



**FFI** Norwegian Defence  
Research Establishment

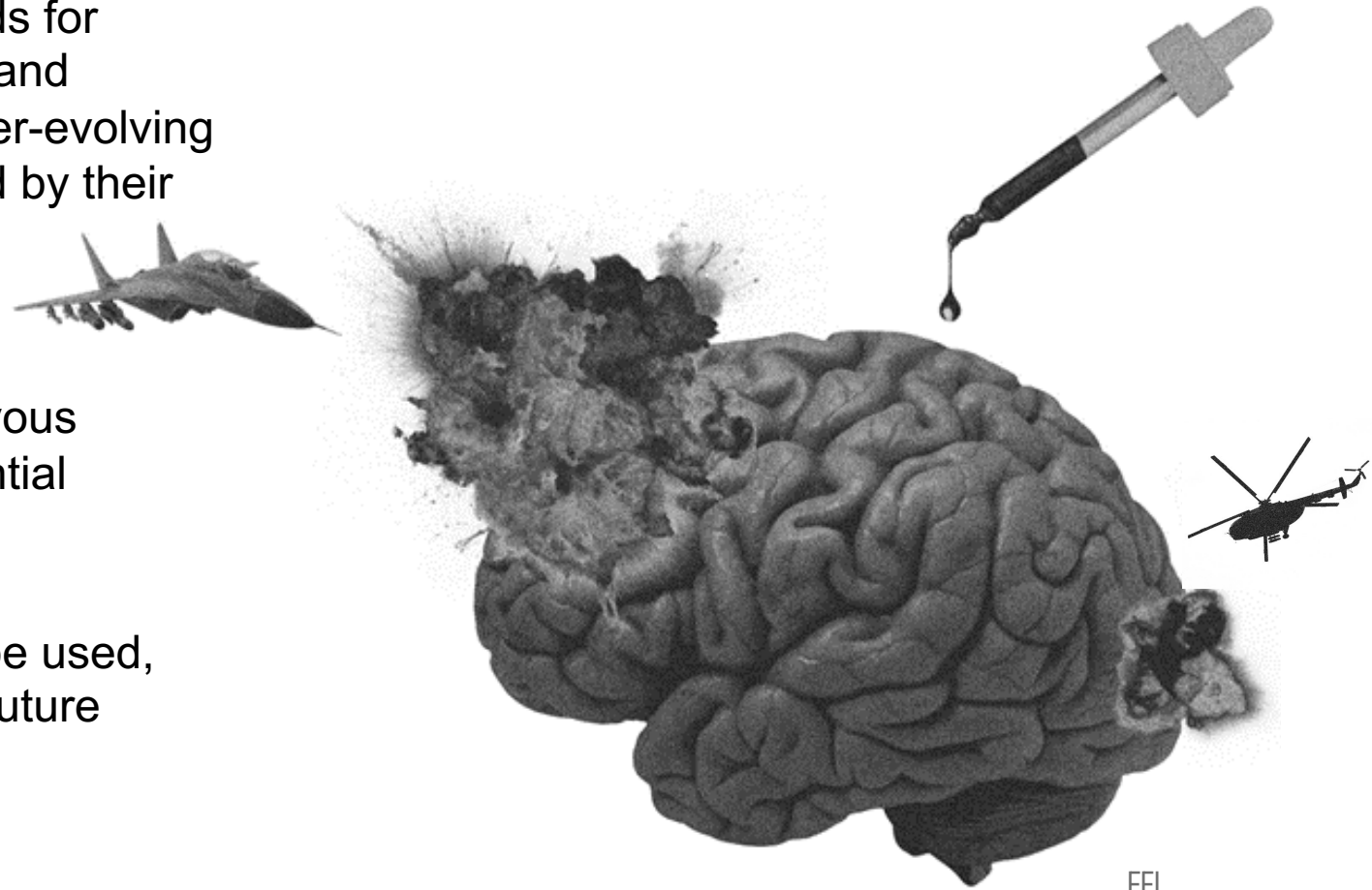
# **Chemicals in cognitive warfare: A peek inside the mind-modifying arsenal**

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# WHATS THE OBJECTIVE?

