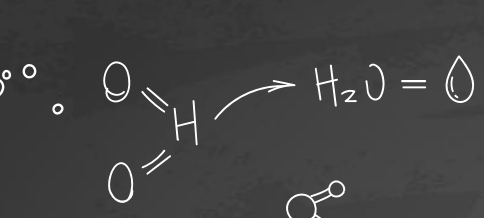
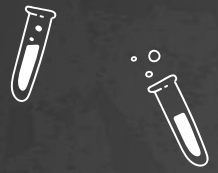
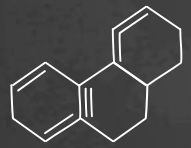
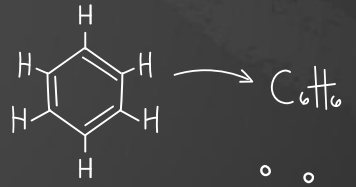
Chemistry - Some thoughts on How Chemistry helped to fight famine, deseases, and kill millions

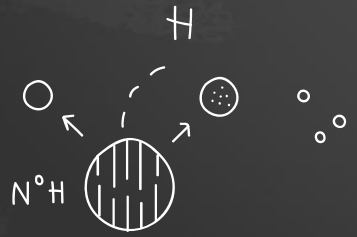
05/23/21

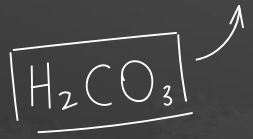




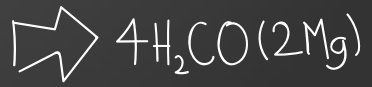











Haber - Bosch process

$$N_2 + H_2 \rightarrow NH_3$$

Fixing nitrogen allowed making fertilizes to feed more people

It is estimated that without chemical fertilizers some 3.5 billion people - almost half of the glob's population - wouldn't be alive today...

Fritz Haber

One of the ways to get explosives:

$$HNO_3 + NH_3 \rightarrow NH_4NO_3$$

The WWI was prolonged for 3 years according to Haber because the process allowed to generate a substitute to the saltpeter.

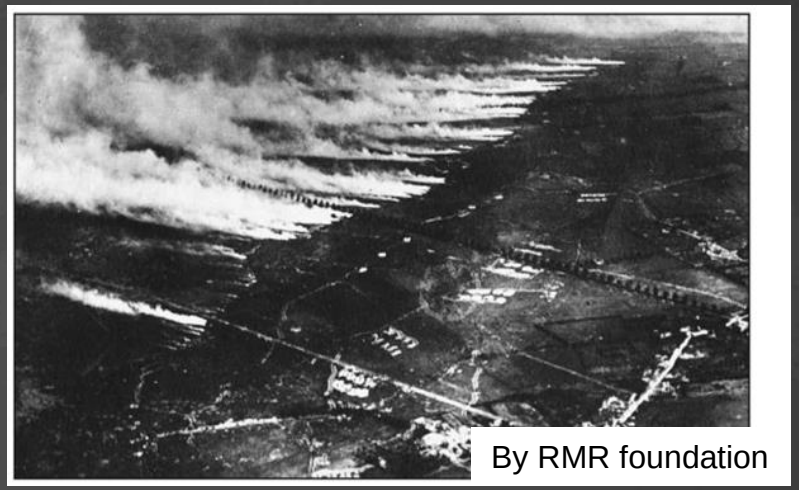
Haber - continued

The first use of the weapons of mass destruction

April 22, 1915, town of Ypres
Western Belgium

From: The great war blog

Chlorine was released from canisters...



By RMR foundation

Germans signed the Hague convention of 1899 which forbade "use of ***projectiles*** the sole object of which is the diffusion of asphyxiating or deleterious gases"

" When we got to the French lines, the trenches were empty. But in a half mile, the bodies of the French soldiers were everywhere... You could see where men has clawed at their faces, and throats, trying to get their breath. Some had shot themselves. The horses, still in the stables, cows, chickens, everything, all were dead"

Haber: " I was a college professor and therefor not to be headed"

Haber was awarded Nobel prize in chemistry in 1918 (received in 1919)

Clara Immerwahr

Immerwahr publicly protested that the work of her husband was a "perversion of the ideals of science" and that it was "a sign of barbarity, corrupting the very discipline which ought to bring new insights into life".

