

THE SCIENCE AND POLITICS OF CHEMICAL WARFARE

AN INTERVIEW WITH MATTHEW MESELSON

Professor Meselson has served as a chemical weapons advisor to the U.S. government since 1963 and was the recipient of the American Association for the Advancement of Science (AAAS) 1990 Scientific Freedom and Responsibility Award. The AAAS cited his "persistent questioning—in the face of hostile criticism—of claims that the Soviet Union was supporting the use of a yellow, rain-like chemical warfare agent in Southeast Asia." The AAAS also noted his study of military herbicide use in Vietnam and his success in "influencing the United States government to renounce biological warfare." In this interview Professor Meselson discusses the status of modern chemical and biological warfare and its effect on the recent Gulf Crisis.

What has been your involvement with the politics and policy making of U.S. biological and chemical weapons?

I got into this by accident. I was a student at Cal Tech in the fifties, when there was a lot more secrecy in connection with military matters and political matters. And it seemed to me very frustrating, because it seemed that maybe what we have in the world is something completely different from what ordinary people think is happening. Because it's secret. Maybe there was another whole universe out there, and if only you could do the right transformation you would see the real universe.

I came to Harvard in 1961. In the summer of 1963, Paul Doty, then in the Chemistry department, told me there was a job opening at the U. S. Arms Control and Disarmament Agency to spend the summer working on arms control projects for the government. He asked if I was interested and I said yes. It sounded interesting because I would work with classified documents and I could discover this other world. They chose six of us. One of the others was the physicist Freeman Dyson. I got there and they told me I would be working on European theatre nuclear arms control. For about a week I tried, but then I realized that I didn't know anything about nuclear weapons. Worse than that, a lot of other people did. So I went to my boss and told him that this wouldn't produce anything useful. Why not have me work on something where I

had more knowledge and they had more need? He said sure, and so I looked at chemical and biological weapons. I decided to forget about chemical weapons that summer because biological weapons was already a big enough subject. I read everything I could, I went to the CIA to see what we thought other countries were doing. I went to Fort Detrick to see what we were doing. At that time we had a very active biological weapons program. We were stockpiling various microorganisms and viruses as weapons.

What kind of biological weapons was the United States investigating at the time?

Pasturella tularensis which is now called *Francisella tularensis* which causes tularemia, which is likely to be lethal if inhaled and Venezuelan equine encephalitis, a virus that causes a severe and only occasionally lethal disease; and two plant

"At high levels I found that people get their information from the newspapers, TV, and from special briefings."

fungi, rice blast and wheat rust; and a couple of toxins, including saxitoxin, a peptide found in shellfish. With *Francisella tularensis* the effects are evident in a couple of days and death occurs within a week or so. With the toxins it is quite quick, within a few hours. Once eaten, the effects of saxitoxin are seen within a couple of hours.

What has been your position on biological warfare since that your work with the U. S. Arms Control and Disarmament Agency?

I returned to Harvard, but remained a consultant. That meant that I would go to the White House or the Arms Control Agency or the Defense Department. At that time I concluded that biological weapons were something we shouldn't be doing.

My reason was really U. S. self-interest. I asked what biological weapons could do—they could kill people over very big areas. The next question was, do we need such a capability? The answer was, no we don't need that additional capability because we've already got one—thermonuclear weapons. The last part of that logic is, why on earth should we be the ones to pioneer something that would give everyone else an ability which up to then only we and a very few other countries possessed? This way of looking at it didn't really prevail until President Nixon decided to completely eliminate the offensive biological weapons program. With his decision we completely renounced development, possession, and all offensive work. We still do research on vaccines and such, but there is no classified work in that.

There has been renewed interest in biological and chemical warfare since the beginning of the Gulf crisis. For perhaps the first time since WWI, U. S. troops are in danger of chemical and/or biological attacks. What is your perspective on this situation?

Many people have an understanding of chemical weapons and anti-chemical defenses based on the conventional wisdom which they pick up from conversations with others, newspaper articles and so on. That conventional wisdom is riddled with errors. Most of the errors are not random. They are perpetuated for reasons: one reason is that people—journalists and their readers—find an allure in shocking stories, so a shocking story or fact will propagate better than a non-shocking fact. Second, no part of the military can maintain good spirits if they don't get to make any new weapons in thirty years. Therefore, the chemical corps was put in the position of having to make strenuous arguments to justify their existence. Only after many years did they persuade the U. S. Congress to resume the production of poison gas weapons after President Nixon halted it in 1969. This reinstatement was in approximately 1985 to 1987. So it took years, and in the course of that, certain assertions would be reinforced more than others—namely those that

would make their case better. That the protection afforded by protective equipment was inadequate or that the burden of wearing the protective equipment interfered immensely with the performance of military duties. Because there was an institution which found favor in that approach and disfavor in the other—because after all if one were to say that defensive equipment was superb and the impact of chemical weapons on forces with equipment is minor then you can say, “Why should we bother

“So there’s a need for people who maintain a lifelong connection with something, and really know all of its ins and outs—the personalities, who’s who and where all the skeletons are.”

having chemical weapons if our adversaries can so easily blunt their effect? Why not spend our money on more effective weapons?”