- The use of neurocognitive science methods for manipulating human cognition, emotions, and behaviour is a growing challenge in an ever-evolving landscape of global conflicts characterised by their asymmetric and "grey zone" nature
- Neuroweapons, such as chemicals and pharmaceuticals targeting the human nervous system, have gained prominence as potential instruments of cognitive manipulation
- Preliminary work to investigate what can be used, how it can be used, the legality and near-future perspectives



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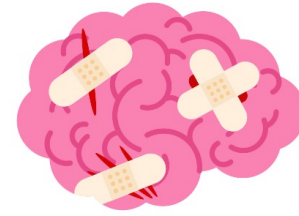
**IMPAIR**



**ENHANCE**



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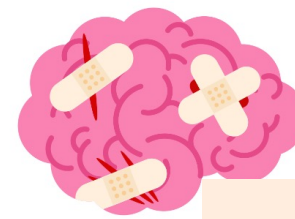
**Neurotoxic agents**



**Incapacitating agents**

# NEUROTOXIC AGENTS

- Compounds that can be toxic to the central nervous system
  - Minamata disease (Japan 1956)
  - Mercury poisoning: Loss of vision, damage to speech, insanity, coma, extensive cerebral damage in fetuses
- Drugs, environmental pollutants, pesticides, chemical warfare agents
- Can accumulate over time
- Cause behavioral and cognitive problems
- Neurotoxin exposure while pregnant
  - Loss of IQ points
  - Autism and ADHD
- CNS: Limited capacity for repair or regeneration
  - Minor damage can → long-term effects



## MEET THE NEUROTOXINS



Manganese



Fluoride



DDT/DDE



Arsenic



Lead



Mercury



Toluene



Ethanol



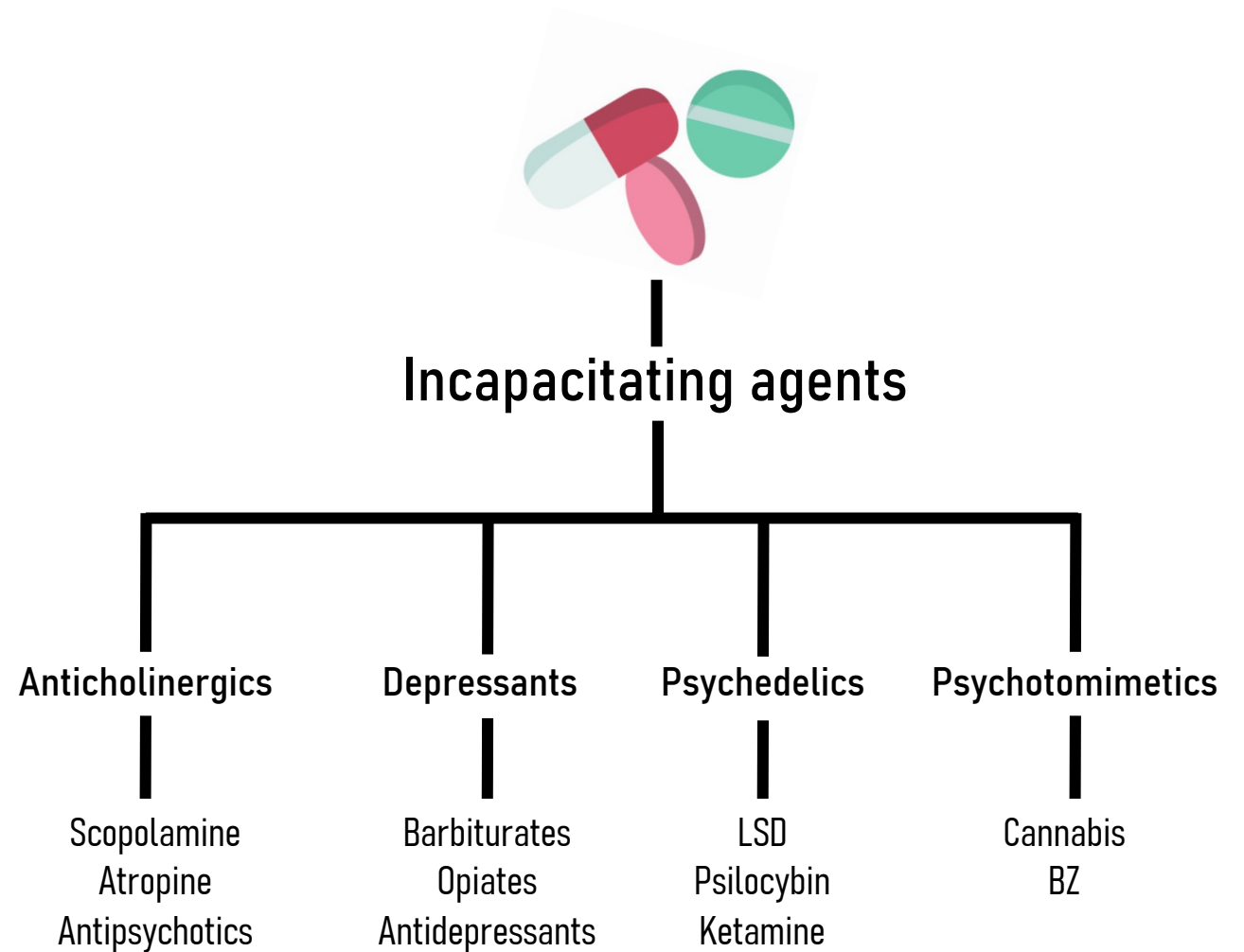
Polychlorinated  
Biphenyls (PCBs)

