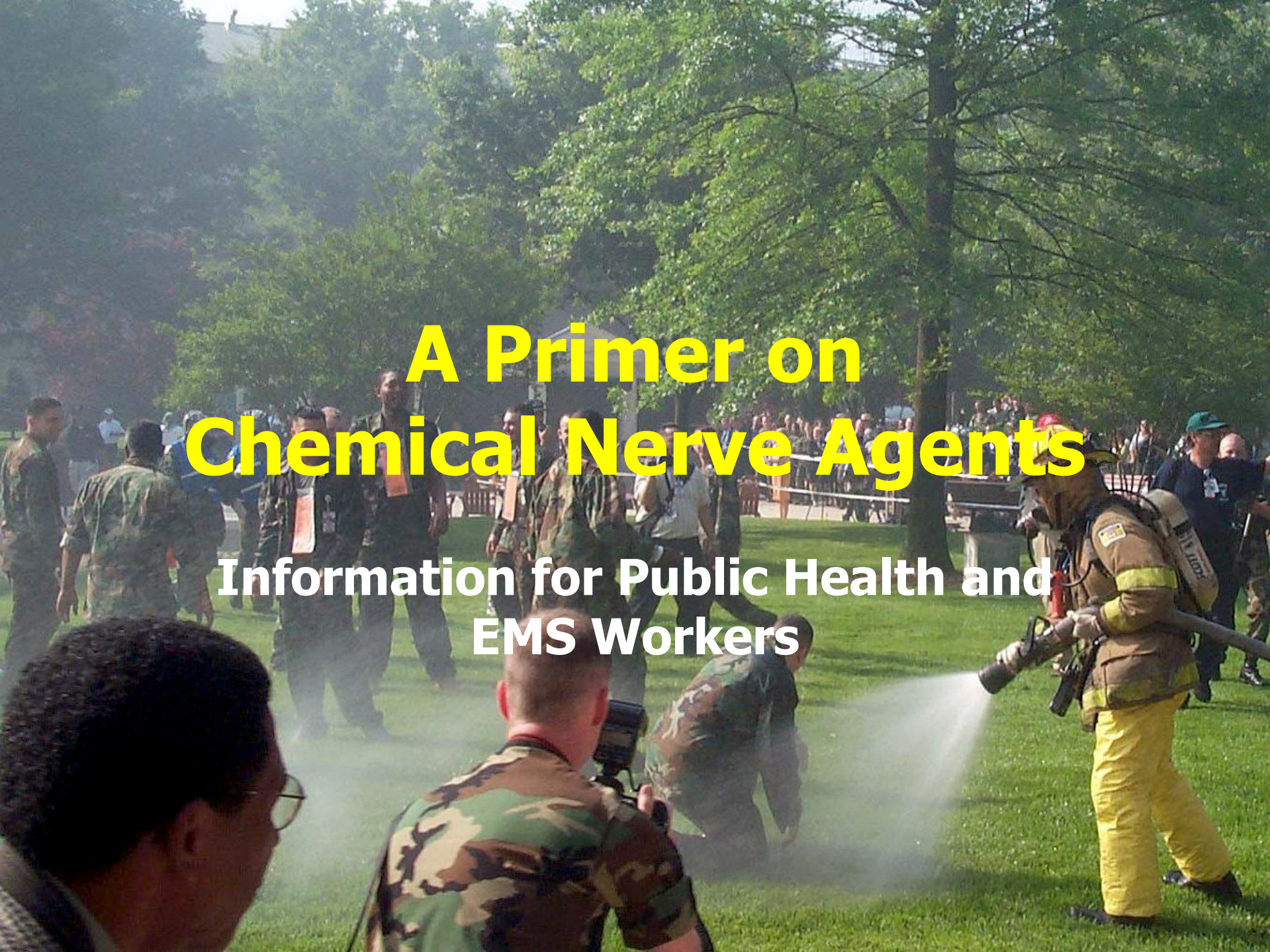


A Primer on Chemical Nerve Agents

Information for Public Health and EMS Workers

This information was adapted and developed from a presentation by:

Area Health Education Center of Southern Nevada

Chemical Nerve Agents

- Nerve agents are a class of organic compounds containing phosphorus (i.e., organophosphates) that disrupt the mechanism by which nerves transfer impulses to muscles and organs
- First created in the 1930's for use as pesticides, but recognized as an effective chemical weapon by Germany during WWII

Chemical Nerve Agents (cont.)

Nerve Agent	Sarin	Soman	Tabun	VX*
NATO Symbol	GB	GD	GA	VX
Odor	None or fruity	None	None or fruity	None or sulfur
Rate of Reaction	Inhalation – very fast Skin penetration – seconds to minutes			

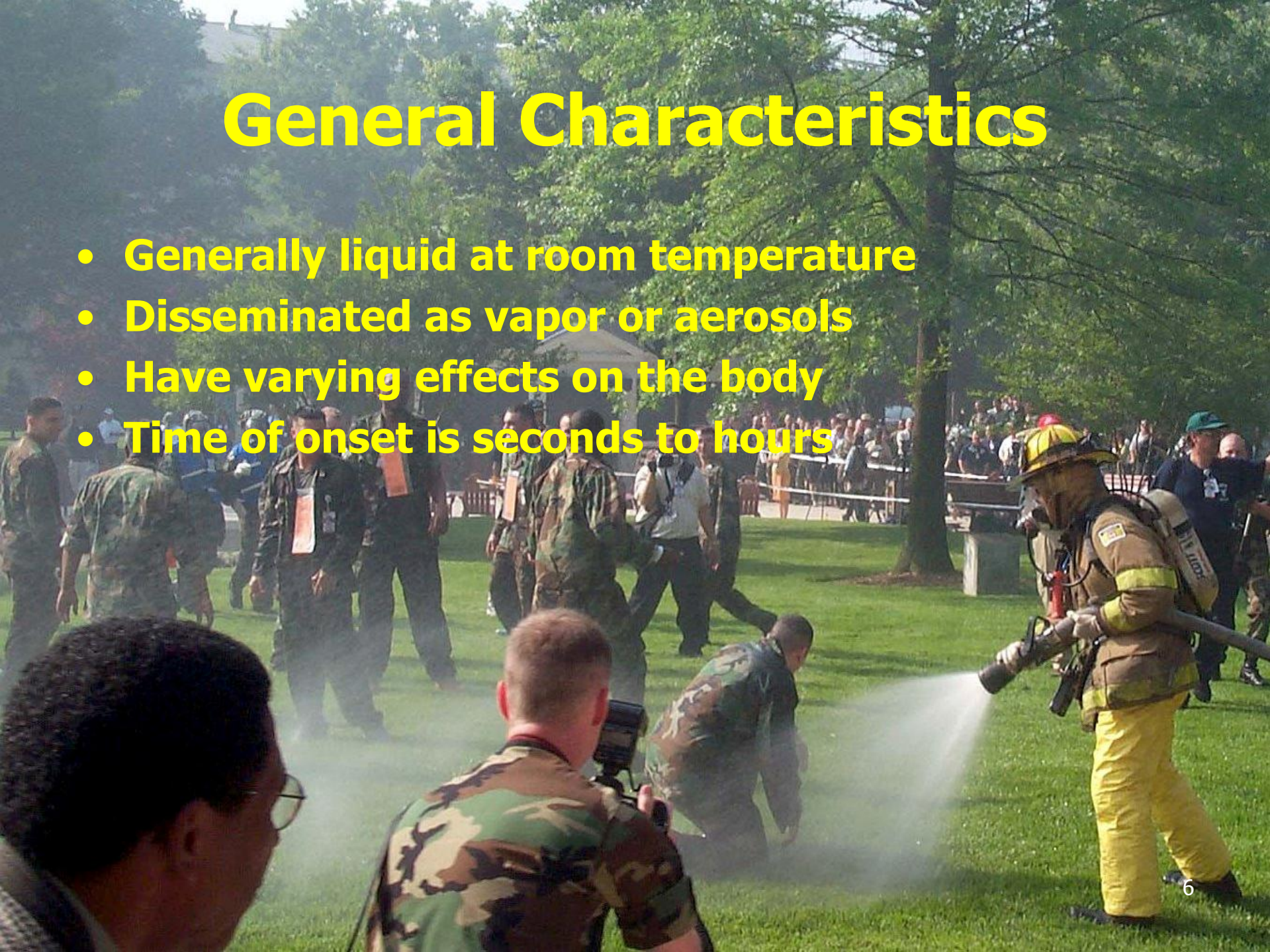
* VX is estimated to be 10 times more toxic than Sarin (GB)

