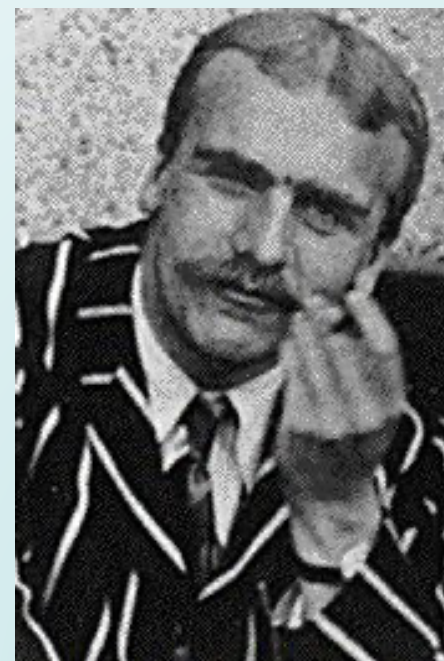


# Science and Technology for NPTS

## Chemistry Segment Instructor: Mark Bishop

*"If...in the future wars we are to avoid gross mismanagement in high places and panic...among the masses, it is essential that everyone should learn elementary science, and that politicians and soldiers should not be proud of their ignorance of it..."*

*J. B. S. Haldane*



# Scenario



- You're working for the state department.
- American troops have been attacked by what appears to be a chemical agent.
- Because it's known that you have some knowledge of chemical weapons, you've been invited to a meeting where the attempts are made to answer a variety of questions, including the following.
  - *What do you think the chemical was?*
  - *Who were the likely attackers?*

# Questions Relating to These attacks

- What are the most common chemical weapons?
- What are the symptoms of exposure?
- How quickly do they act?
- How deadly are they?
- How are they dispersed?
- Are they hard to make? Is it hard to get the necessary ingredients (precursors)?

# Other Important Questions



- How do scientists help to determine what was used?
- What are their physiological effects in the body?
- What are the treatments for exposure?



# What chemical weapons have already been used in Syria?



- Syrian American Medical Society, a charity that runs medical facilities in Syria, reported the following.
  - Nearly 200 chemical attacks since 2012
  - Used reports and first-hand accounts from physicians and health workers in Syria.
  - By 2015, documented chemical attacks led to at least 1,491 deaths and 14,581 injuries from chemical exposure.

<http://www.sams-usa.net/reports/a-new-normal-ongoing-chemical-weapons-attacks-in-syria/>

[https://www.sams-usa.net/press\\_release/sams-syria-civil-defense-condemn-chemical-attack-douma/](https://www.sams-usa.net/press_release/sams-syria-civil-defense-condemn-chemical-attack-douma/)

# OPCW-UN Fact-Finding Missions (FFM) and Joint Investigative Mechanism (JIM)

- Described the investigations and results of eight cases of possible use of chlorine or a chlorine derivative and one related to the use of sulfur mustard in Syria.
- Reported that there were three incidents where there was either a substance “matching the characteristics of chlorine”, “a canister with traces of chlorine or a chlorine-like substance”, “a significant number of people — up to 150 — may have been exposed to chlorine” and a “canister with traces of chlorine”.
- Two cases with a “toxic substance” used.
- They reported one incident where “there was sufficient information to conclude that Islamic State in Iraq and the Levant (ISIL) was the only entity with the ability, capability, motive and means to use sulfur mustard in Marea on 21 August 2015”.
- For the other incidents, they were unable to confirm the use of chemical weapons.

[https://www.un.org/ga/search/view\\_doc.asp?symbol=S/2016/738](https://www.un.org/ga/search/view_doc.asp?symbol=S/2016/738)

# OPCW-UN JIM Report



- One goal is to help you understand and evaluate important documents, such as the Third Report of the Organization for the Prohibition of Chemical Weapons-United Nations Joint Investigative Mechanism relating to the use of chemical weapons in Syria.