The Atlantic



# INCAPACITATING AGENTS

- Can affect movement, strength, stamina, motor learning, perception, judgment, morale, decision-making, pain tolerance
- Ideally:
  - Temporary incapacitating effects
  - Acts rapidly and of a specific capability
  - Reversible over time or specific treatment
  - Does not compromise safety or survival
  - Is predictable
- Realistically:
  - Affected by dose and route of exposure
  - The individuals' health, sex, physiology, and previous experience with drugs
  - Combination with other drugs, medication or diseases



# HISTORICAL USE OF INCAPACITATING AGENTS

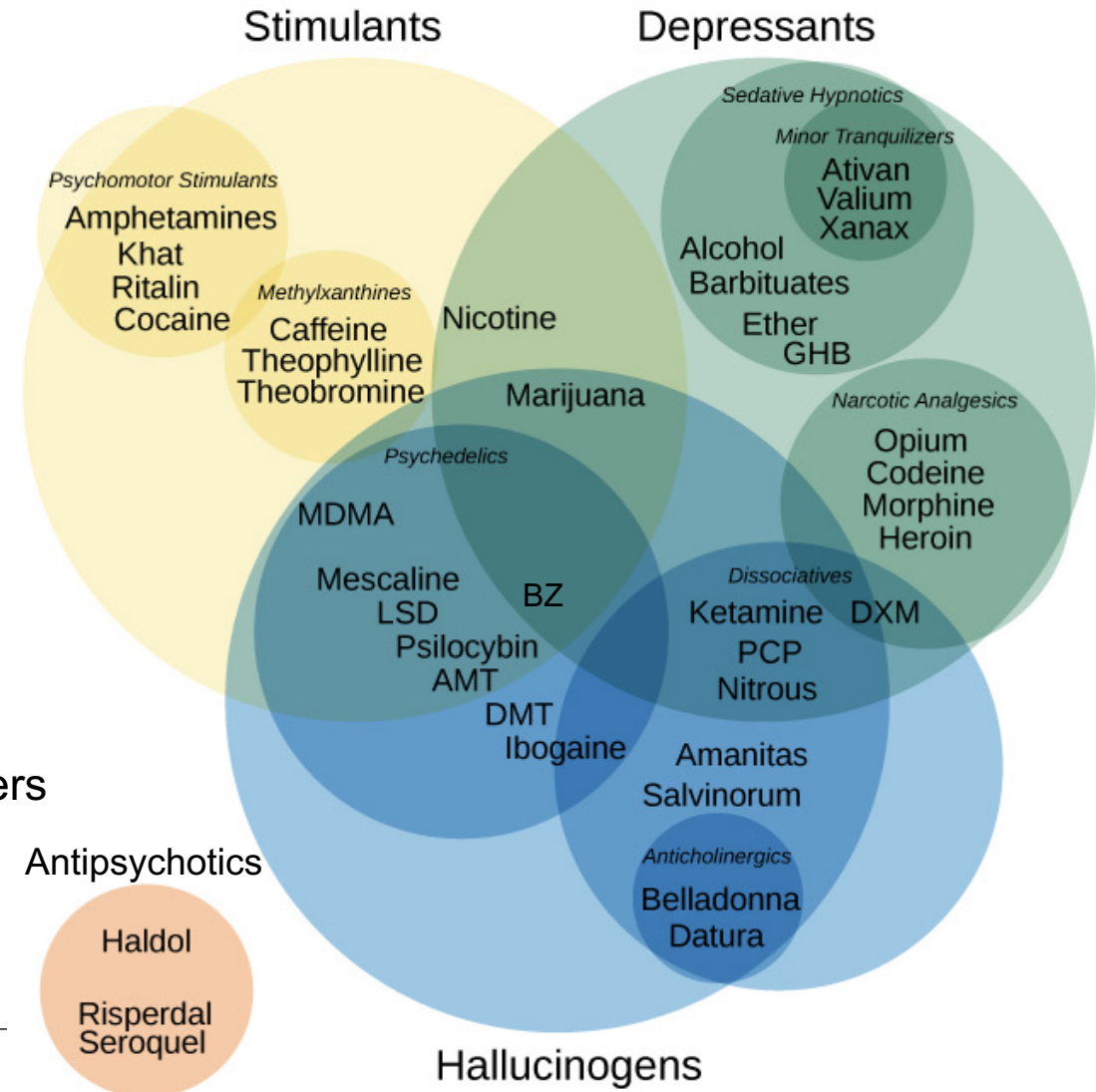
- BZ: Mimics symptoms of psychosis or schizophrenia-like illness.
  - ‘Nonlethal hallucinogenic chemical agent’
  - US Army: Weaponized in 1961, destroyed stockpiles early 1990s
- Opioid agent: Sedation, confusion, slowed heart rate
  - Fentanyl analogs used to incapacitate during a siege, Moscow 2002
    - Caused mass casualties (120+)
- Scopolamine: Sedation, hallucinations, blurry vision, memory problems
  - Drug-facilitated sexual assault, incapacitate and rob victims, South America