Organophosphate Pesticides

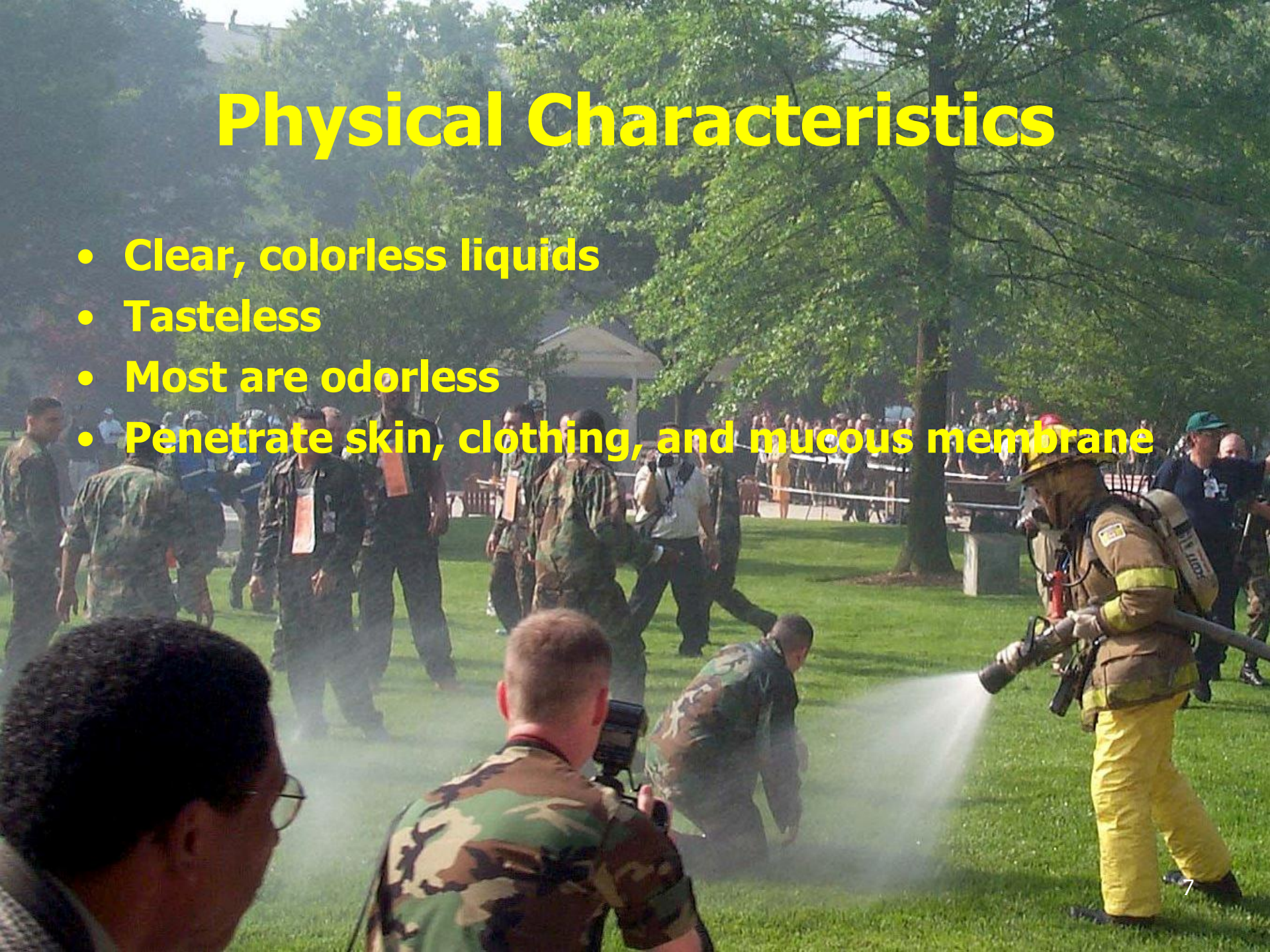
- Organophosphate pesticides account for about half of the insecticides used in the United States
  - Approximately 60 million pounds of organophosphate pesticides are applied to U.S. agricultural crops annually
  - Nonagricultural uses account for about 17 million pounds per year
- Dozens of organophosphate pesticides are now in use including:
  - Diazinon
  - Malathion
  - Parathion

General Characteristics

- Generally liquid at room temperature
- Disseminated as vapor or aerosols
- Have varying effects on the body
- Time of onset is seconds to hours



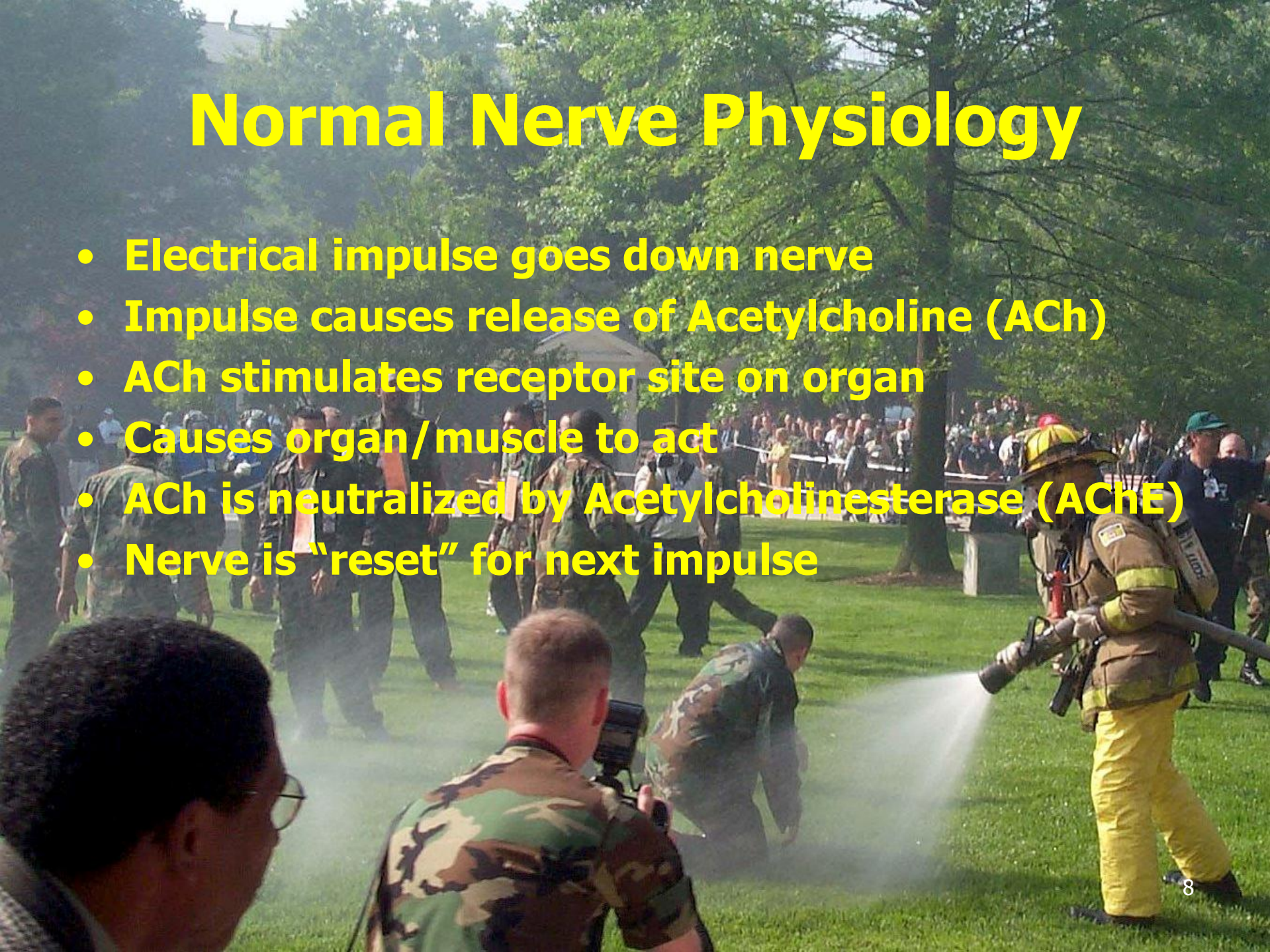
Physical Characteristics



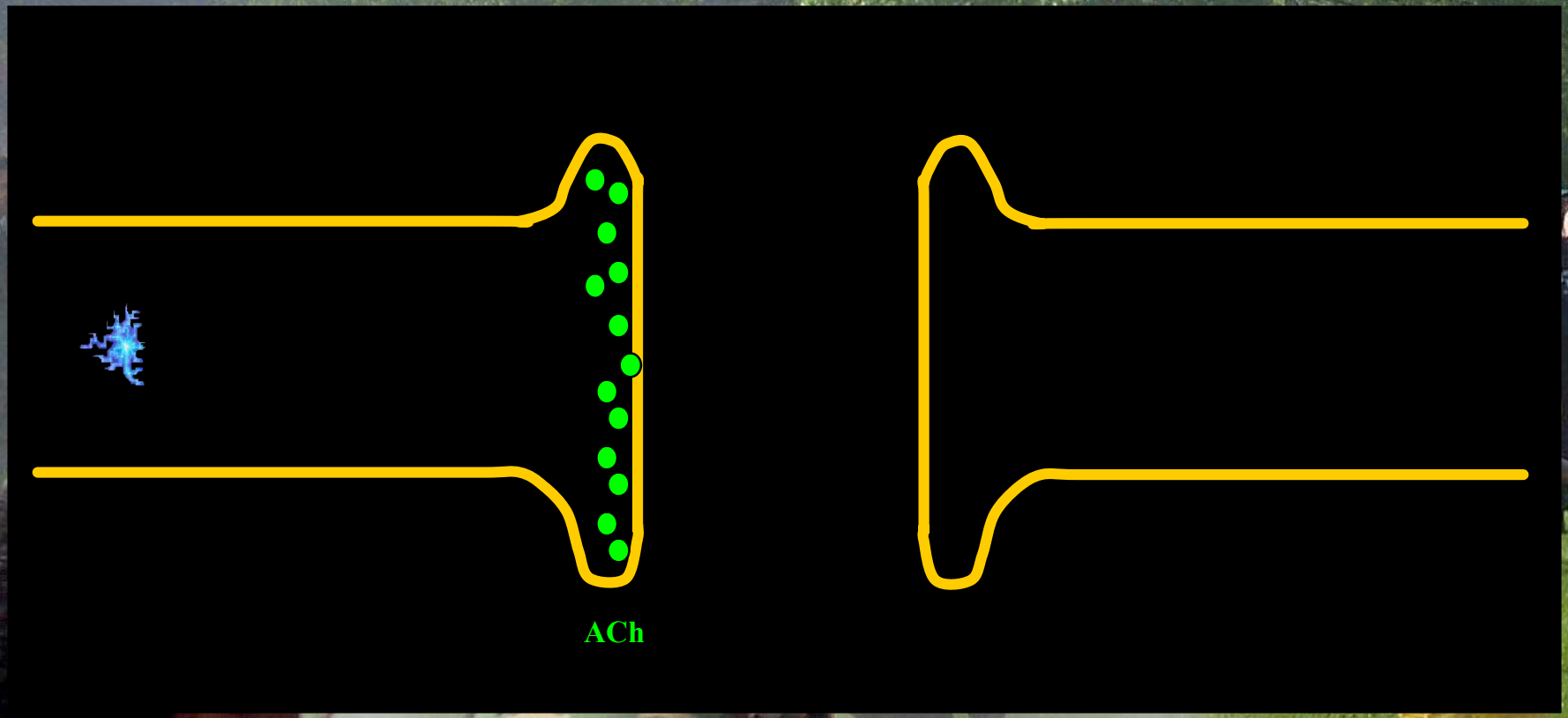
- Clear, colorless liquids
- Tasteless
- Most are odorless
- Penetrate skin, clothing, and mucous membrane