CHEMICAL WARFARE WORLD WAR 1

WORLD WAR ONE IS SEEN AS THE DAWN OF MODERN CHEMICAL WARFARE, WITH A VARIETY OF DIFFERENT CHEMICAL AGENTS BEING EMPLOYED ON A LARGE SCALE, RESULTING IN APPROXIMATELY 1,240,000 NON-FATAL CASUALTIES, AND 91,000 FATALITIES. A VARIETY OF POISONOUS GASES WERE USED THROUGHOUT THE CONFLICT, WITH EACH HAVING DIFFERING EFFECTS UPON VICTIMS.

TEAR GASES

(ethyl bromoacetate, chloroacetone & xylyl bromide)

CHLORINE

PHOSGENE

(carbonyl dichloride)

MUSTARD GAS

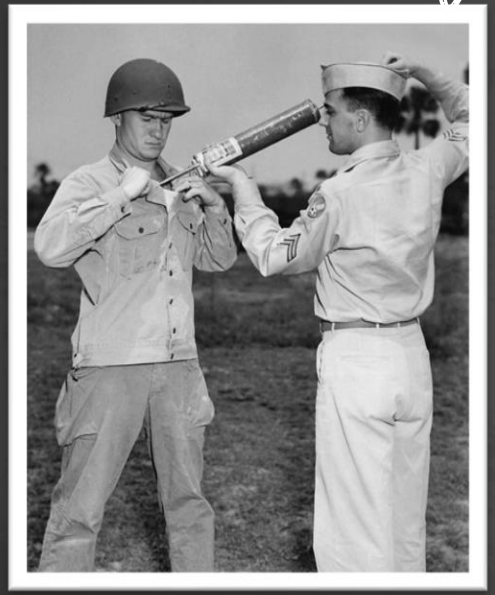
(bis(2-chloroethyl) sulfide)

US developed arsenic-based chemical known as Lewisite

1914	1915	1915	1917
France against Germany	Germany against France and Britain	Germany against Britain	Germany against Britain 1918- Britain against Germany 1919 - Britain against Red Army

10% of all casualties was from chemical weapons

After the war… Synthetic pesticides. DDT



A U.S. soldier is demonstrating DDT hand-spraying equipment. DDT was used to control the spread of typhus-carrying lice.

https://commons.wikimedia.org/w/index.php?curid=1889029

Paul Muller – Swiss chemist, discovered DDT insecticidal properties in 1939

An airplane spraying DDT over Baker County, Oregon as part of a spruce budworm control project, 1955

https://commons.wikimedia.org/w/index.php?curid=60428907

DDT is an endocrine disrupter and possible carcinogen...

In 1925 the Geneva Protocol was signed prohibiting the use of chemical weapons in war, but it did not ban production and stockpiling.

WWII

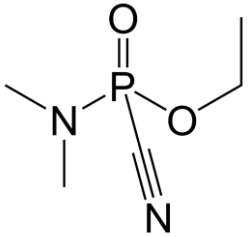
After the Geneva Protocol, chemical weapons were not used in combat.

But all the major powers still worked on them.

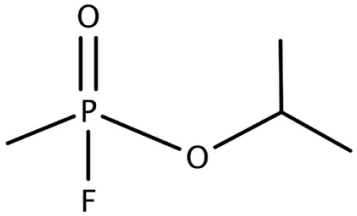
From 1936-1944, German chemists discovered 3 new nerve agents: Tabun, Sarin, and Soman.

After 1945 Soviet forces moved the Tabun plant from Germany to Stalingrad.