Now, suddenly there’s the Gulf crisis, and a lot of the people at high levels don’t communicate much with the low levels, the people in the laboratories and the people who designed the equipment. Nor do they read the old documents, because a lot of the important work was done by people who either retired or died. At high levels I find that people get their information from the newspapers, TV, and from special briefings. But now you have to ask, who are the briefers? And the people who brief the decision makers often are not the people who know. So there’s a need for people who maintain a lifelong connection with something, and really know all of its ins and outs—the personalities, who’s who, and where all the skeletons are. That is something a scientist can do. Newspapers say that a drop of VX the size of a pinhead, 0.6 mg, will kill you. This is correct...if injected with a hypodermic syringe into your blood stream. The threat of VX that people are likely to encounter is the threat of it contacting the skin. Actually it

would take a hundred times as much as 0.6 mg to kill you, and then only if allowed to remain for a considerable time. If promptly wiped off with, say, talcum powder, you will not be affected. Now that’s very different. But the people who are making decisions often remember, “a drop the size of a pinhead.” So they will be more likely to think we have to threaten to use poison gas on the Iraqis to keep them from dumping it on us than they would think if better informed. Maybe we need to retaliate. Maybe we do not, but to make those decisions on the basis of misinformation is very dangerous.

How probable would the use of chemical weapons be in modern wars, keeping in mind the recent situation with Iraq?

There’s no doubt that the Iraqis used chemical weapons against Iran. The U. N. seven times sent a team to take samples and many, many Iranians with mustard burns on their bodies were sent to Western hospitals for treatment. The use is admitted by the Iraqis, but they say that the Iranians started it, although this is by no means substantiated.

Chemical weapons are mainly effective in ground wars--there’s no sense in using them in a militarily ineffective way. If you’re getting into a psychological or political milieu I’m no expert about the Iraqi mindset. But if you’re asking me from a military point of view, the SCUD attacks on civilians are militarily insignificant. It has great political impact, and so would gas, but has no military affect. But with a ground war, if they’re feeling desperate they might hope that their initial use of gas would have a significant effect.

So would the use of chemical warfare against troops be mainly a psychological weapon?

It depends. If used against unprotected people it is incredibly effective. Just look at Bhopal, if the weather is right and the people are not wearing gas masks it is a very efficient way of killing people over large areas. Every case in history when gas warfare has been initiated, beginning in WWI and



Courtesy of Matthew Meselson

continuing in Spanish-Morocco, in China, Mussolini against the Ethiopians, the Egyptians against the Yemenis and us in the case of using CS riot control agent (tear gas) in Vietnam, the gas was against people who initially had no gas masks. [CS was named after two Harvard chemists who first reported it's synthesis and unexpected toxicity.] There has never been a case in which poison gas was used against forces that initially had gas masks. Furthermore, there are many nations in the world that have armies; essentially all those armies have gas masks. Very few have troubled to have poison gas weapons. This is testimony to the fact that there is a vast difference between the utility of chemical weapons against people with gas masks and against people without them. So the answer to your question is: chemical weapons are relatively useless militarily against people with good anti-chemical defense but are very effective against others.

I don't think [chemical weapons] would ever be a large problem for our troops. Iraq has a lot of mustard gas, they must have several thousand tons of mustard gas. They also have tabun which is a nerve agent. They may in addition have a more persistent nerve agent called VX. They may also have a volatile nerve agent called sarin. First of all, some people think that in a chemical war it's poisonous everywhere, 24 hours a day at all points on the map. Well, the way to disabuse yourself of that is to think about conventional war. In a conventional war bombs and artillery and projectiles come in, then the attack stops, then starts in a different place, then it stops again. It's very sporadic and patchy. It is certainly not the case that artillery and projectiles are falling everywhere, all the time, or anything even remotely like that. It is certainly unlikely that any armed force will have more than 10% of their munitions as chemical weapons. So now take that very sporadic impacting of bombs and projectiles and take 10% of it. Now you're beginning to understand the distribution of chemical hazard on the battlefield. Some of those agents will be volatile, so for those the duration of hazard will be short. Not only that, in the day time the sand is hot and therefore the air rises leading to rapid vertical mixing. In this case there is hardly any downwind travel of the poisonous gases. It's only in the night and the very early morning that you can get a stable enough atmosphere to create a volatile gas hazard that will last for more than minutes.