Photo Illustration by Sarah Rogers/The Daily Beast

# WHICH CHEMICALS CAN BE USED IN COGNITIVE WARFARE?

- **Anticholinergics:** Confusion, blurry vision, memory problems
- **Depressants:** Deep sedation, hypnosis, can be lethal
- **Hallucinogens:** Profound changes in perception, mood, judgement. Can cause paranoia, psychosis, seizures
- **Human enhancement drugs:** Enhance alertness, energy, blood pressure, concentration
- **Psychotomimetics:** Induce psychosis or schizophrenia-like illness
- **Neurotoxic compounds:** Neurological and psychiatric disorders affecting attention, memory, cognitive functions





# HOW CAN CHEMICALS BE USED IN ADVERSARIAL COGNITIVE WARFARE?

- Any country with a chemical industry can manufacture toxic chemicals

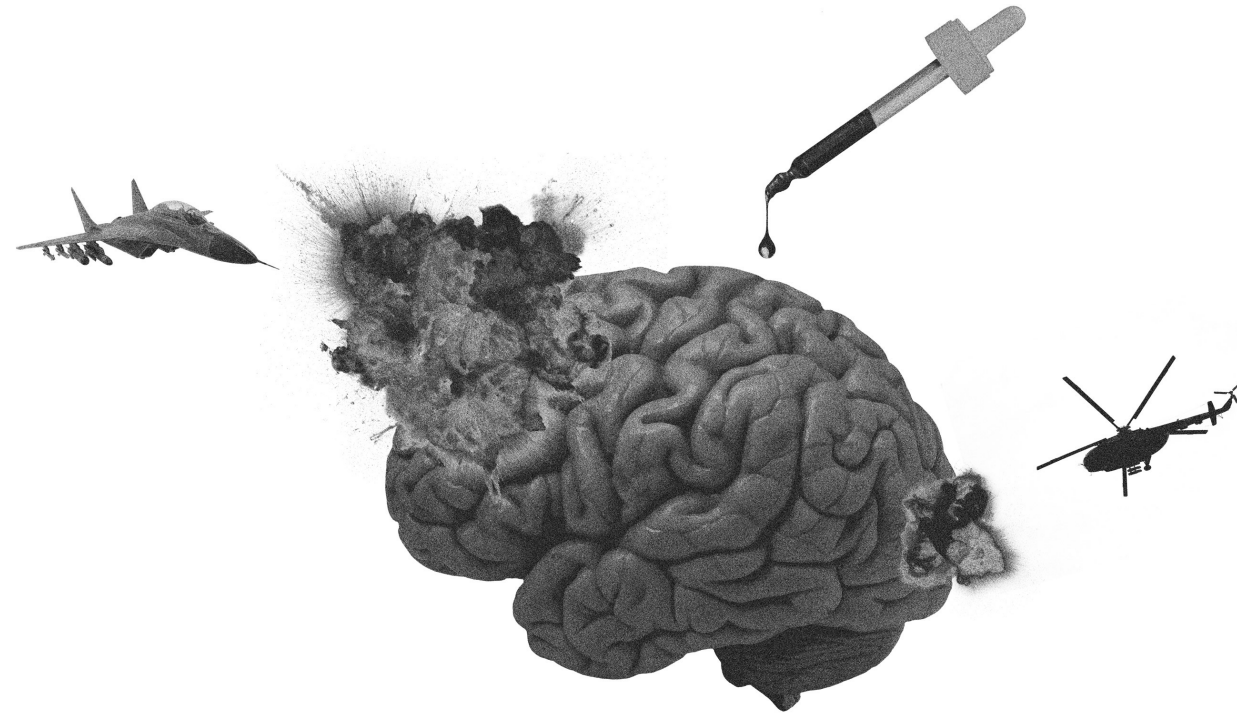
**TOXIC COMPOUND + METHOD OF DELIVERY =**



MACROVECTOR

# HOW CAN CHEMICALS BE USED IN ADVERSARIAL COGNITIVE WARFARE?

- Many unconventional tactics could be deployed
  - Exposing people to neurotoxic compounds
  - Introducing psychoactive chemicals into food supply
  - Spraying metallic nanoparticles are ingested and debilitate the brain and CNS
  - Exposing the population to developmental toxic chemicals to affect cognition in coming generations
  - Using AI to create new pharmaceuticals
  - Direct injection, ingestion, topical application, and inhalation
  - Hallucinogens → perception
  - Drug-filled rubber bullets
  - Pump incapacitating agents into buildings