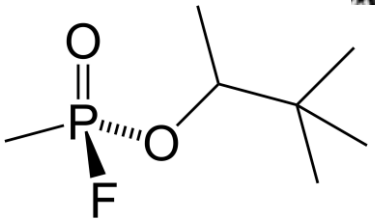
Aerial image of Dyhernfurth Tabun factory in 1941 taken by British spy planes.
Credit: National Collection of Aerial Photography, NCAP-000-000-036-543



Tabun



Sarin



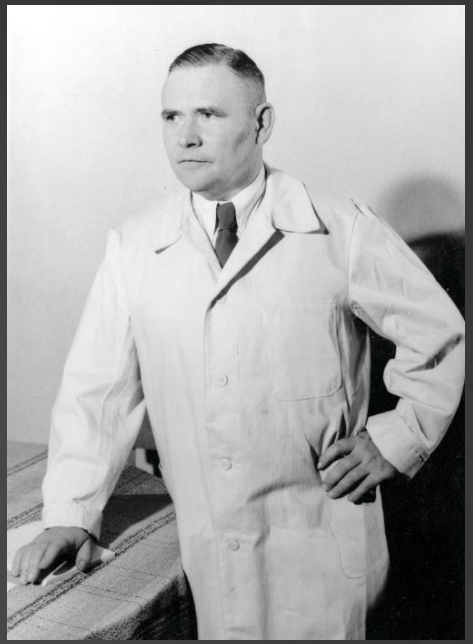
Soman

Hundreds of tons of tabun were shipped to the US

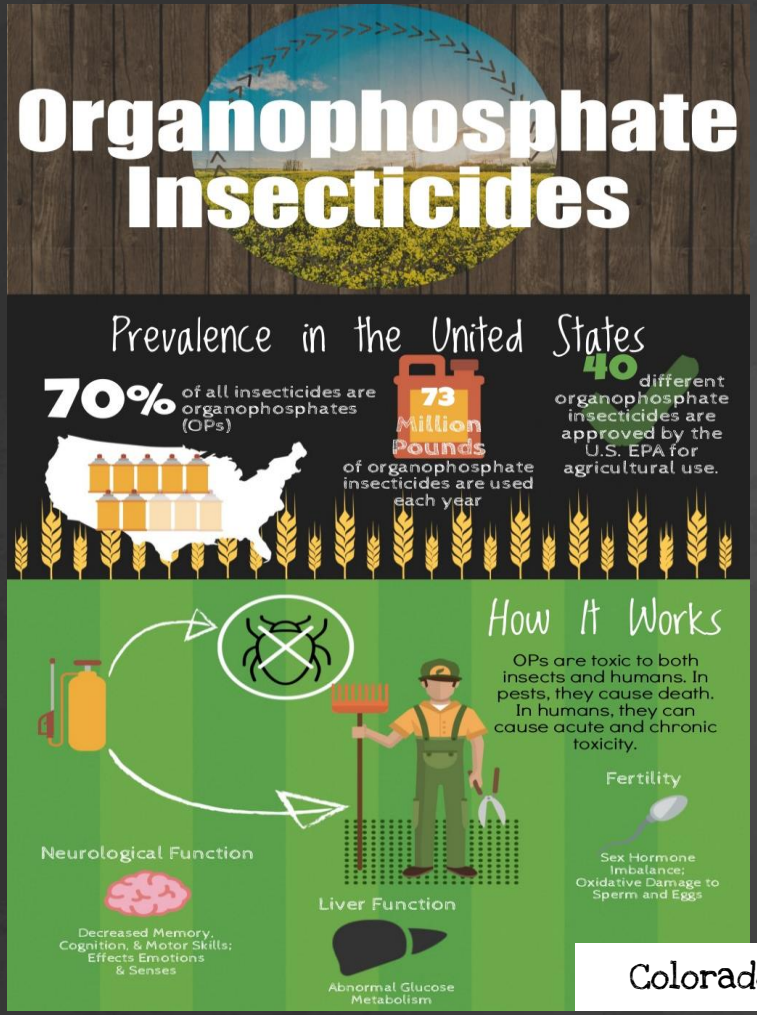
Nazi chemists were recruited in the US to counteract the Soviets in their search for the new toxins.

