Q & A

Chemical, biological weapons are quickly becoming anachronisms of war

Photo by Jane Reed

A Conversation with Matthew Meselson

Matthew Meselson is the Thomas Dudley Cabot Professor of the Natural Sciences and an expert on chemical warfare. Peter Costa is director of the University Office of News and Public Affairs. The following is an edited transcript of the conversation between Meselson and Costa.

Note: The war in the Persian Gulf was concluded without the use of chemical or biological weapons.

Costa: Before we talk about Iraq's arsenal of chemical and perhaps biological weapons, could you tell us something about the history of chemical weapons? I read that the Germans were the first to use chlorine gas on a large scale in 1914 during World War I.

Meselson: It was in 1915 in April, at the Second Battle of Ypres in Belgium. The German attack was based on releasing chlorine gas from about 5,000 cylinders that had been placed along a four-mile-long front. They waited for days until the wind was right. When it was right, they opened the taps on the cylinders, the chlorine gas cloud came out and rolled toward two divisions of French Colonial and Territorial troops. They broke, understandably, didn't know what it was, [and] had no gas masks. The Germans didn't advance very much before sundown. The next day, Canadians on one of the flanks held the line. The experiment was a flop in the sense that it was not followed up, it could have been, but the German military was not prepared to consider it as anything more than an experiment.

From then on, throughout the war, there was a race between newer chemicals and newer ways of delivering them, and gas masks and protective tactics. The defense won. Gas was not an important weapon in World War I. Huge amounts were used, it caused about three percent of the total casualties on the Western Front, but it was usually used against people in static positions, not against troops on the attack. Causing casualties in war to men who are just waiting around is not really a measure of military success. It's the blunting [of] the success of attacks that matters. Gas caused a lot of misery, but the gas mask—even though those old gas masks weren't very comfortable or terribly good—was enough to mainly deal with the problem.

Costa: Later on they were using something called phosgene. What is that?

Meselson: Phosgene is a gas that is a lung injuriant, and it was released from artillery shells and was one of the more lethal chemicals used in World War I. But, again, the gas mask afforded adequate protection. Although it certainly did cause casualties, even in the last year of the war, 1918, when gas warfare had evolved as far as it was going to in that war, shell for shell, German chemical shells were no more effective in causing casualties to the British expeditionary force [than] were German high explosive shells.

Costa: Later on, during World War II, the Germans developed but did not use something more potent: a weapon that used something called an organophosphorous nerve agent. What can you tell us about that?

Meselson: During insecticide research a series of compounds that were exceedingly toxic to both higher animals and insects was discovered. This was immediately [told] to the German army and [it was] developed as the first organophosphorus nerve agent, tabun, it's called, or GA. Then, at the end of the war, the United States and, I assume, the Soviet Union imported some of the German scientists and copied their work and we built up, as did the Soviets, very large stockpiles of nerve-gas weapons. We now have about 30,000 agent tons, mainly of two different nerve agents: one that evaporates quickly and one that evaporates slowly, and mustard gas. And the Russians have essentially the same thing plus one other blister agent in addition to mustard gas, one that we considered obsolete a long time ago called lewisite. The Russians also have a nerve gas that we don't have that is intermediate in the rate at which it evaporates. Their total

stockpile is about 40,000 tons, a little larger than ours. Both sides have a lot of obsolete weapons. I don't mean the chemical has become obsolete, I mean the caliber or the nature of the projectile or bomb is obsolete.

Costa: Let's look at biological weapons. They include viruses, bacteria, microbes that can cause things like encephalitis and Q fever. How has this research progressed and can these weapons be used to affect whole populations of cities?

Meselson: The work on biological weapons also goes back to World War I. Germans were doing it in World War I on a modest scale. During World War II, the United States built a huge factory in Vigo, Indiana, and later at Pine Bluff, Arkansas. We had a very large biological weapons program. We stockpiled tularemia, which was our standard lethal agent, and Venezuelan equine encephalitis, a virus which was our so-called incapacitating agent. All of that is completely gone [since] President Nixon decided to totally renounce biological weapons, even their development. None of that happens in the United States anymore *at all*. We don't have biological weapons. Biological weapons, in theory (because no one has ever done it) could cover very large areas because a very small amount in terms of weight of a microorganism is enough to infect a human being.

Costa: Could you demystify the concept of binary chemical weapons? What does that mean?

Meselson: It's a simple concept. It's the idea that instead of having the nerve agent itself, which is very toxic, you have two precursors that when mixed form the highly toxic nerve agent. Although one of them is rather toxic, neither of them is nearly as toxic as nerve agent itself and so it would make people feel less queasy about shipping it around. Of course, if you ship around the separate canisters and assemble them only on the battlefield, you pay a price. It means that the complexity, first of shipping then of receiving, of assembling and, if they're not used, disassembling these weapons falls on the shoulders of the people who have the least time to spare for such operations, namely, soldiers in a war. Nevertheless the United States did begin to make these binary weapons, that release exactly the same gas as our other GB nerve agent artillery shells, but they are binary. However, we have stopped making them; the program has been cancelled. We and the Soviets have a bilateral understanding which, after Congress acts, will be an agreement, and that involves destroying about 80 percent of our holdings down to 5,000 tons, and also ceasing all production.