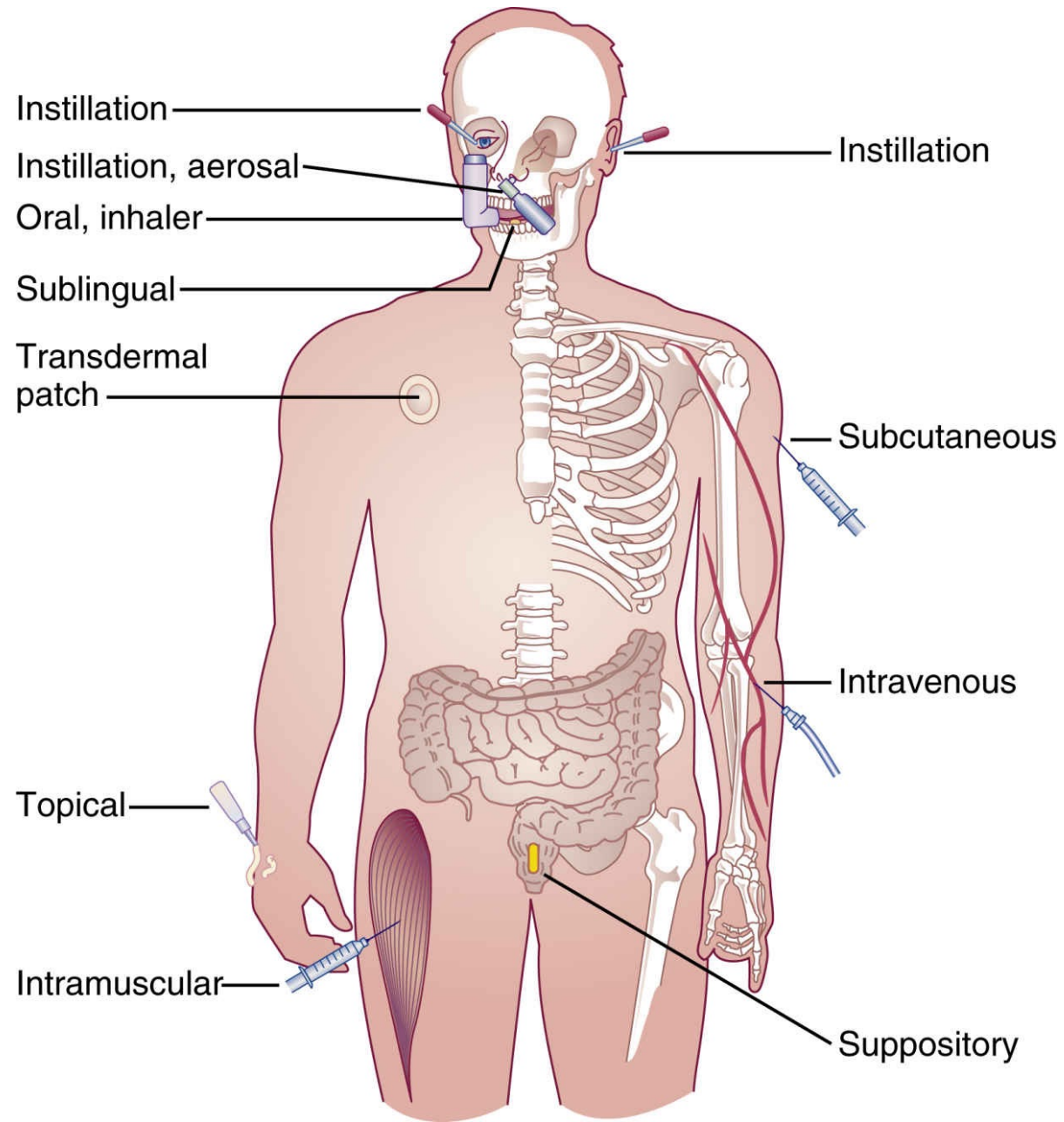
# WHAT IS STOPPING THEM?

- Effective delivery of an agent:
  - Dissemination and uptake
  - Delivering the appropriate concentration in the right places, dose-response, unpredictable effects, and a given drug's pharmaceutical window
- The pulmonary route is a popular method for targeted drug delivery of therapeutics
  - Aerosolization of incapacitating agents could meet operational requirements; large-scale open-air dissemination for battlefield use, counterterrorism or hostage rescue, and individual targeting for riot control purposes
  - Crucial differences between drug delivery in a clinical and a weapons context
  - The blood-brain barrier
    - But, nanotechnology-based drug delivery systems demonstrate the potential to deliver peptides to the brain