[https://www.un.org/ga/search/view\\_doc.asp?symbol=S/2016/738](https://www.un.org/ga/search/view_doc.asp?symbol=S/2016/738)

# VX Attack on Kim Jong-nam



- 13 February 2017 - Kim Jong-nam killed in the Kuala Lumpur International Airport in Malaysia
- Eldest son of Kim Jong-il
- Half brother of Kim Jong-un
- Two women are thought to have attacked him with the nerve agent VX
- Widely believed to have been ordered by the North Korean government

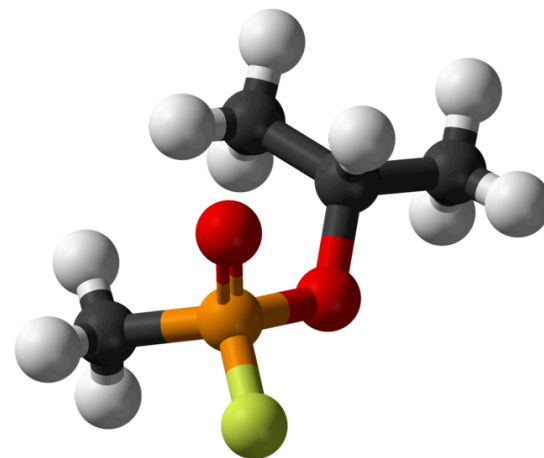
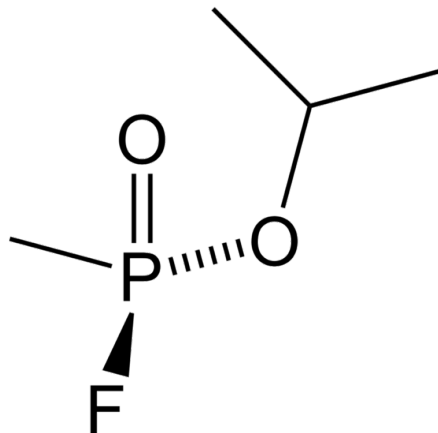
# Questions Relating to VX Attack on Kim Jong-nam



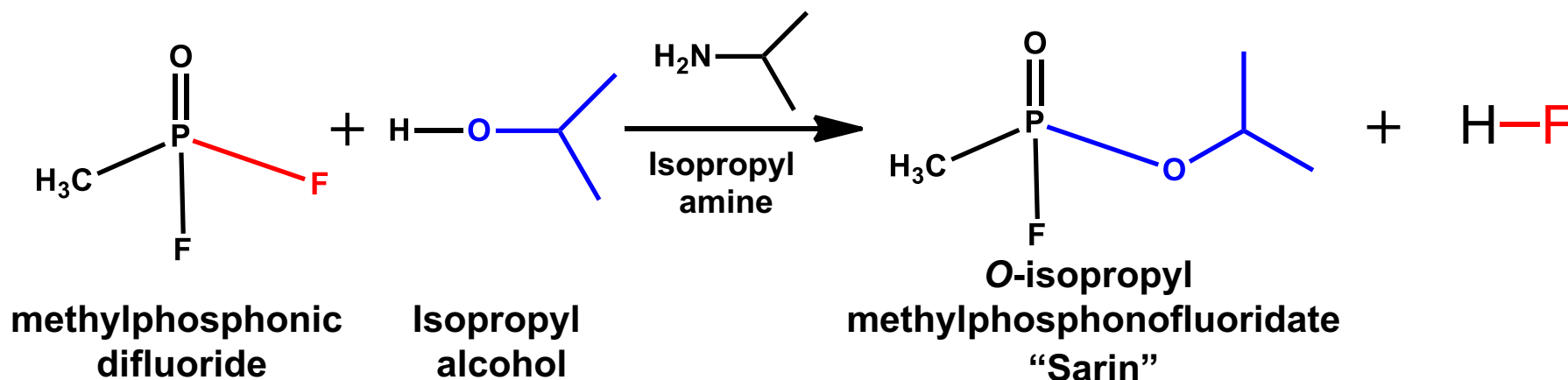
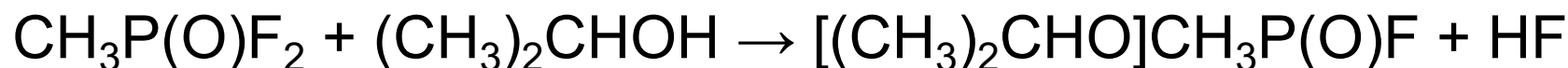
- Why did the two women touch Kim Jong-nam's face?
- Why weren't the two women significantly affected?
- Why weren't the other people in the airport and in emergency vehicle affected?
- Is North Korea thought to have VX and other chemical weapons?
- Are there restrictions for making, stockpiling, and using chemical weapons?
- Do these restrictions apply to North Korea?