How much danger is there in chemical weapons used against military targets drifting into civilian areas?

By that time it may be so dilute that you don't have a hazard any more. Once you get below a certain concentration it's harmless. But in a stable atmosphere, yes there can be a downwind hazard

for tens of kilometers. If you talk about a persistent agent there is mustard gas. It soaks into the sand, but it does evaporate slowly so there will be a vapor hazard where mustard is on the ground for a few hours under desert conditions. Vapor of mustard can attack your skin and cause blisters, but you have to stay in it for quite a while. In WWI we had no detectors and we had no protective clothing yet round per round, artillery shell per artillery shell, mustard gas was no more effective than high explosives. Saddam has the same old mustard gas, but we now have detectors and excellent protective clothing. Also we are much more mobile. In WWI people got mustard burns because they were stuck in trenches. Mustard vapor is dense and they were just lying in it. Even so, only two or three percent of the hospitalized victims died. So mustard gas is a burden, but it's no big deal for troops with modern

“I think a scientist should first of all try to analyze a problem as objectively as he possibly can—independently and critically and objectively. And then, however, not refrain from giving his own policy preferences and explaining them.”

detectors and protection.

The nerve agent, VX, will evaporate more slowly than mustard gas, but it will evaporate within a few hours in the desert. There's no significant vapor hazard to the skin. Mustard vapor can cause blisters, nerve agent vapor doesn't bother skin except at very high dosage. VX is thicker than molasses so if you think you have VX on your clothing you just take that off and throw it away. If it's on your bare skin you can wipe it off with a pad or talcum powder or with Fuller's earth; this can completely prevent any effects because it goes in very slowly. So yes, chemical weapons would

impose a burden, but nothing compared to the devastating effects of a high explosive fragmentation shell, which has improved a lot since WWI. I would much rather be in a war where only chemicals are used than one where only artillery high explosives are used. Artillery shreds people into pieces, it's just terrible.

In the Gulf War, has there been good contact between the scientists who really know about these subjects and those who make the decisions? Do you think any scientific advice has gotten to the upper echelons?

Yes, I personally have had contact with the government about this issue. Not only do they call me, I also call them. Also it has been said in some newspaper articles and television programs that our equipment is not good enough. I saw *The New York Times* had an editorial saying that the author of a weapons book, then they gave the incorrect name of the book, said that American masks were inferior to European masks. *The Times* said that this book, Jane's NBC Protection Equipment, is the bible of the field. Nobody I know considers Jane's any kind of bible in this field.

I was in Europe recently at the chemical defense establishment of one of our European allies, and I asked the director of personal protective equipment, “If you were in the Gulf, which mask would you prefer of all possible masks?” He said the M17-A1, which is the American mask. It's not that there are any big differences, but anybody who says there's something very different about our mask and any other doesn't know what they're talking about. Then there are the stories of cyanogen chloride and hydrogen cyanide that can go right through our masks...absolute nonsense. In WWII we discovered that the Japanese gas mask was penetrable to these agents if you use gigantic amounts. By gigantic I mean, say, ten 1,000 pound bombs over an area the size of a football field. Now you can't do that in very many places. We have developed our gas masks by impregnating it with chromium and certain other things so that it is vastly superior to the old Japanese mask. So this

was a problem that was addressed at the end of WWII and solved.

We never did use gas against the Japanese. The Japanese used it against the Chinese before we entered the war. The United States has never used gas, except with the Allies in WWI and our extensive use of the riot control agent, CS (tear gas), in Vietnam. Tear gas use was gas warfare inasmuch as it was used almost entirely to force people out of their bunkers and tunnels because it's very difficult to kill people in bunkers. Then we would hit them with artillery or with bombs from B-52's right after

"We have some state of mind that hacking people or blasting people is more acceptable than poisoning people or using biological warfare."

a CS attack when they were supposedly out in the open. But it didn't work, and then they got Chinese gas masks. We sent 11 million pounds of CS over to Vietnam, mainly in artillery shells and bombs.

What was the international reaction to the use of tear gas against the Viet Cong by the U.S.?

My sense is that international lawyers who have studied the issue are nearly unanimous that riot control agents in combat are prohibited by the Geneva Protocol of 1925. There's little room for doubt in that. In 1932 the British government asked the parties to the Geneva Protocol what they thought and every nation that responded said of course tear gas is prohibited. We were not party to that treaty, so we were not asked at that time. Then when the Vietnam War came around CS use was initiated without Dean Rusk's approval. In his view as the State Department's legal advisor it was a clear breach of the Geneva Protocol. After a brief pause the army resumed the use of CS. During war it is difficult to argue treaty points and international law.