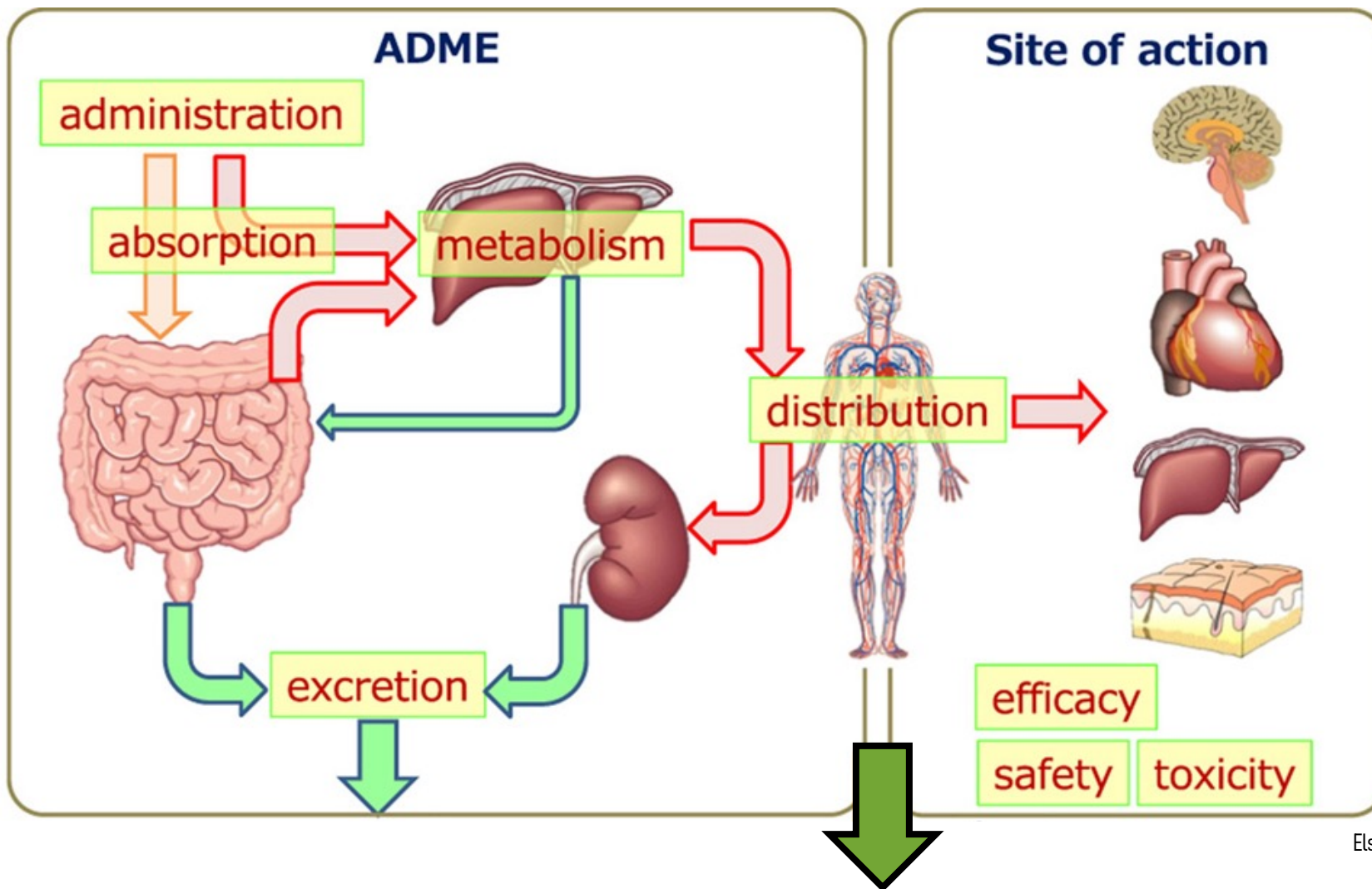


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# Routes of Drug Administration