Shrader produced 2 reports:

1. Unclassified – organophosphate insecticides
2. Classified – on organophosphate nerve gases



Gerhard Shrader – Nazi chemist, developed organophosphate nerve agents. After 1945 worked in the US.



"Persistent habit of solving problems with chemicals that introduce new problems" (Von Hippel)

Colorado State University

https://youtu.be/tbQsByQTaqI

Since 1960s neonicotinoids...

Application of nionics to rice fields led to a dramatic decline in the food available for fish in lake Shinji, north of Hiroshima, which in turn, led to the collapse of the lake's fishery

Eliminating "knocking" in car engines

Thomas Midgely Jr. discovered in 1921 that "knocking" in car engines could be eliminated by lacing gasoline with tetraethyl lead.

By Plaz… …BY-SA 3.0, https://cc… …ikimedia.org/w/index.php?curid =1027241…

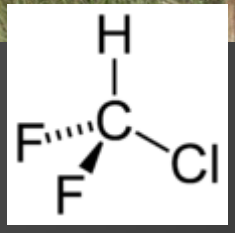
Over the ne… TRI…

The prize of eliminating knocking turned out to be neurological damage in kids all over the world…

Thomas Midgely Jr. suffered lead poisoning in the course of his research

Refrigerators

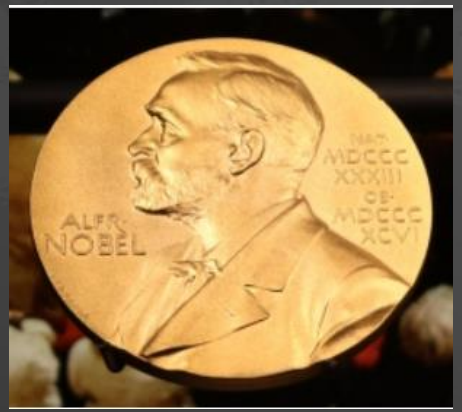
Early refrigerators used toxic chemicals like methyl chloride and sulfur dioxide. Several people were killed by appliances leaking methyl chloride.



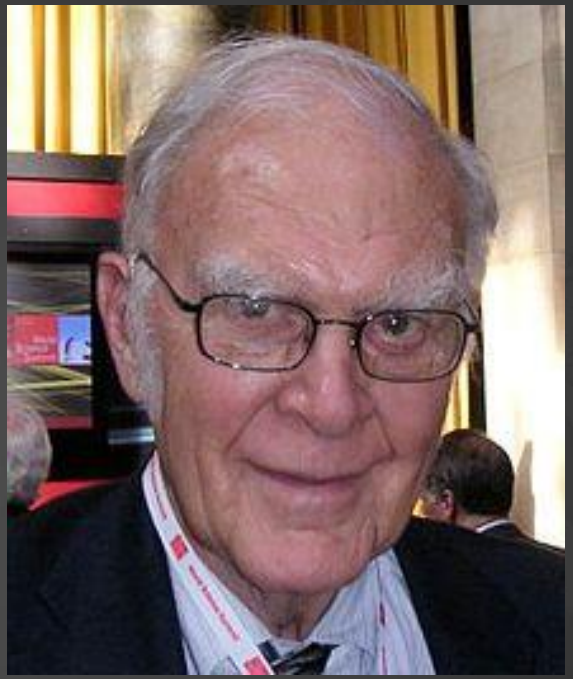
In 1928 Midgely and his team came up with the world's first chlorofluorocarbon, or CFC – Freon. Giant step froward for Frigidaire, but a great step back for planet Earth…

Released into the air, the compound made its way to the stratosphere, where it damaged the ozone layer, which protects the globe from ultraviolet radiation…

