mL solution
  - 600 mg of pralidoxime chloride in a 2-mL solution
- Features next-generation BinaJect™ delivery technology
  - 2 antidotes delivered sequentially into separate areas of the muscle
  - Easy to use: only 1 injection with 1 needle

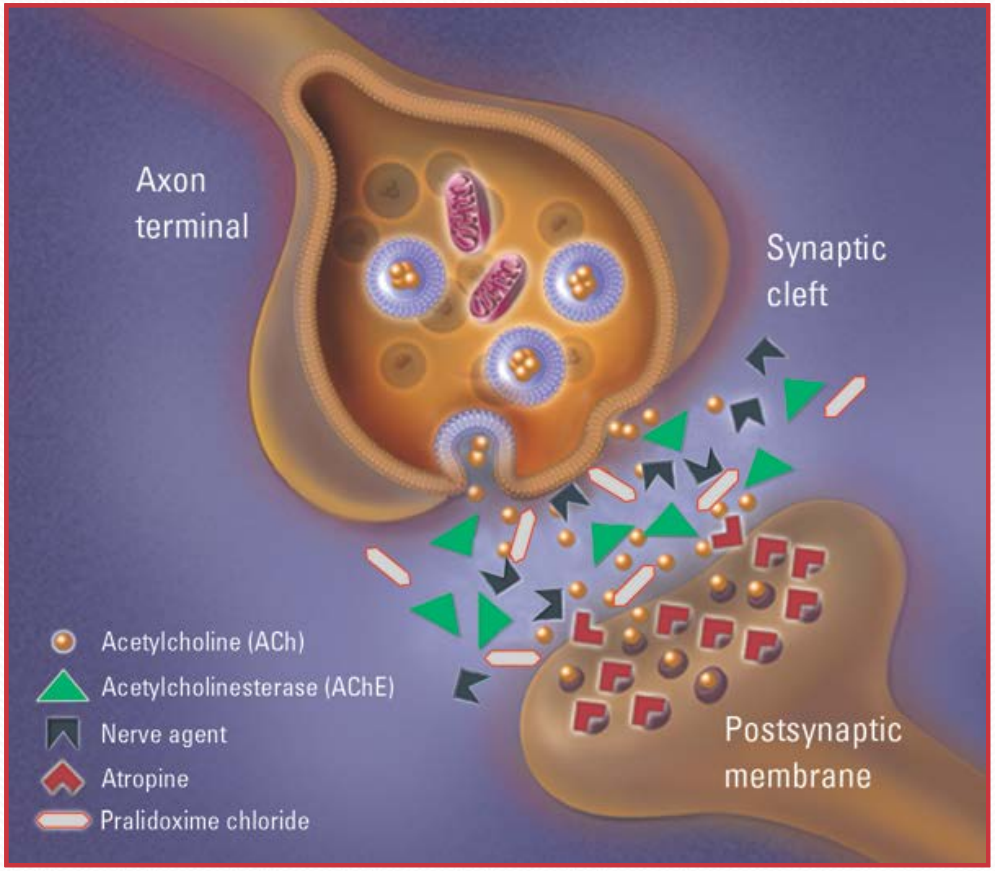
Where Does DuoDote Work?

- Effects of organophosphorus poisoning:
  - Chemical nerve agents and organophosphorus insecticides cause an excess buildup of acetylcholine (ACh), a neurotransmitter
  - This buildup occurs when the activity of an enzyme called acetylcholinesterase (AChE) is blocked by the nerve agent[4]
  - Blocking AChE results in overstimulation of cholinergic nervous pathways
  - There are 2 types of ACh receptors: muscarinic receptors affect breathing and gastrointestinal functions, while nicotinic receptors affect vascular function and muscle movement[4]



How Does DuoDote Work?