Normal Nerve Physiology

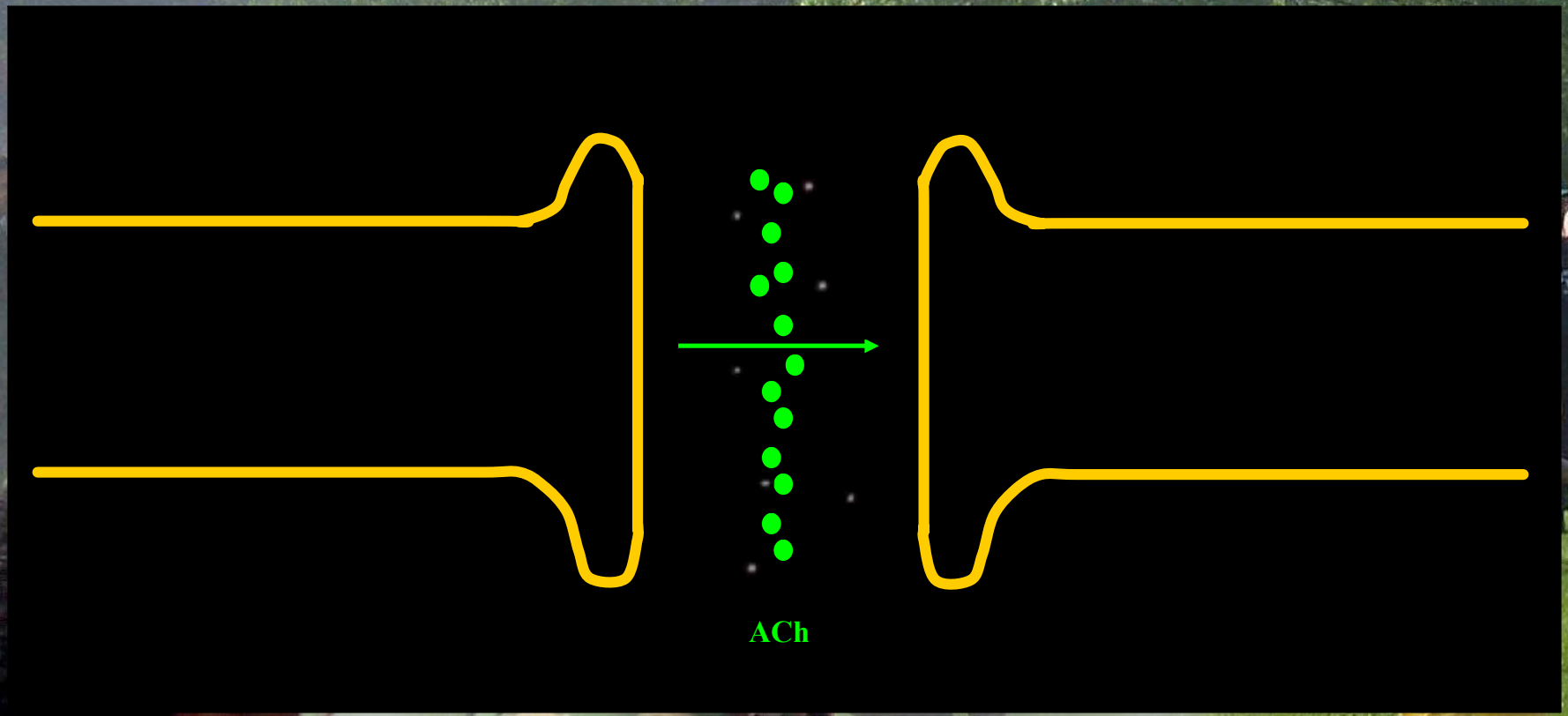
- Electrical impulse goes down nerve
- Impulse causes release of Acetylcholine (ACh)
- ACh stimulates receptor site on organ
- Causes organ/muscle to act
- ACh is neutralized by Acetylcholinesterase (AChE)
- Nerve is "reset" for next impulse