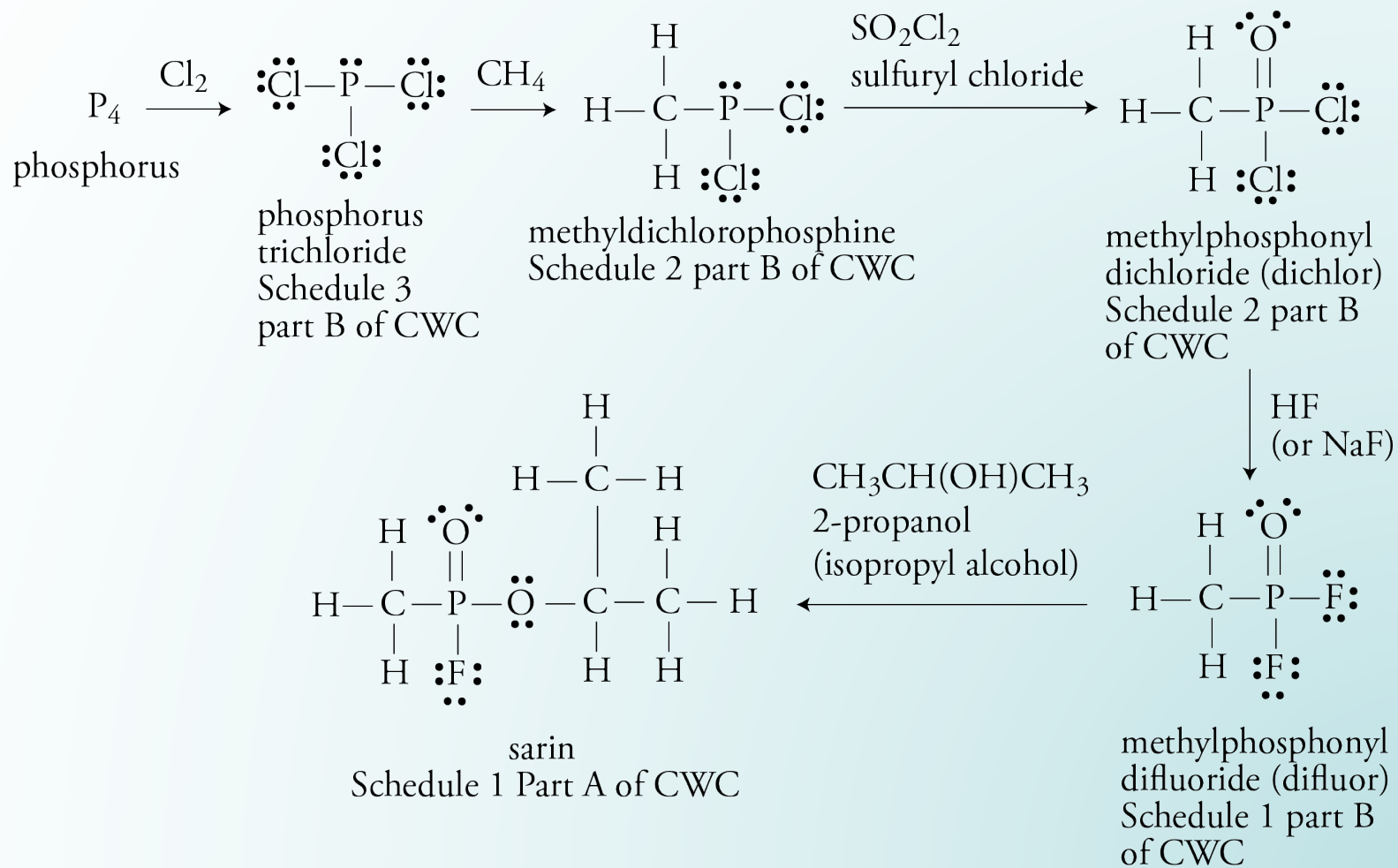
# Sarin (GB)