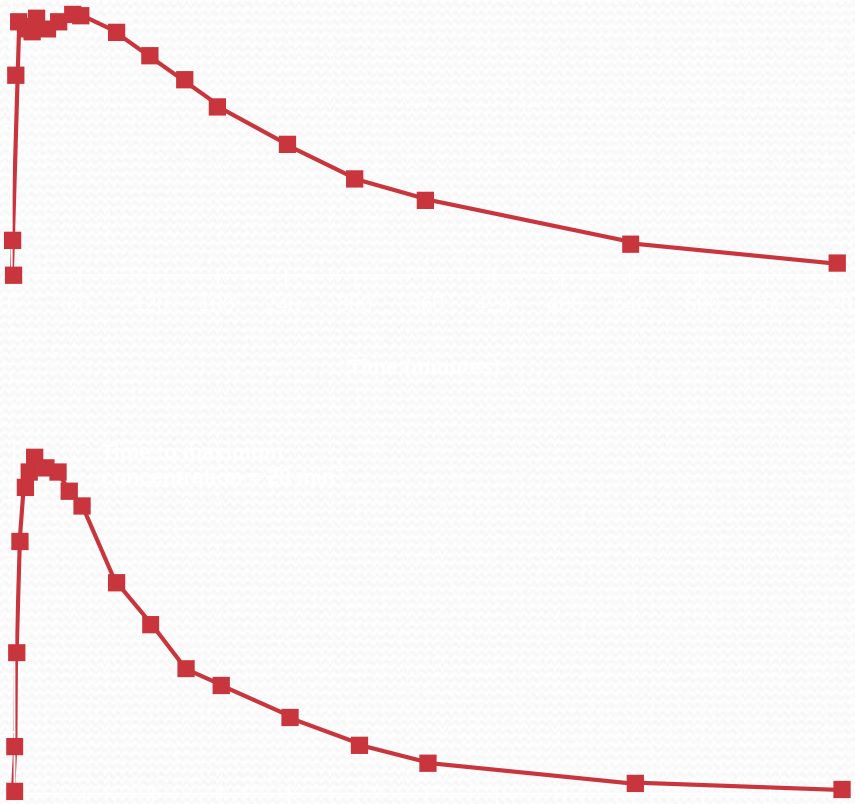
- Complementary actions:
  - Atropine blocks ACh on the postsynaptic (downstream) side of synapses at muscarinic cholinergic receptors in multiple organ systems, thereby reducing cholinergic overstimulation
  - Pralidoxime chloride reactivates the AChE enzyme, allowing it to resume its function of moderating the activity of ACh once again[1]



How Quickly Does DuoDote Work?

- After injection, atropine and pralidoxime chloride begin counteracting the effects of organophosphorus poisoning within about 10 minutes

- Both antidotes reach their peak concentrations in the bloodstream within about 30 minutes[1]



What Happened to MARK-1?

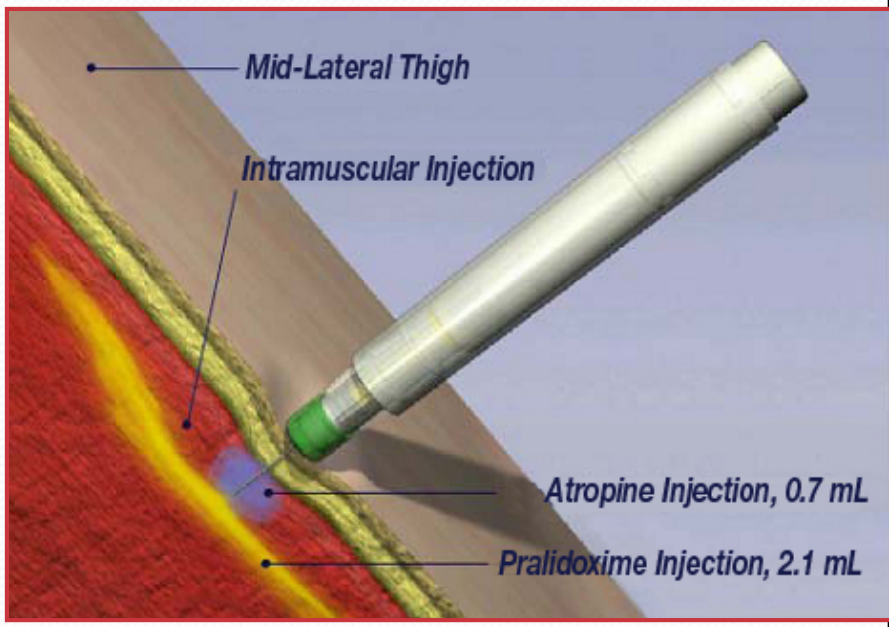
- Mark-1 kits are no longer available for use.
- DuoDote has replaced them
- Here is a slide that compares them side by side