Costa: Let's look at the Iraq situation. As we speak, the ground war is in its second day, and it appears to be going very well for the coalition forces although there is the fear that chemical or biological weapons could be used by the Iraqis. Was Iraq a signatory of the Geneva protocol of 1925?

Meselson: Yes, indeed. They ratified the Geneva protocol way before we did. The Geneva protocol prohibits only actions in war. The action in war was the use of chemical weapons against Iranians by Iraq. The use against the Kurds, if you mean the village of Halabja or the subsequent events near the Turkish border, was not in war. Although [it was] an atrocity, [which] you can compare, for example, to Hitler's gassing of people in World War II, it was not covered by the Geneva protocol.

Costa: I have the wording here: "The use in war of asphyxiating, poisonous or other gases, and of all analogous liquids, materials, or devices is prohibited." So you're right. What kinds of chemical and or biological weapons does Saddam Hussein really have?

Meselson: What he really has, I don't know. What we do know [is that] under power granted by the General Assembly and the Security Council, the United Nations Secretary General sent eight different investigating teams to Iran mainly, but also to Iraq, to investigate the use of chemical weapons. They documented, took samples, and had them analyzed. Many Iranian mustard gas victims were sent to hospitals in Western Europe, so there is no doubt about [its use]. Also collected in the battlefield [were] samples of the nerve agent tabun. There are also reports about the nerve agent GB (sarin), one that evaporates quickly, and even VX. I can't certify [the presence of] that last one, but it doesn't matter greatly. Saddam Hussein almost certainly has a supply of nerve gas chemical ammunition, as well as mustard ammunition.

Costa: Military advisers say that the reason he hasn't used them is that there might be a delivery problem, besides the fear of retaliation.

Meselson: Maybe he hasn't fitted chemical weapons to his Scud missiles. He certainly would have no difficulty delivering chemical artillery shells and chemical rockets because he has done that repeatedly in the war with Iran. However, it wouldn't have much military effect. The coalition forces have excellent antichemical protection. It's effect would be largely political, it would kill people without gas masks, civilians, Bedouins, and of course animals, but it would have very little military effect in my opinion. Political effect, but not military.

Costa: So it's a terrorist weapon essentially?

Meselson: Yes, it is, but it's very effective against soldiers without gas masks. As I say, chemical weapons are unique. You really cannot protect a person very effectively against high explosive weapons or against blast, flame, or shrapnel, without putting so much armor around him that he is essentially or at least largely out of the battle. Even in a tank if you're hit with the right weapon, that's that. There is nothing that can protect you. But with chemicals—and they are unique in this respect—you can protect a person without preventing him from conducting his military activities. A gas mask is by far the most important thing, plus a chemical protective suit if there are agents around which act on the skin or if you expect to be exposed heavily or have to stay for protracted periods in the presence of the vapor, let's say, of mustard. The protection is excellent and so round-for-round the number of casualties you get with high explosive weapons will be much higher than with chemical weapons.

Costa: Do you conceive of our using or Israel using chemical or biological weapons in retaliation—ever?

Meselson: I can't speak for Israel. I know a little bit more about the United States: we do possess chemical weapons, we reserve the right to use them in retaliation, even though we ratified the Geneva protocol, we ratified it with a reservation. The answer to your question is no, I do not think it is at all likely. By the way, whether his word's worth anything I can't say, but Iraqi Foreign Minister Tariq Aziz has said in very clear terms that Iraq will not use chemical weapons unless the United States uses nuclear weapons. We are not about to use nuclear weapons, so if the Iraqis abide by their word, they're not going to use chemical weapons. On the other hand, we need to stay prepared because maybe they won't abide by their word. It is not up to Tariq Aziz, it's up to Saddam Hussein and I don't know his mind, of course.

Costa: There was a report recently that a chemical detection unit detected some traces of chemical gas that perhaps had been blown up in a stockpile. Is that something to worry about?

Meselson: No, we know they have chemical stocks and they will get hit sometimes, and some will come out. In this case we were probably so far from it that it didn't matter anyway. You had to have sensitive detectors to even know it was there. As I say, our protective equipment is excellent, [and] we have excellent detectors.

Even in World War I chemical weapons were not very successful. Since that time the chemicals haven't changed all that much. We do have nerve agent which is more poisonous and more rapidly acting, but the gas mask has improved immensely. They had no protective clothing to speak of in World War I, and they had no detectors so they didn't know when to put things on and take them off. People have a mistaken idea about chemical weapons. They think that in a chemical war the entire battlefield is poisonous at all times at all points. Just stop to think what a real war is like: it's sporadic. Munitions, whether artillery or air delivered, come in at a particular place; then stops; then somewhere else; then stops. There is a lot of moving, a lot of waiting. Even when [it's] intense, the falling of munitions is sporadic. No country is going to fire off more than 10 percent at most of their munitions as chemical munitions. Divide that sporadicity, so to speak, by ten [and] what you really have is a temporary hazard here and a temporary hazard there. There are some persistent agents but they're not that dangerous once on the ground. Our protective equipment is more than adequate against them.