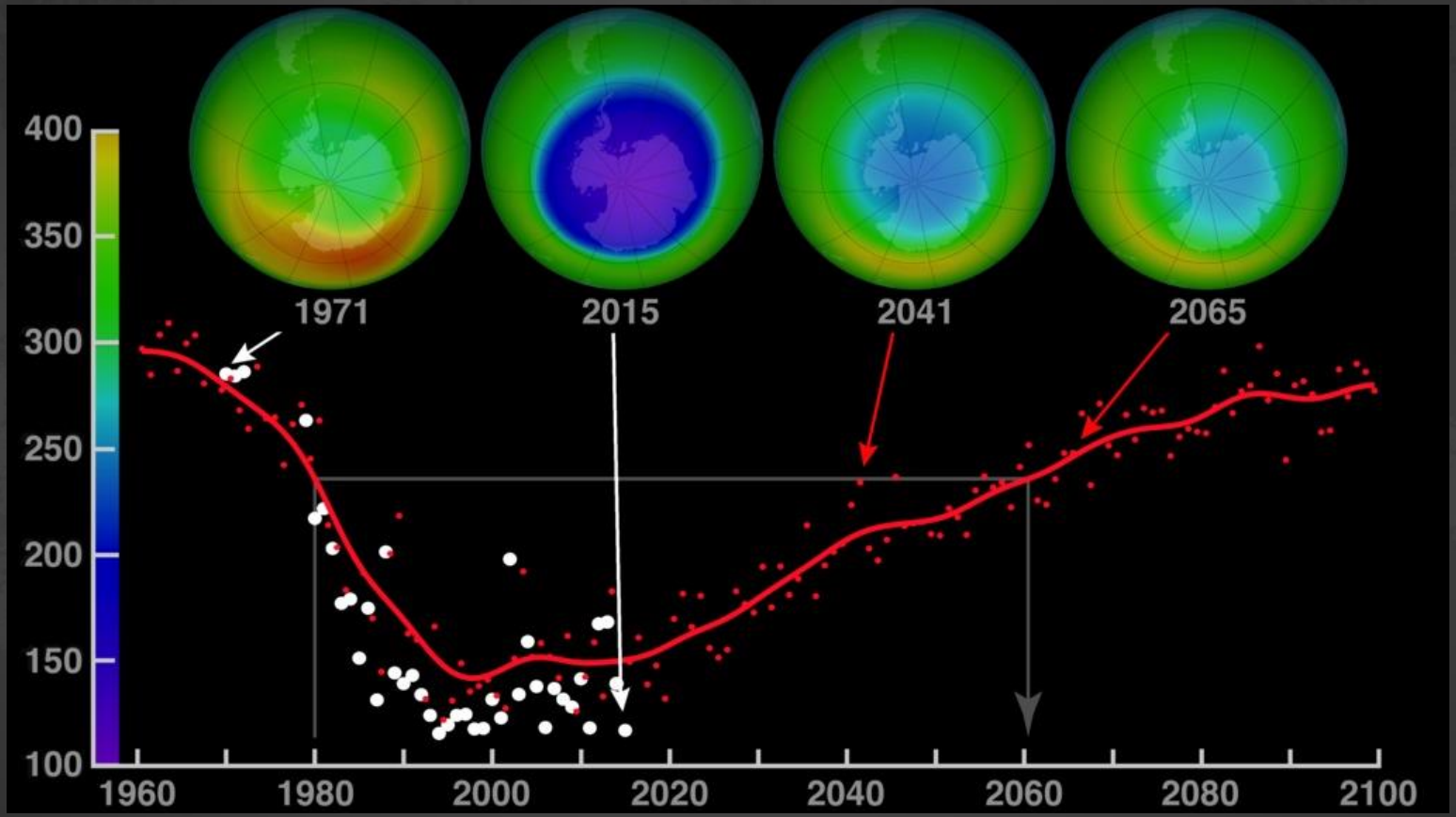
"The work is going very well but it looks like the end of the world"



Nobel Prize in 1995



Professor Sherwood Rowland proposed mechanism of fluorocarbons contribution to ozone level depletion.