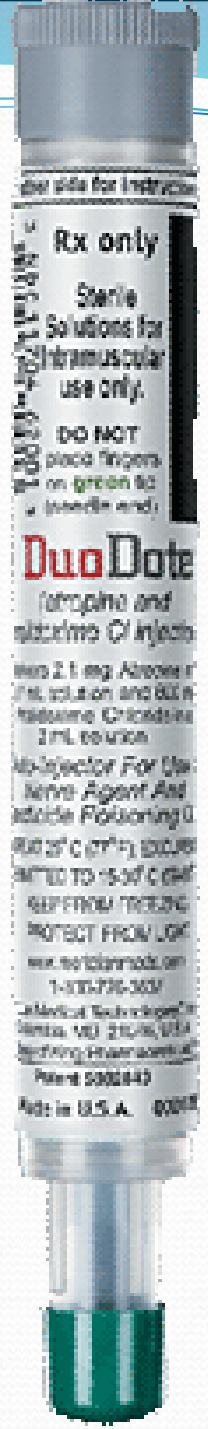
DuoDote™ Replaces the Mark I™ Kit
Delivers the same protection in a single auto-injector

	DuoDote Auto-Injector	Mark I Kit[2,3]
Product Name:		
Active Ingredients:	• 2.1 mg atropine sulfate equivalent • 600 mg pralidoxime chloride	• 2 mg atropine sulfate equivalent • 600 mg pralidoxime chloride
Delivery Mechanism:	1 auto-injector featuring dual-chamber technology	2 auto-injectors, each with a single traditional chamber
Steps to Administer:	Simple administration with just 1 injection	Additional steps required – 2 separate injections
Overall Dimensions:	6” x 1” x 1”	6” x 1.5” x 1”
Shelf Life:	3 years	5 years
Packaging:	Chemically hardened pouch	Foam pouch

DuoDote Injection Instructions

- Select site and inject:
  - The injection site is the mid-outer thigh area. You can inject through clothing, but make sure that pockets are empty
  - Swing and firmly push Green Tip straight down (at a 90º angle) against mid-outer thigh, continuing to push firmly until you feel the auto-injector trigger
  - After the DuoDote Auto-Injector triggers, hold it firmly in place against the injection site for 10 seconds




Rx only
Sterile
Solutions for
Intramuscular
use only.
DO NOT
DuoDote
Made in U.S.A.

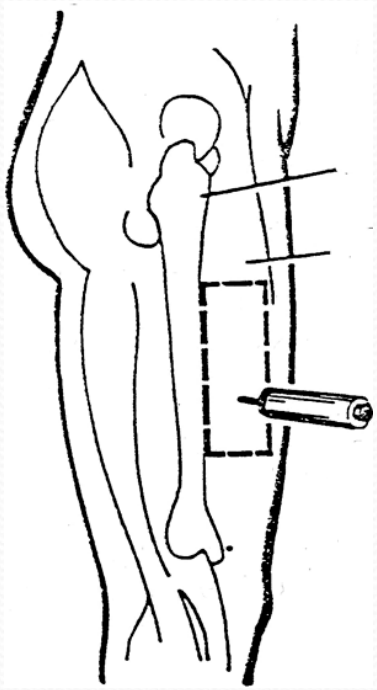
1
Pull
off gray
safety
release.
2
Swing and
firmly push
green tip
against
outer thigh
so it 'clicks'.
HOLD
against
thigh approx.
10 seconds.
3
Seek
medical
attention.