In World War I, men traversing heavily contaminated mustard areas [had] very low casualty rates and they weren't wearing any protective clothes or protective shoes. Because of this unique ability to actually protect people against chemicals, which can't be done as well at all for flame and shrapnel, chemical weapons are pretty feeble weapons if you're properly protected.

Costa: Do we have any such chemical weapons stored around the world?

Meselson: None outside of the United States, except at Johnston Island, a United States dependency.

Costa: How can we stop the proliferation of chemical and biological weapons?

Meselson: One way *not* to stop it is to unilaterally impose trade embargoes. After all, mustard gas, still a perfectly serious chemical warfare agent, is at least 70-year-old technology. Can you imagine trying to prevent the proliferation of a 70-year-old technology? I heard a vice president of one of the nation's biggest chemical companies say the other day, "It's like trying to un-invent fire."

A long time ago, a military nation was powerful if it had a lot of men and horses, and men and horses do not proliferate. Just because I have lots of horses doesn't mean that you do. Now military strength is based increasingly on technology. The difference between men and horses and technology is that technology proliferates.

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There is no way to hold it back over any long period of time. Any nation that desperately wants to do some of these things can do them. We need to have a worldwide treaty. Sure, our antiproliferation measures can make it a little more difficult, but to think that these measures will do anything in the long run, except make other countries angry at us for restricting trade, is a mistake. We need these measures temporarily but, believe me, they are just band-aids. They are worse than band-aids because if you don't get something else there to solve the problem soon, the band-aid will aggravate the problem. That something else is the international treaty being negotiated in Geneva now. Contrary to what most of the media people say, the treaty is very far advanced and would have verification and sanctions. It would be a move in the direction that the human species had better move [in] if we're going to protect ourselves against the work of me, my colleagues, and other people who do basic research. Research is taken and applied for good and for ill. The only way to prevent the ill over the long run is by acting together.

Costa: The U.S. Government charged years ago that the Soviets were using chemical warfare in Southeast Asia, so-called yellow rain. After years of study, your research showed that yellow rain was actually caused by bee droppings. Could you tell us about this controversy?

Meselson: It wasn't just my research. It was Professor Peter Ashton at Harvard; Professor Tom Seeley, who was then at Yale; Dr. Joan Nowicke of the Smithsonian Institution; Professor Jeanne Guillemin at Boston College, among others, because it took a lot of different kinds of expertise to figure out this really astonishing thing.

There were approximately 100 samples of something yellow handed in to American, British, Australian, and other diplomats and military people in Southeast Asia by refugees saying, "This came from the sky and is toxic." All—without any exception—of those yellow materials that had been looked at properly under the ordinary light microscope by people who know how to tell what they're seeing, are nothing other than bee feces, concentrated aggregates of pollen.

This is, in a way, humorous, but it is the United States government that is controversial. Last year, the largest scientific organization in the U.S., the American Association for the Advancement of Science gave me a prize for research on this. For our country, which is one of the most honest and open countries in the world, to cling to allegations that resulted partly because of honest mistakes, but partly because of sheer politics, long after they have been disproven, is a scandal. President Bush ought, if he really wants a workable chemical weapons treaty, to do a little housecleaning. To make false accusations, then to stick to them, is a sure way to undermine the very kind of law and order that we need in the world if we're going to avoid the more hazardous offspring of science. The yellow rain was a complete mistake. We were very angry with the Russians then because of Afghanistan, we wanted to pinprick them a bit. We didn't have any real way of getting at them because we were not going to send troops, but science got really abused. My friends who are in the scientific community in the government would never tolerate that kind of dishonesty and lack of accountability in academia. We are blessed to live in a country where politics can afford to be honest. In fact, our kind of country won't work unless it is. Yellow rain is a shameful chapter in U.S. intelligence and political history.

Costa: Another controversy was of possible chemical/biological weapon development in the Soviet Union, with the outbreak of anthrax a few years ago. Could you talk about that?

Meselson: There are two parts to that problem. There is in the city of Sverdlovsk a large secret military facility that does biological defense work. The Soviets have declared that. There is no doubt or question about it. For $700 you can buy a nice picture of it from the French satellite company Spot. It has a security fence around it and all of that. In the late 1960s, the U.S. government had reason to believe that [the facility] was developing biological weapons, and to this day the Soviets have not let us go look. This is up to them to do, the ball is in their court. It could well be that it was never doing anything illegal, but the only way the world is going to know about that, at least what it is doing now—possibly we'll never know what it used to do—[is] to be invited to go look. And only the Russians can invite us. . . . .

This interview was broadcast nationwide on the UPI Radio Network as part of the public affairs radio series called "Harvard NEWSMAKERS."