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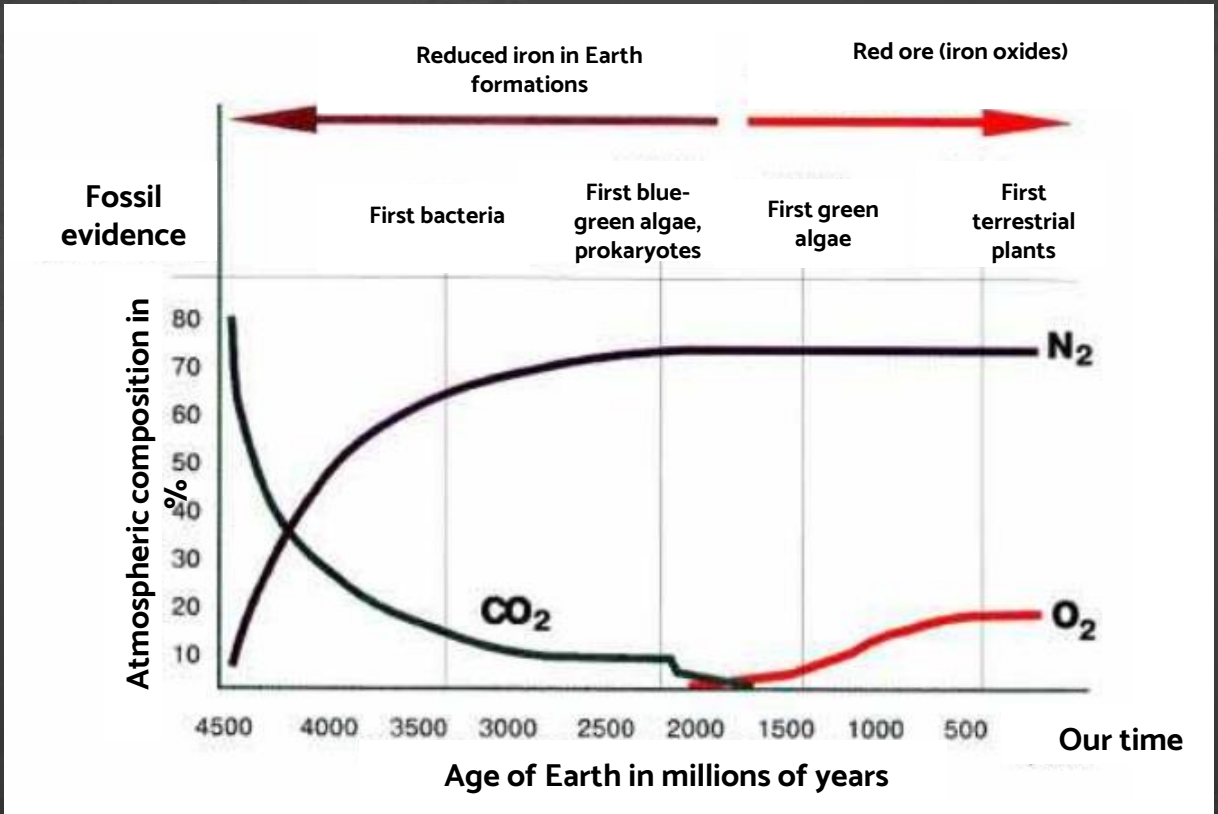
The question is whether any civilization can wage relentless war on life without destroying itself, and without losing the right to be called civilization" *Rachel Carson, 1962*




HAPPY
SUMMER
VACATION!

This class uses the materials from the following sources:

Manyuilov and Rodionov “Chemistry for children and adults”
Kuzmenko, Eremin, Popkov “Beginnings of chemistry”
E. Kolbert “Chemical warfare’s home front”
F. A. von Hippel “The chemical Age...”