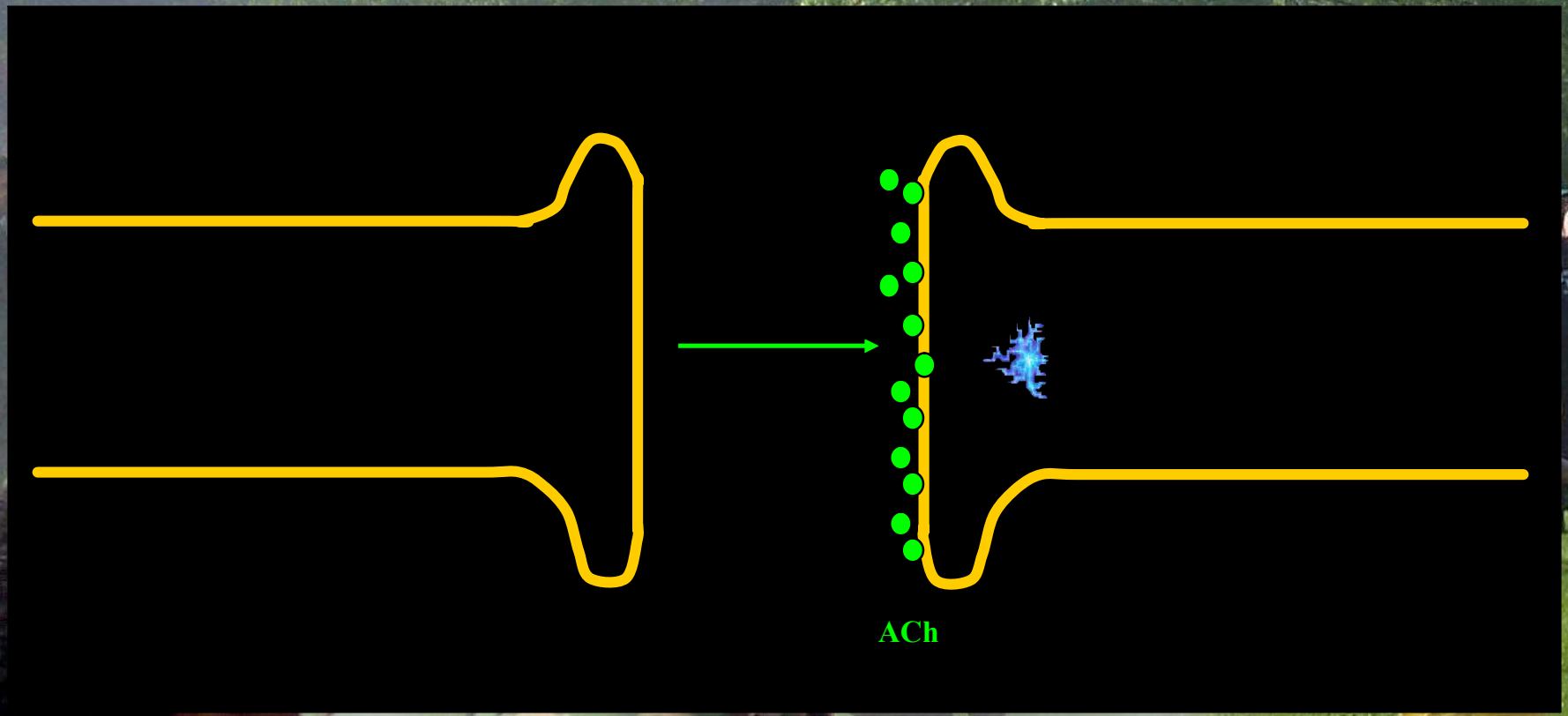
Normal Nerve Transmission



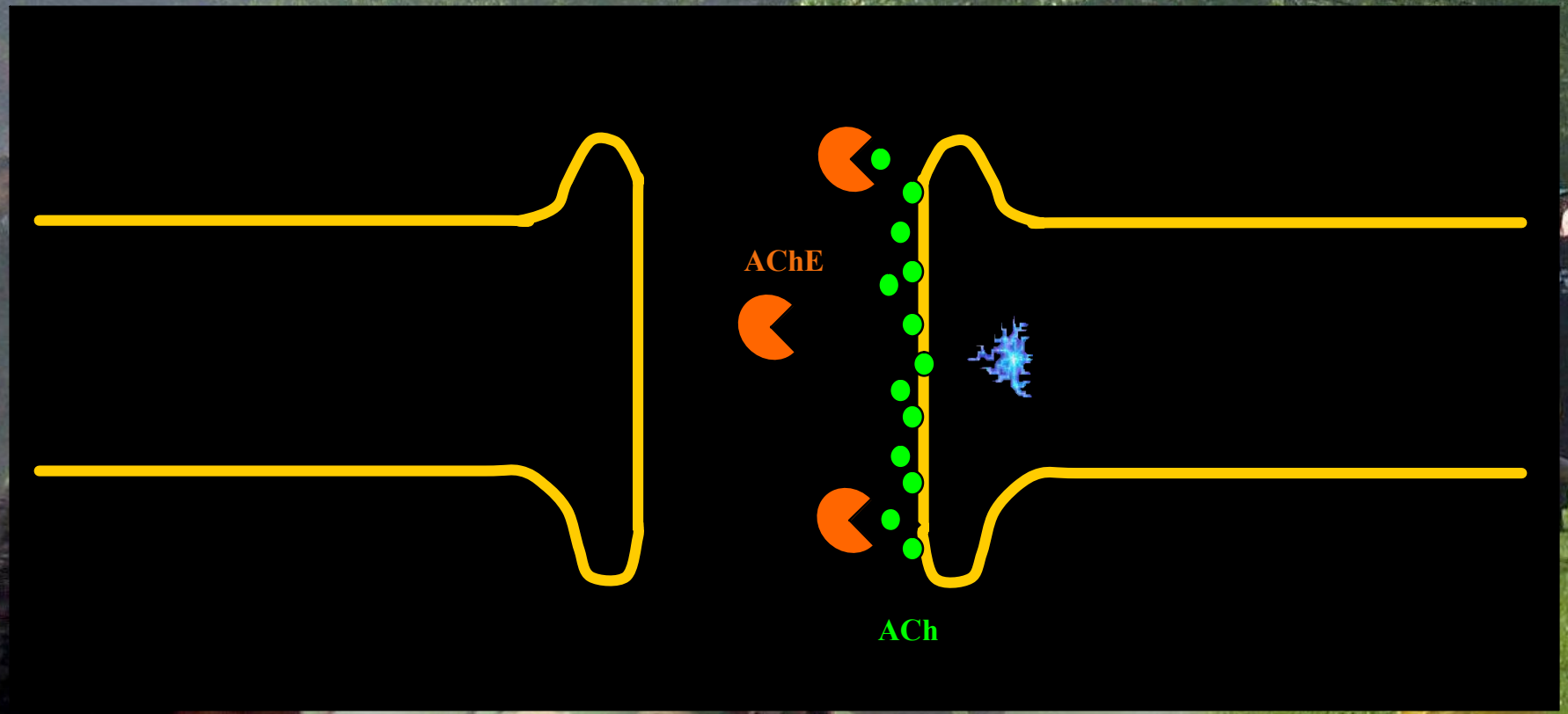
Nerve Impulse Release ACh



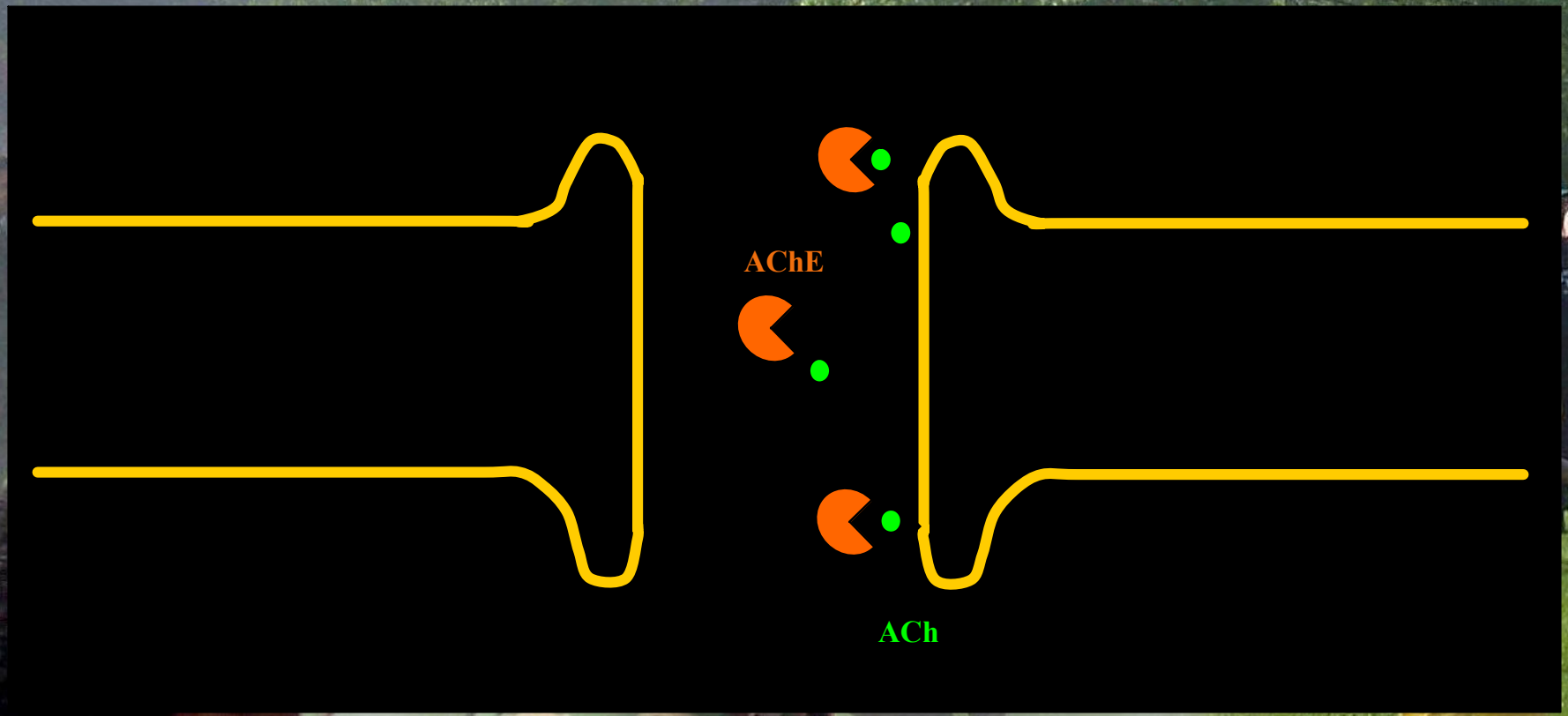
ACh Activates New Nerve Impulse



AChE is Released

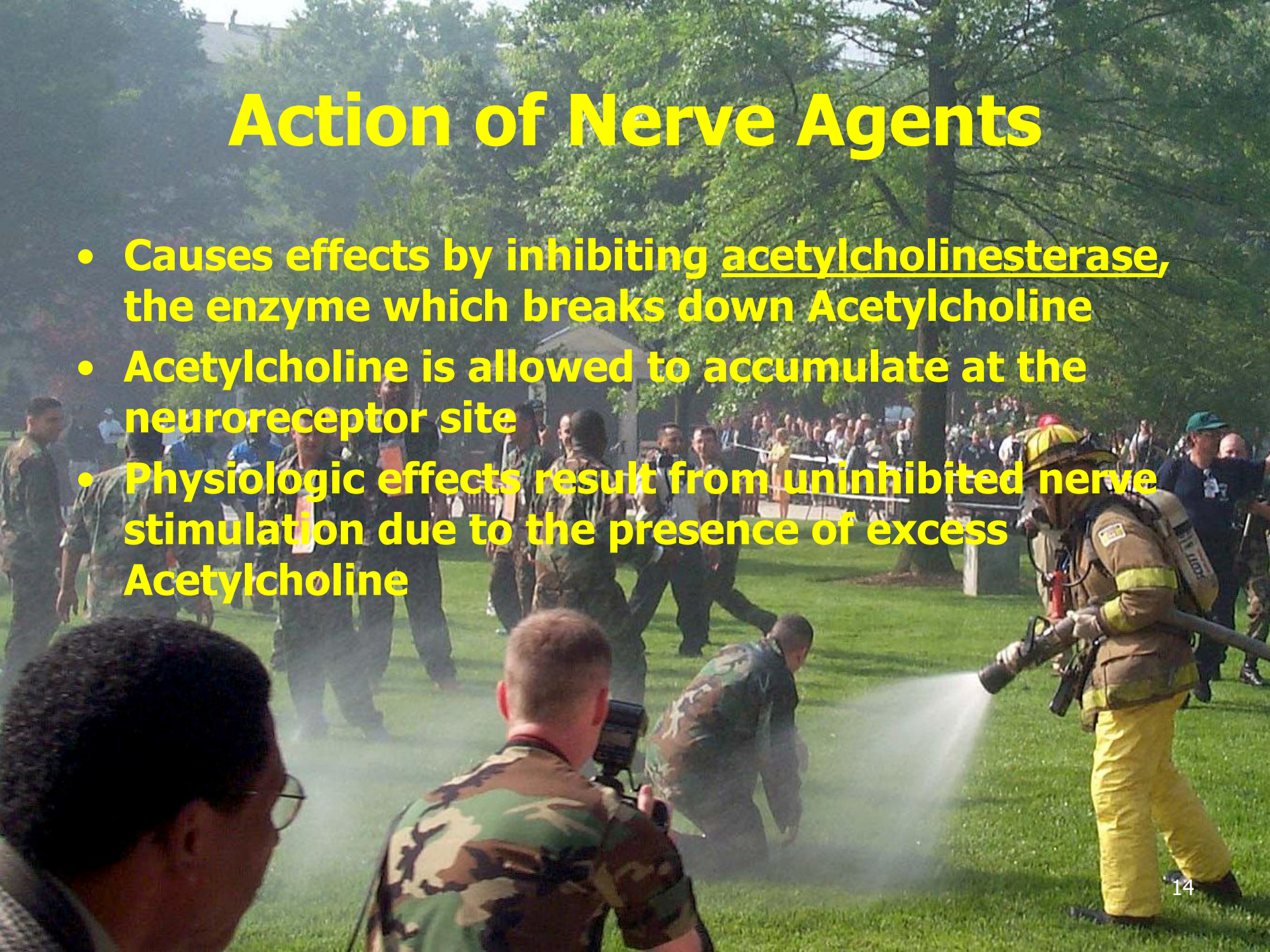


AChE Neutralizes ACh

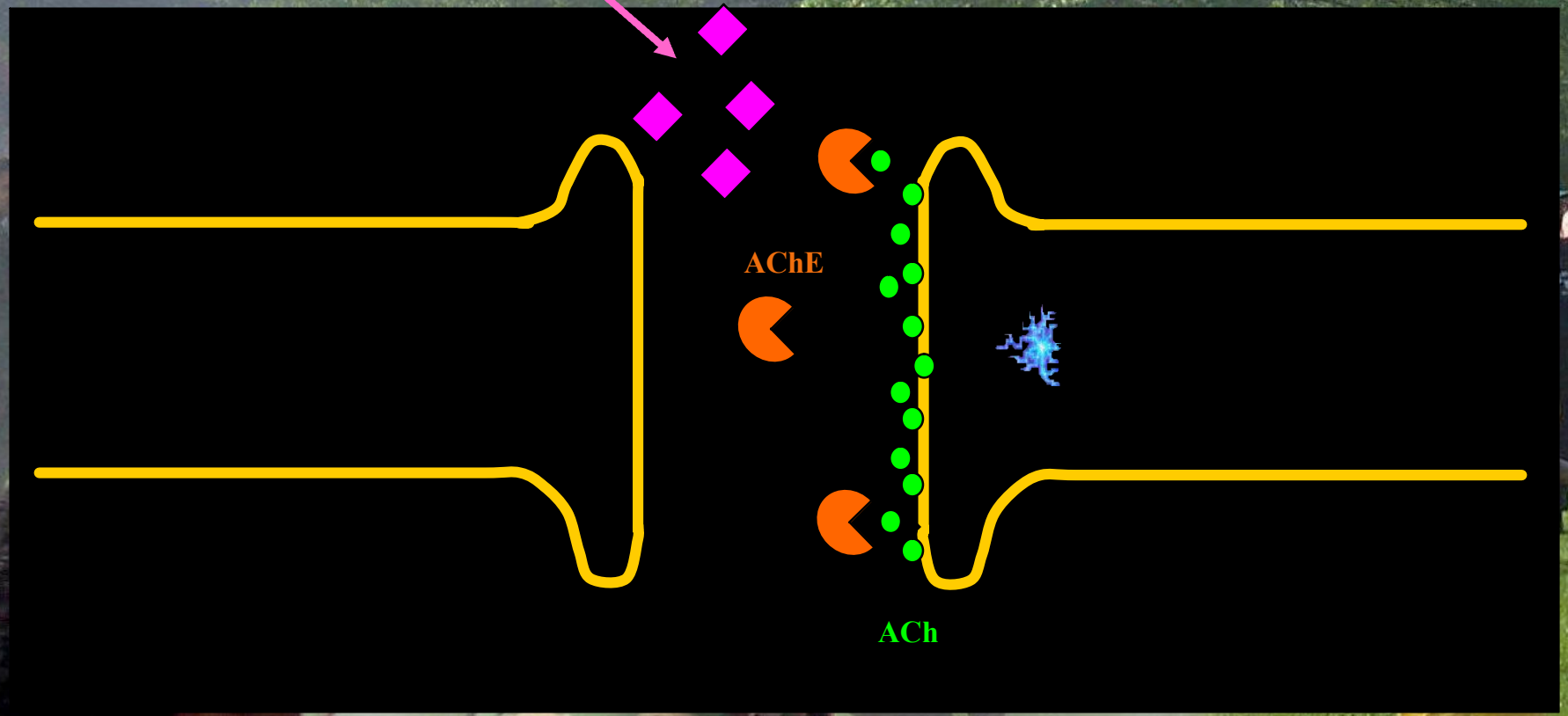