After the war, President Ford issued an executive order that prohibits U. S. forces from using riot control agents in combat except for very particular purposes: one is the rescue of downed pilots. Maybe somehow by using CS if there were a lot of people without gas masks around the pilot trying to prevent rescue the gas use would make them clear out. Another permitted use is, I believe, with rioting prisoners of war; but never in combat. That executive order still stands, and puts us in the funny position where we've said to all other countries, "It's legal, the Protocol doesn't prohibit it;" while at the same time we are telling our own people you can't use it except for these very rare situations. So we're cutting off our nose to spite our face all because we used it in Vietnam and we never ever want to say we did anything wrong. Incidentally, we did not ratify the Protocol until after the Vietnam war anyway.

In WWI the first gas use was tear gas. Before the German chlorine attack in April 1915 the French were using tear gas and the Germans gave that as a reason for going on to use chlorine. In every other case of chemical warfare I know tear gas was used first, including Iraq. Maybe because people have it lying around. And then it can escalate to other gases.

On a final note, do you think we will be able to reduce our chemical weapons stocks?

Reduction is rather unimportant unless it is a prelude to getting rid of them completely. The 5,000 tons to which we would reduce under the U. S.-Soviet bilateral agreement is more than was permitted by recent congressional action anyway. Congress has required a 90% reduction, and the 5000 tons represents only an 80% reduction. The 80% that we do destroy will be the 80% that's not much good anyway. So it's very important if it is practice for getting rid of all of them completely. It's of little consequence otherwise. It's something we would have done anyway.

Do you think we should completely destroy our chemical weapons stockpile?

Yes, absolutely, in the context of a multinational chemical disarmament treaty.

What do you see as the social responsibility of the scientist?

I once saw a report by Wolfgang Panofsky who was on President Kennedy's scientific advisory committee. It was about antiballistic missiles [ABM's]. It had two parts: the first part was a careful and I think objective dissection of the problem, with all the different options the President might choose; the second part was his own views and what he felt about ABM development. I think a scientist should first of all try to analyze a problem as objectively as he possibly can—Independently and critically and objectively. And then, however, not refrain from giving his own policy preferences and explaining them. Both parts are essential, but if you blend those things together too much you lose your bearing. If you do just the former you lose something. Of course if you do just the latter, there's no distinction in being a scientist; everyone can do that.

Chemical and biological weapons have been universally condemned, whereas nuclear weapons have not. Why are chemical and biological weapons considered by lawmakers more dangerous to mankind than nuclear weapons?

I think the array of international laws we have is not necessarily a perfect mirror of what's good for mankind. It's also a mirror of what powerful nations want and do not want. To persuade the United States and the Soviet Union to give up nuclear weapons is not possible right now. There has probably been less condemnation of nuclear weapons for two reasons. First of all, with chemical weapons, sophisticated forces don't need them in combat against other sophisticated forces. Second, we have some state of mind that hacking people or blasting people is more acceptable than poisoning people or using biological warfare. The Romans even had a saying that "war is fought with weapons, not with poison." Where this comes

from, if there is such an instinct, as a chemist I can't tell you. But there does seem to be that attitude. Maybe there's some wisdom in it, because after all we're moving into an era of development when we will understand essentially all of life's processes including the mental ones. And if that technology of life sciences were turned to hostile purposes, whether in war or something else, that would represent using life in a deliberate way against life. Maybe there are standards that we just don't violate because of our humanity. But if you ask just what is humanity, we really don't know that much about it. There is a certain amount of sympathy with our

"All the things that make civilization worthwhile, where do they come from? Some people would say, if you start turning life against life you are doing something fundamentally dangerous to our future."

fellow creatures, that seems part of it. But what really is it? Is it possible that there are ways of losing it? Maybe there are. Maybe there are ways of behaving or ways of altering the body or altering the mind so that we lose the most precious possession, our fundamental humanity, which is sometimes not displayed very favorably but ultimately that's what we care about. If we didn't care, if we were just bacteria in a chemostat, and all we cared about was the right food and the right temperature and enough reproduction, none of us would be terribly interested in the whole thing. Then you look at, why did Homer write the *Iliad* and the *Odyssey*, why did the Sumerians have the *Gilgamesh Epic*? All the things that make civilization worthwhile, where do they come from? Some people would say, if you start turning life against life you are doing something fundamentally dangerous to our future.