- Most easily prepared from methylphosphonyl difluoride and isopropyl alcohol.



# Rough Possible Steps for Production of Sarin



# Russia's Novichok



- Novichok (new guy or newcomer) – a category of nerve agents allegedly developed in the 1970s and 1980s in a Soviet secret program called Foliant.
- One of the Novichoks, called A-234, is thought to have been used in the Salisbury, UK attack on the former Russian military intelligence (GRU) officer Sergei Skripal and his daughter Yulia in March of 2018.

# Novichok to Schedule 1



- October 2018 - the U.S., Canada, and the Netherlands proposed adding two groups of Novichok chemicals, including A-234, to Schedule 1.
- January 14, 2019 - OPCW Executive Council recommended adoption
- April 2019 - Russia submitted its formal objection to the joint proposal, thus preventing the Executive Council's recommendation from becoming final

# Novichok to Schedule 1



- November 27, 2019 - Twenty-Fourth Session of the Conference of the States Parties to the CWC adopted two decisions to amend for the first time the Annex on Chemicals to the Convention by adding Novichoks and some carbamates to Schedule 1.

<https://www.opcw.org/media-centre/news/2019/11/conference-states-parties-adopts-decisions-amend-chemical-weapons>

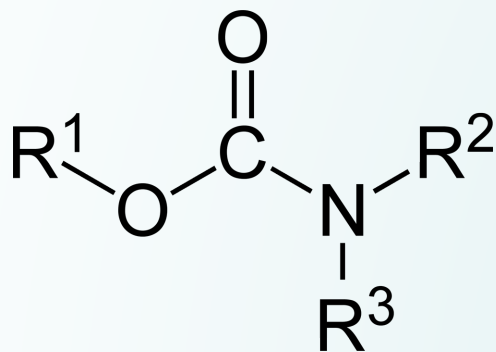
<https://www.opcw.org/chemical-weapons-convention/annexes/annex-chemicals/schedule-1>

<https://www.armscontrol.org/act/2020-04/features/updating-cwc-we-got-here-what-next>

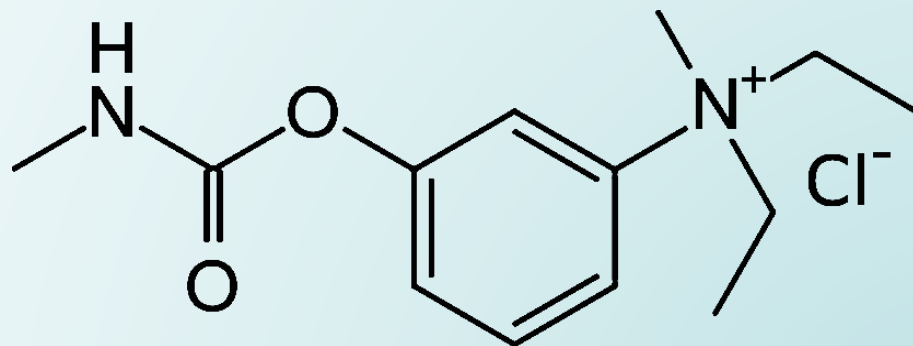


# Carbamates to Schedule 1

- Some carbamates were studied as potential nerve agents, but they were not considered suitable for weaponization.
  - Do not pass through blood-brain barrier
  - Only stable in solid or aqueous form