Action of Nerve Agents

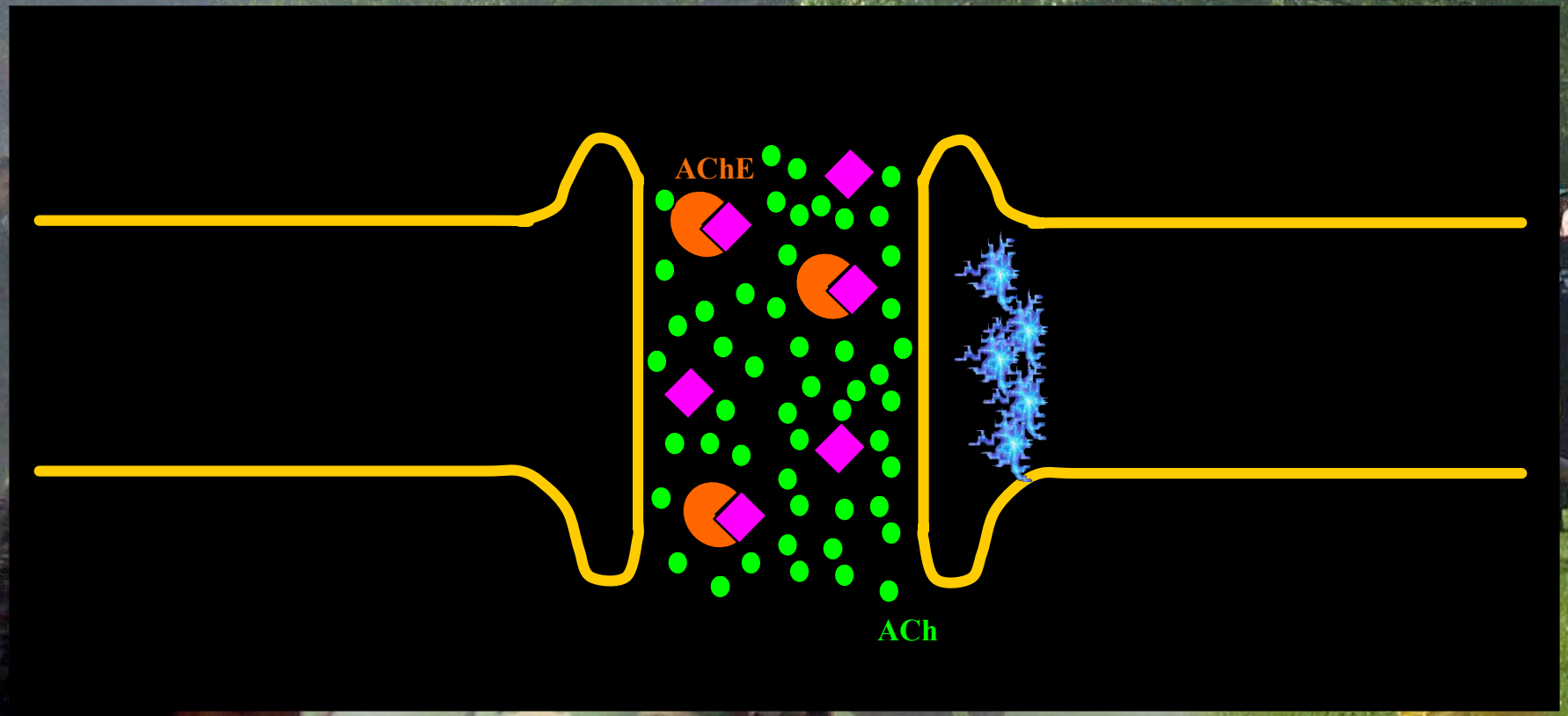
- Causes effects by inhibiting acetylcholinesterase, the enzyme which breaks down Acetylcholine
- Acetylcholine is allowed to accumulate at the neuroreceptor site
- Physiologic effects result from uninhibited nerve stimulation due to the presence of excess Acetylcholine



