

Biology and chemistry for peace not war

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In the past

About 100 years ago, in the First World War, we saw the use on a large scale of lethal chemical weapons. After the First World War, the international community tried to deal with this problem by agreeing the 1925 Geneva protocol, which, in effect, bans the use of chemical agents and biological agents in warfare. The importance of this ban is made very clear last year when we saw the use of a nerve agent in Syria (Sarin), which killed at least 1000 people. So we're dealing with an issue of the development of science and the efforts of the international community to develop international law so that that science is only used for benign purposes.

During the last century, there were a series of offensive chemical weapons programs by major states and the use of chemicals on a large scale - for instance in the Iran Iraq war of the 1980s. There were also less well known, a series of offensive biological weapons programs by major states and the use of such agents for instance by the Japanese in the Second World War. As a result of this the international community decided to try to supplement the 1925 Geneva protocol, which bans use, by the 1975 Biological and Toxin Weapons Convention, which adds a series of other restrictions to the ban on use, so that you can only use biology for peaceful purposes. And, although it took much longer, they also agreed the 1995 Chemical Weapons Convention, which means essentially that you can only use chemistry for peaceful purposes.

It's very important that these international restrictions are also backed up by national legislation to enforce them, by an international determination to make sure that this prohibition is enforced, and to deal with any deviation. So that when the chemical weapons were used in Syria, the international community as a whole got together and we have, or are in the process now of removing those weapons, and destroying those weapons, so that in addition to this huge stocks of chemical weapons held by the major states during the Cold War being destroyed by the Chemical Weapons Convention, we are also now got rid of the Syrian chemical weapons.

In the future

What we have to do now is to make sure that this prohibition on the hostile use of chemistry or biology continues into the future, and the problem here is that we are in the middle of a huge revolution in biotechnology, which many people feel could make it easier and simpler for more people to engage in a hostile use of chemistry and biology. So there are a whole series of other things we have to do in the future to make sure that this essential prohibition is continued and strengthened.

First of all, we must make good the problem's that there are in the international conventions themselves so that we need to make sure that the ineffective verification system of the biological and toxin weapons Convention is remedied and that that convention is given a large-scale international organisation to take care of its development in the future. We need to make sure that the problems within the Chemical Weapons Convention - for instance of what many people may feel is a loophole, which allows the development of 'non-lethal', so-called, chemical agents, can be prevented. And then we need to make sure for instance that all of our scientists in biology and chemistry are well educated so that they understand the history of the misuse of their sciences and that they are more wise to make sure that we anybody who is meddling in these areas is picked up early and that there are systems been in place in our universities and institutions so that any such potential deviation can be notified to higher authorities within those systems and there are codes of conduct in place to ensure that that happens.

A variety of other things should also be in place but the essential idea is that the prohibition is strengthened and developed over the coming decades, so that the revolution in biotechnology can deliver benefits for humankind in medicine, and agriculture, in energy, without the threat of malign misuse in the inevitable conflicts that there will be over the coming decades and that what we end up with hopefully by the middle of the century is a really secure international system backed up by a web prevention, which really means that we don't see the misuse of the sciences.

The scientific community

We have greatly improved the education of our scientists in regard to the their responsibilities for the internal operation of science, so that in a way that I wasn't educated 40 years ago to understand the dangers of plagiarism, the necessity of proper acknowledgement of other colleagues, mentoring of young scientists so that they understood the norms of the science that they were in. All of that's been greatly improved. It's not done universally to the level we would like but it's far, far better than it ever was in the past.

The task now is to educate scientists to the same level in regard to the external responsibilities they have - for instance ,in explaining their science to the public, in taking part in a reasonable way in advocacy of their science to the general public, and in responsibility for the possible misuse of their science, the so-called 'dual use' problem. Scientists have to be aware that some of the things they do could be dangerous, if falling into the wrong hands and therefore we need well-educated people who understand this problem and are able to deal with it. For instance, we would greatly hope that genetic engineering would enable us to produce an plants which are resistant to drought, which are more productive, which are resistant to pests but that same genetic engineering capability might be used for instance to greatly improve the capability of the pest to interfere with food production and we need people to beware that.

We also have to find ways to, to maintain the openness of science. Science works best when it's open, when my results can be checked by some other scientists, that I can check that other scientists results and that we can move forward in a collaborative way. But we also have to understand that sometimes it may be necessary to be very careful about openness of our science. There was an instance, recently, of scientists in the United States discovering a new form of botulinum toxin, which could not be countered by any of the available countermeasures at the present time, and after careful consultation they and their journal editors decided that they would not publish that - some of the information about that new form of botulinum toxin - until countermeasures had been developed. Those kind of countermeasures can be developed, it doesn't really interfere too much with the openness of science that there's a short delay in publication openly of the information they withheld. And that's very much, it seems to me, the kind of sensible approach that we should take. Although I have to say that that's rather straightforward and simple example of dual use and there may be very much more complicated issues that we have to face in the future. But with an educated scientific community we should be able to do that.

DIY biology and bioterrorism

Turning then to the question of people were not educated in science but who are interested in dabbling in science, for instance, what we call garage biology. The record at the moment seems to be very much the way we would like things to happen. In that people who are amateurs in science, who are interested in doing simple biological experiments, have been careful to interact with scientists and with some members of the security community to make sure that what they are doing is, er, benign and is not venturing outside of what we would think sensible to do. So we have to reinforce the message that that's the way to go, we have to be interactive scientists and people interested in security issues with the amateur garage biology community and encourage them to engage in the science and understand the science and also to help them to protect that from misuse.

Another aspect, which has been, er, more in the news than some of the other issues, is the problem of potential bioterrorism. I think the historical record shows that they have been very few instances of bioterrorism. I think this is in good part related to the strength of the prohibition and the feeling that most people have that it would go against the norm of misuse are of biology to engage in bioterrorism. But we have to acknowledge that the revolution in biotechnology will place capabilities in more and more hands. So it's very important I think that we strengthen and maintain the prohibition so that it is minimally likely that anybody will go and engage in bioterrorism.