General structure



T-1123

# Assignment



- An assignment will begin after the fourth chemistry module lecture.
- You will divide yourselves into groups of four.
- Two people in each group will pretend to be either *terrorists* or a country's *military leaders* and plan a simulated chemical weapons attack...choosing the goal of the attack, the target, the chemical weapon, the means of dispersal, the source of the chemical weapon, and the means of transporting the chemicals.
- Two people in each group will act as the *security team* attempting to stop the attack.



# Assignment

- The *terrorists* or *military leaders* will provide subtle clues to the *security people*.
- Based on the clues they have received, the security team will develop a plan to stop the attack, and failing that, a plan to minimize the effects of the attack.
- Each group of four will make a 5-minute presentation describing their experience.

# Recommended Reading



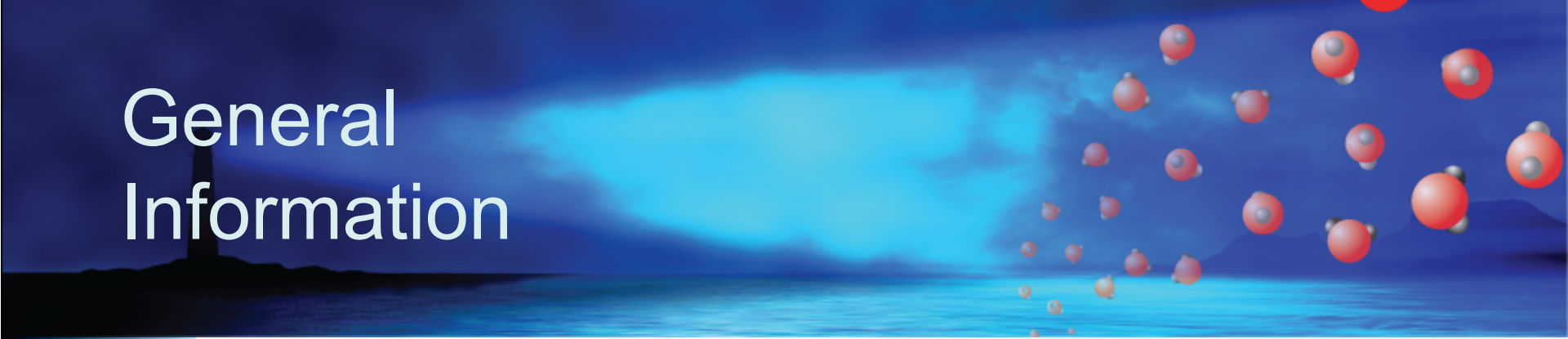
- *An Introduction to Chemistry – Atoms First* by Mark Bishop

[http://preparatorychemistry.com/Bishop\\_Atoms\\_First.htm](http://preparatorychemistry.com/Bishop_Atoms_First.htm)

- *War of Nerves – Chemical Warfare from World War I to Al-Qaeda* by Jonathan B. Tucker ISBN 978-1-4000-3233-4

[https://www.amazon.com/s?k=War+of+Nerves+%E2%80%93+Chemical+Warfare+from+World+War+I+to+Al-Qaeda&ref=nb\\_sb\\_noss](https://www.amazon.com/s?k=War+of+Nerves+%E2%80%93+Chemical+Warfare+from+World+War+I+to+Al-Qaeda&ref=nb_sb_noss)

# General Information



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## Web Sites

[https://preparatorychemistry.com/Bishop\\_Atoms\\_First.htm](https://preparatorychemistry.com/Bishop_Atoms_First.htm)

[http://institutebishop.org/science\\_technology.htm](http://institutebishop.org/science_technology.htm)

## Canvas