Nerve Agent Targets AChE at the Neural Junction

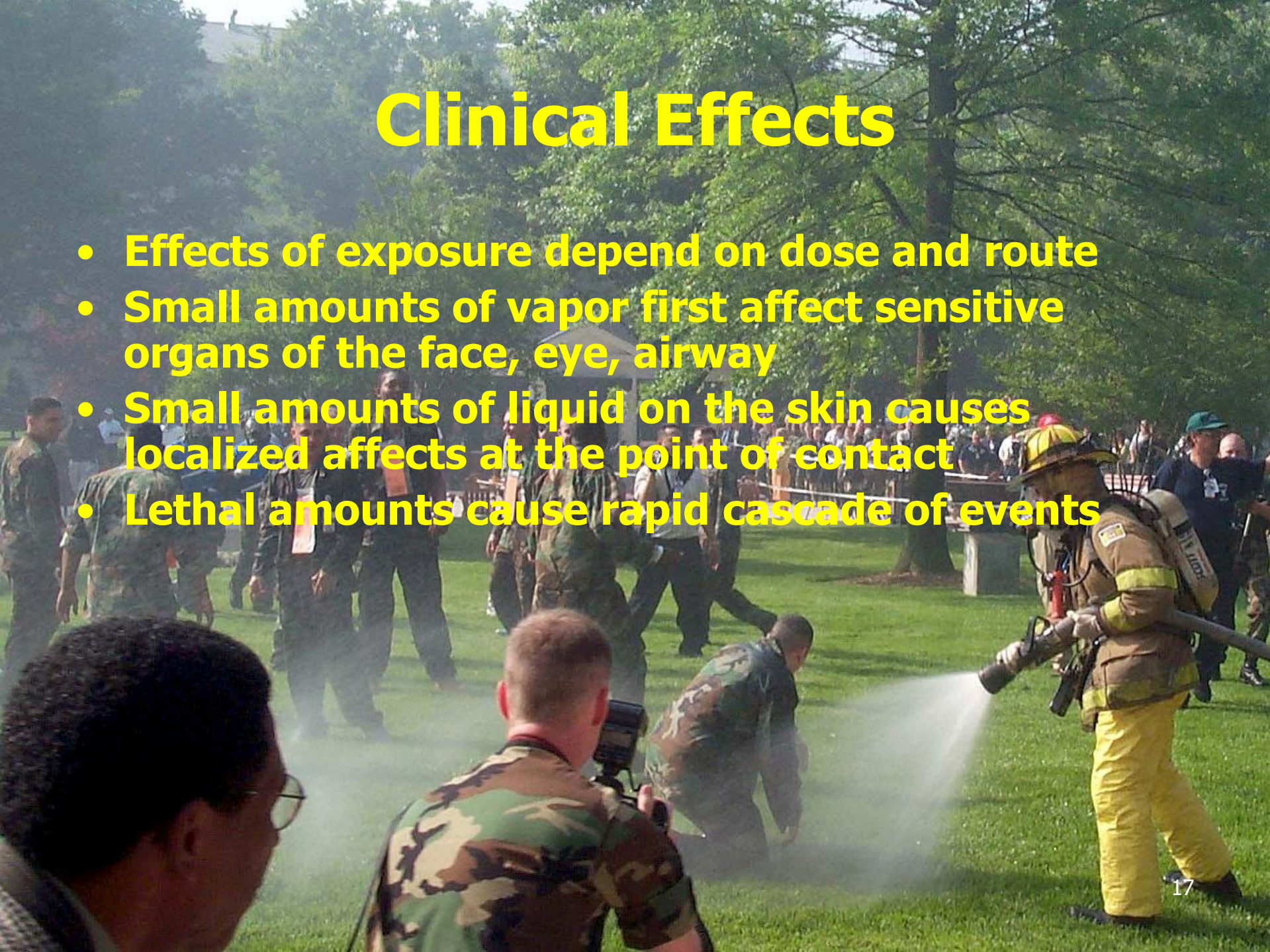


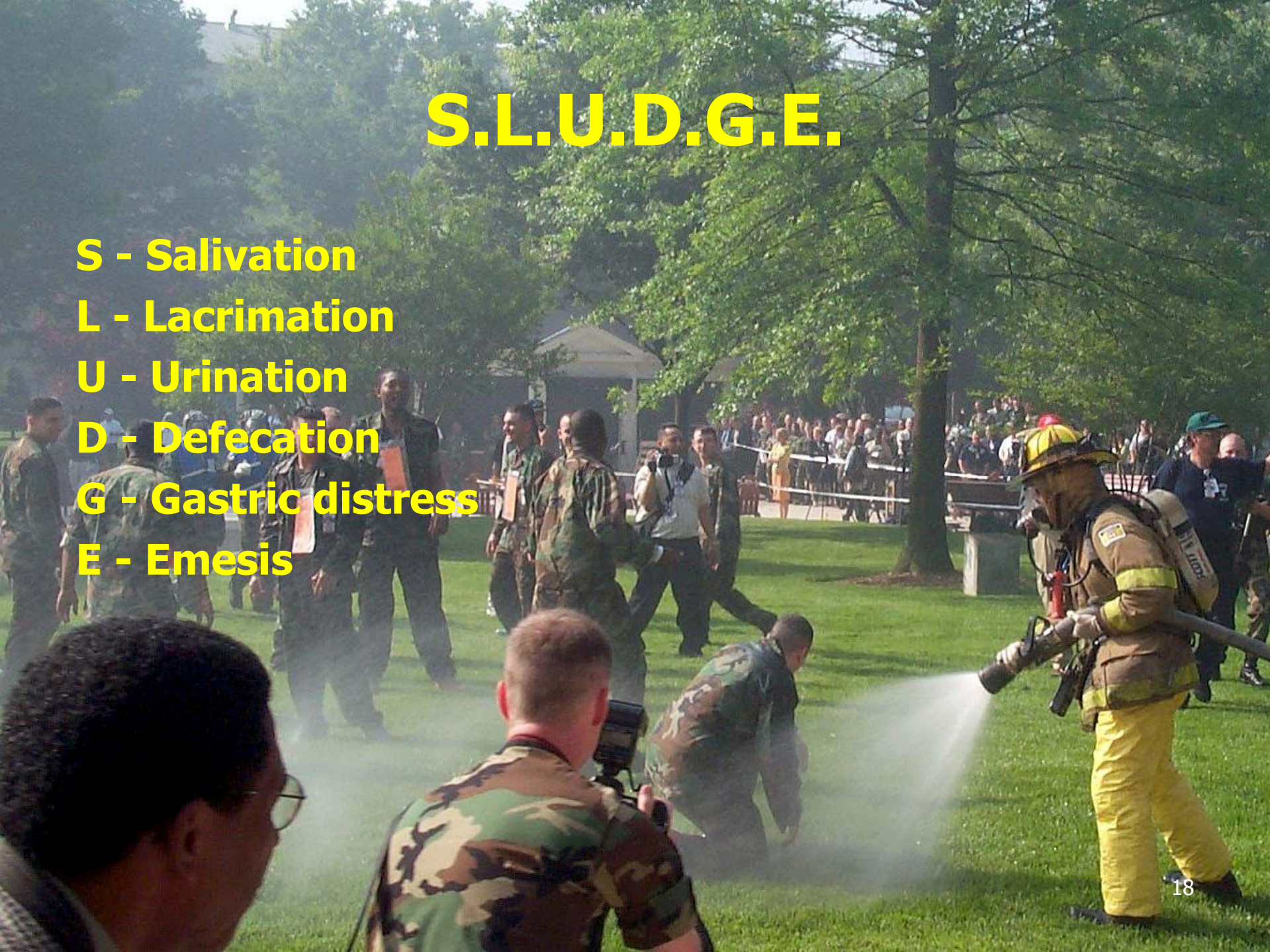
Nerve Agent Binds to AChE Allowing Ach to Accumulate



Clinical Effects

- Effects of exposure depend on dose and route
- Small amounts of vapor first affect sensitive organs of the face, eye, airway
- Small amounts of liquid on the skin causes localized affects at the point of contact
- Lethal amounts cause rapid cascade of events





S.L.U.D.G.E.

S - Salivation

L - Lacrimation

U - Urination

D - Defecation

G - Gastric distress

E - Emesis

Eyes

- Constricted pupils (Miosis) is a classic sign of exposure
- Along with complaints of:
  - Pain
  - Dim vision
  - Blurred vision
  - Conjunctival injection

Respiratory

- Rhinorrhea (perfuse watery runny nose)
- Bronchorrhea (excessive bronchial secretions)
- Wheezing
- Dyspnea (shortness of breath)
- Chest tightness
- Hyperpnea (increased respiratory rate/depth) - early
- Bradypnea (decreased respiratory rate) - late

Gastrointestinal Tract

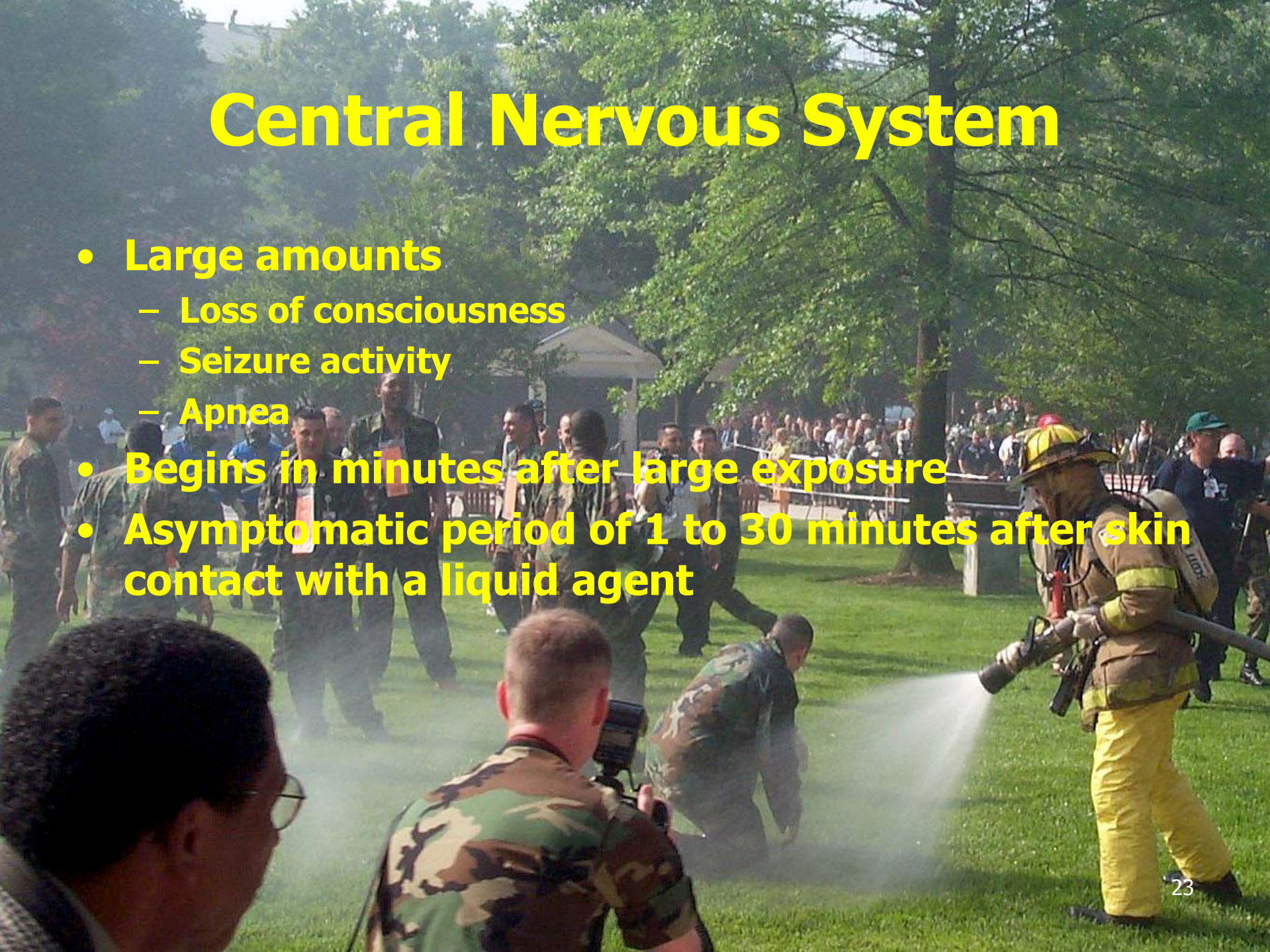
- Abdominal pain
- Nausea & and vomiting
- Diarrhea
- Urinary incontinence, frequency