Self Treatment

- Do not place finger over either end!
- Upper outer quadrant of buttocks is best spot
- Hold in place for 10 seconds

Alternate location

- Can also use lower, outer quadrant of thigh
- Needle will go right through clothes, turnout, or PPE without problems



Basic/Advanced Standing Orders

- Routine patient care: Assess for SLUDGEM (salivation, lacrimation, urination, defecation, gastric upset, emesis, miosis/muscle twitching)
- Remove to cold zone after decontamination and monitor for symptoms
- Treatment using DuoDote™ autoinjectors *self and peer only*
- *Treatment using DuoDote ™ autoinjectors to public in emergency stockpile release only*

Basic Standing Orders

- Antidotal therapy should be started as soon as symptoms appear.
- *All injections must be given IM*
- Treatment using DuoDote™ autoinjectors *self and peer only*
- *Treatment using DuoDote™ autoinjectors to public in emergency stockpile release only*

Adolescent/Adult Basic Standing Orders

- 2 or more minor symptoms
  - One DuoDote™ kit
  - Reassess: if more severe symptoms appear within 10 minutes administer
  - Two additional DuoDote™ kits
- Initial Moderate Symptoms
  - Two DuoDote ™ kits
- Initial Severe Symptoms
  - Give Three DuoDote kits AND
  - One autoinjector of Diazepam 10 mg
- May repeat DuoDote™ kit every hour for three hours

Basic Standing Orders: PEDIATRIC

- DuoDote™ may be used for pedi patients in life threatening situation w/ exposure symptoms
- Child 13-25kg (29 - 55lb) – One DuoDote
- Child 26-50kg (56 - 110lb) – Up to Two DuoDote kits based on progression of symptoms
- Child over 51kg (>110lb) – Up to Three DuoDote kits based on progression and severity of symptoms

Paramedic Standing Orders: PEDIATRIC

- Children <12 kg (26 lbs):
  - Use of DuoDote kit is not recommended
  - If no other source available after 90 min may consider using one DuoDote kit.
- If child is seizing and >26 (> 57lbs)kg
  - May use one Adult Diazepam injector

Provider Protection

- If a first responder display symptoms:
  - Notify dispatch immediately
  - Evacuate area
  - Do not reenter until cleared by Hazmat
  - Remove clothing and decontaminate
  - Treatment basic and paramedic same as for mass casualty

Provider Treatment

- Use only if nerve agent symptoms are present. DuoDote™ kits offer no prophylactic protection and use prior to appearance of symptoms may be harmful. All injections must be given IM.

Accidental OD

- If First Responder accidentally gives Mark 1 kit to themselves without being exposed to nerve agent
  - Hot
  - Red
  - Unable to sweat (dry)
  - Confusion
- Need to be kept in cool, controlled environment until wears off

References

- [1] Watson WA, Litovitz TL, Klein-Schwartz W, et al. 2003 Annual Report of the American Association of Poison Control Centers Toxic Exposure Surveillance System. *Am J Emerg Med.* 2004;22:335-404
- [2]Department of Health and Human Services. Centers for Disease Control and Prevention. Third *National Report on Human Exposure to Environmental Chemicals*. Atlanta, GA: National Center for Environmental Health; 2005 NCEH Pub. No. 05-0570.
- [3]Olson KB. Aum Shinrikyo: once and future threat? *Emerg Infect Dis*. 1999;5:512-516.
- [4]Cannard K. The acute treatment of nerve agent exposure. *J Neurol Sci*, 2006;249:86-94
- [5]Department of Health and Human Services. Centers for Disease Control and Prevention. Third *National Report on Human Exposure to Environmental Chemicals*. Atlanta, GA: National Center for Environmental Health; 2005;NCEH Pub No. 05-0570

Any Questions?

- Lets practice!