Elsevier 2018

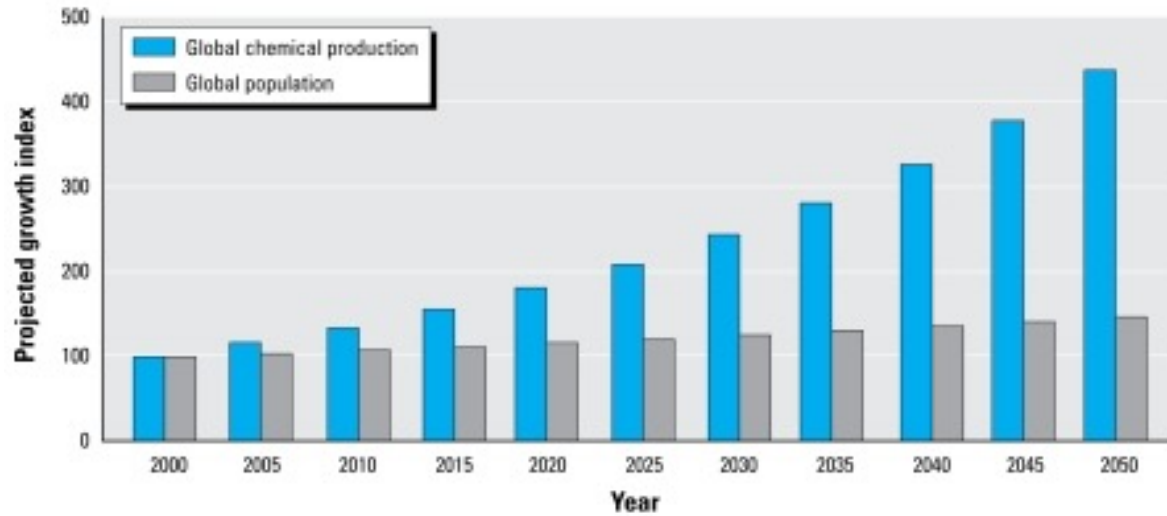
# IS IT LEGAL TO USE CHEMICALS AS WEAPONS?