Skeletal Muscle

- Weakness (may progress to paralysis)
- Fasciculations (local or generalized)

Central Nervous System

- Large amounts
  - Loss of consciousness
  - Seizure activity
  - Apnea
- Begins in minutes after large exposure
- Asymptomatic period of 1 to 30 minutes after skin contact with a liquid agent



Medical Management

Medical Management

- Management of nerve agent exposure includes:
  - Decontamination
  - Ventilation
  - Administration of antidotes
  - Supportive therapy
- The condition of the patient dictates the need for each of these and the order in which they are instituted

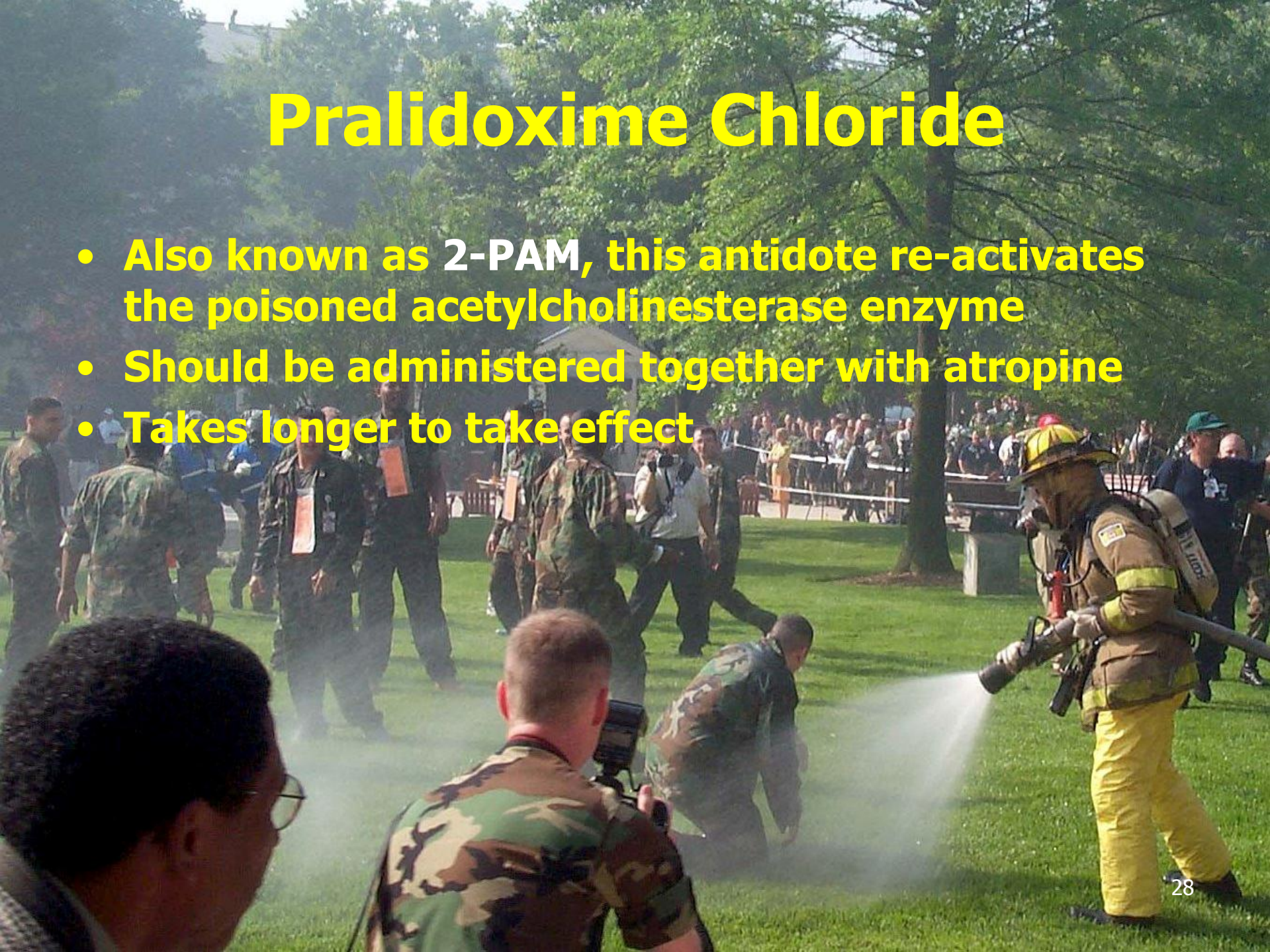
Nerve Agent Antidotes

Atropine Sulfate

- An anticholinergic drug
- Blocks neuroreceptor sites for acetylcholine
- Clinical effects:
  - Dries secretions
  - Reduces smooth muscle constriction

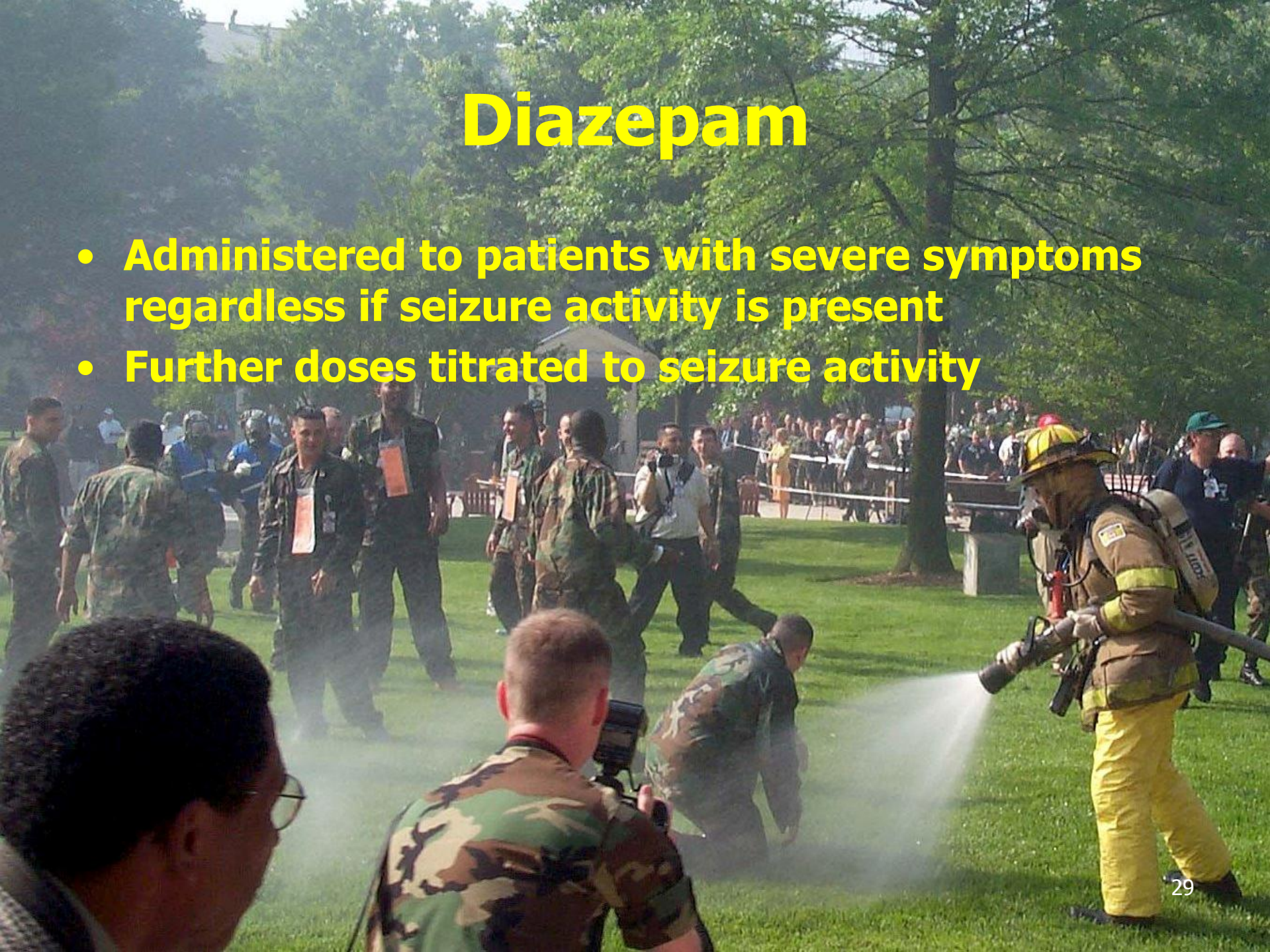
Pralidoxime Chloride

- Also known as 2-PAM, this antidote re-activates the poisoned acetylcholinesterase enzyme
- Should be administered together with atropine
- Takes longer to take effect