- Legal?
  - No
- International treaties strictly regulate chemical weapons and require member states to establish domestic controls and exercise export control to prevent their proliferation.
- The CWC prohibits the development, production, acquisition, stockpiling, transfer, and use of chemical weapons and **use of toxic chemicals** unless for some given purposes:
  - Chemicals used for industrial, agricultural, research, medical, pharmaceutical or other peaceful purposes
    - Many chemicals that may be used as cognitive weapons are regulated as pharmaceuticals
  - Employment of chemicals (notably domestic riot control agents) by law enforcement, including manufacturing, stockpiling = legal
    - RCA in warfare = prohibited
- The OPCW monitors State Parties' compliance

# IS IT LEGAL TO USE CHEMICALS AS WEAPONS?

- Serious concern that development, manufacturing, stockpiling and use by law enforcement of pharmaceuticals can be used as cover for developing pharmaceutical-based agents/central nervous system-acting chemicals as new types of chemical agents
- The use of CNS-acting chemicals as an aerosol for law enforcement purposes is considered inconsistent with the CWC
- Biological and chemical weapons control requires a balance between eliminating the use of such weapons and promoting beneficial applications of chemical and biological sciences
  - BZ is used in the research of Parkinson's disease, Alzheimer's disease and other types of dementia
  - U.S. Army explored the same drugs that now are prescribed in lower doses to treat Tourette's Syndrome as incapacitating agents

# FUTURE PERSPECTIVES ON THE WEAPONIZATION OF CHEMICAL AGENTS



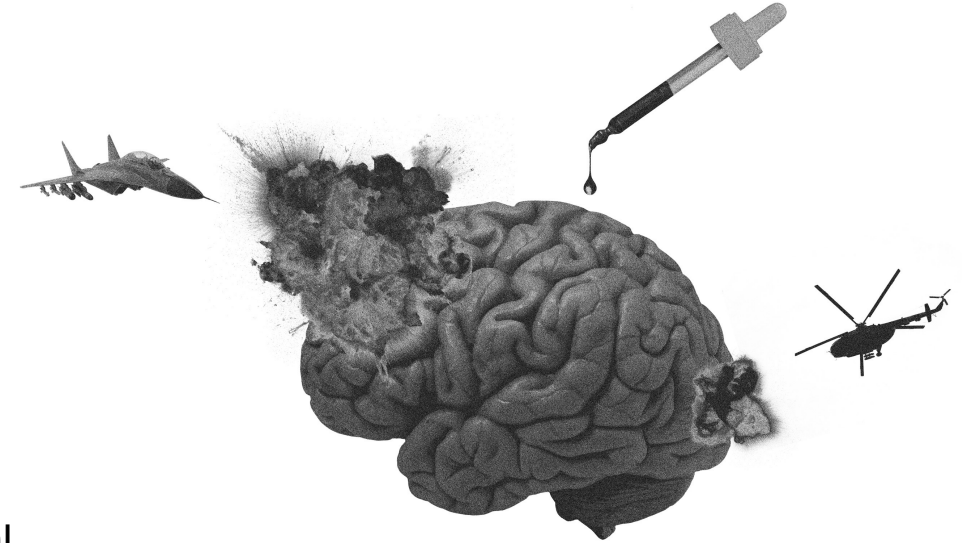
(American Chemistry Council 2003; OECD 2001; United Nations 2004).





# MAIN FINDINGS

- Chemical agents can be used as attack vectors in cognitive warfare, posing significant challenges to national security and defence
- The threat is multifaceted
  - Military-grade agents, novel incapacitating agents, toxic chemicals
  - Accessibility is expected to increase due to emerging technologies
  - Can alter cognition and behaviour
- New chemicals can be developed while hidden in a legitimate chemical production facility, e.g., PBA.
- To “outsmart” our adversaries, we must study their novel methods of targeting human cognition with chemicals and develop effective countermeasures and defences
  - NATO's adversaries do not necessarily operate under the same ethical standards and values as liberal democracies





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**FFI turns knowledge and ideas  
into an effective defence**