Diazepam

- Administered to patients with severe symptoms regardless if seizure activity is present
- Further doses titrated to seizure activity



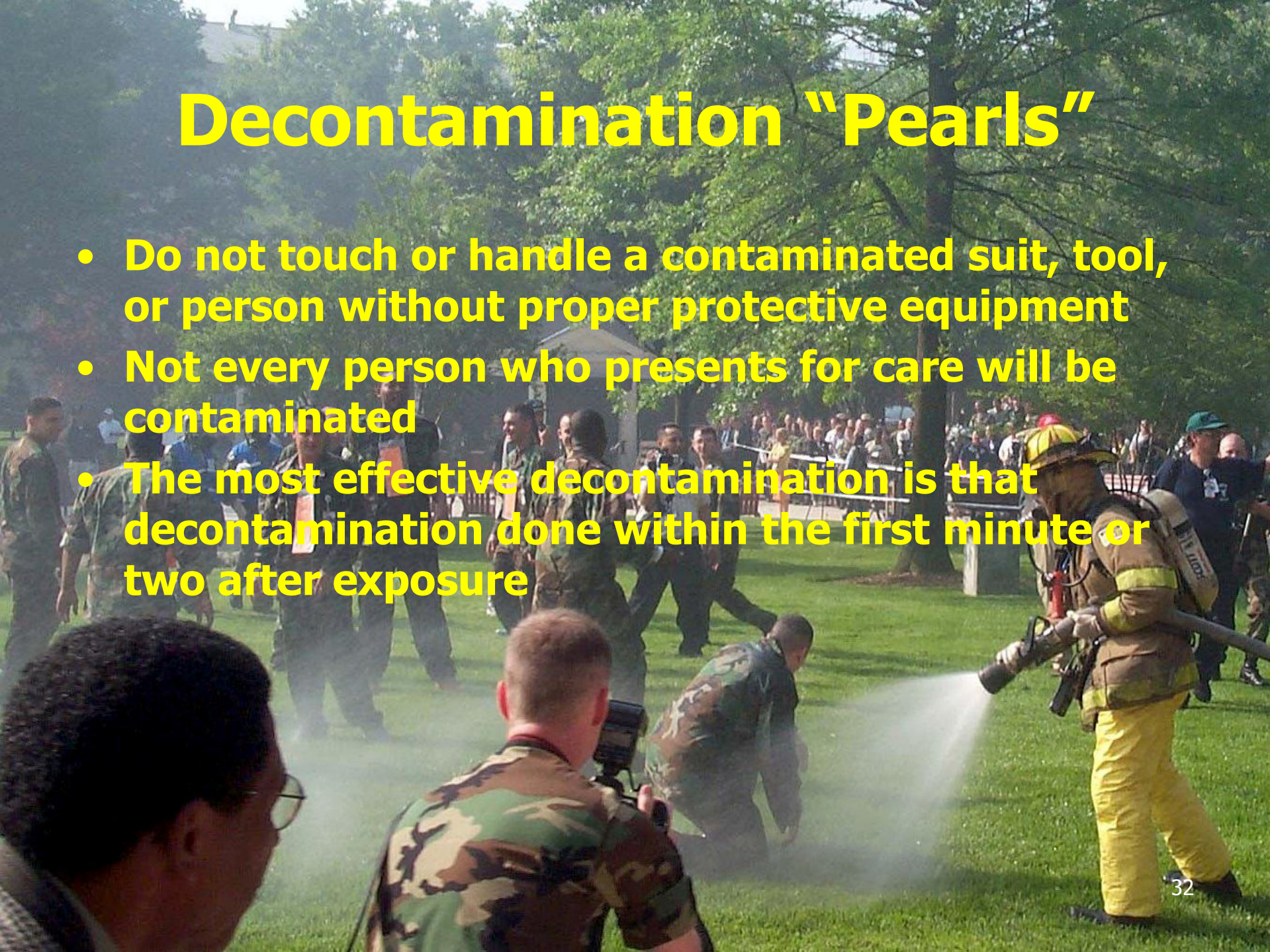
Decontamination

Decontamination

- Purpose of decontamination is to remove or neutralize harmful contaminants from surfaces
- Reduces absorption
- Minimizes transfer from clothing to skin
- Prevents or reduces cross contamination of:
  - Health care workers
  - Other citizens
  - Facilities
  - Equipment

Decontamination "Pearls"

- Do not touch or handle a contaminated suit, tool, or person without proper protective equipment
- Not every person who presents for care will be contaminated
- The most effective decontamination is that decontamination done within the first minute or two after exposure



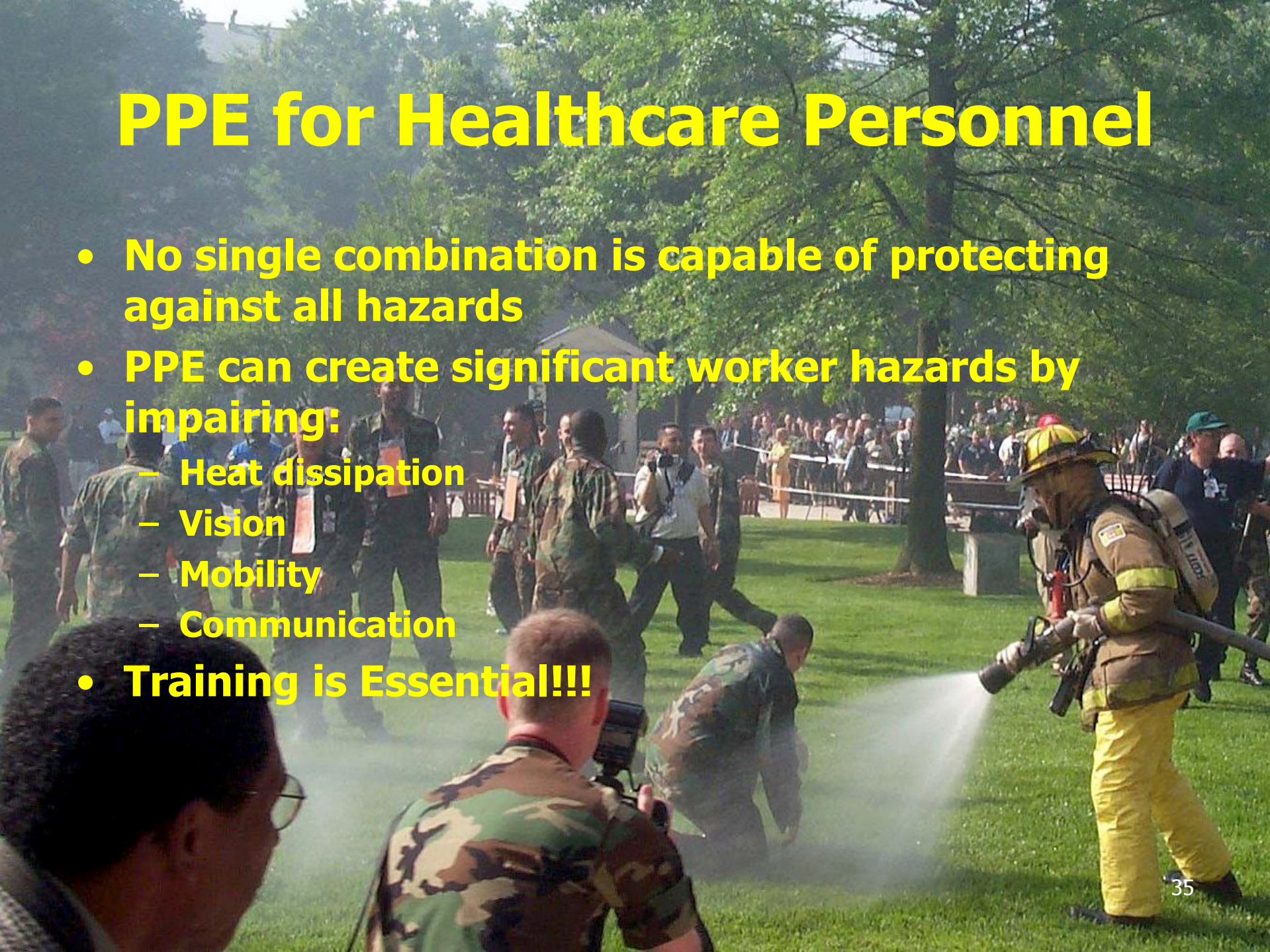
Decontamination Solutions

- Flushing with water followed by physical removal with soap and water solution is preferred
- If water is limited, use Sodium Hypochlorite solution (0.5%)
  - 1 to 10 dilution of household bleach

"Waterless" Decon

- 80-90% of contamination is removed by simply undressing
- The ability to quickly decontaminate large crowds is facilitated by rapid disrobing

PPE for Healthcare Personnel



- No single combination is capable of protecting against all hazards
- PPE can create significant worker hazards by impairing:
  - Heat dissipation
  - Vision
  - Mobility
  - Communication
- Training is Essential!!!

Special Thanks to

Better health through education

Area Health Education Center of Southern Nevada

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