

Personal Memo from  
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Matt Miselson

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Defining a "toxin"

A discussion paper for our meeting  
in London.

I enjoyed seeing you beyond hatred.

Yours,  
JM.

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STATUS OF TOXINS UNDER THE BWC

3/3/89

Lederberg

The BWC prohibits "Microbial or other biological agents, or toxins whatever their origin or mode of production" [if for other than peaceful purposes.] There is no definition of toxins either in the treaty, nor so far as I am aware in the negotiating history of the Convention -- they were thrown in as an afterthought. The historical context does identify biological agents with those that proliferate in the course of doing harm. Review conference discussions have fairly certainly included infectious nucleic acids and recombinants among forbidden biological agents. "Toxins" are generally understood to be poisonous substances generated as byproducts of biological growth -- examples are botulinum toxin or mycotoxins (like trichothecenes). They generally have complex chemical structures, but not always. New methods of chemical synthesis leave open the possibility that any toxin could be produced by chemical methods as an alternative to biological but the "whatever mode of production clause" would prohibit such products as well.

Toxins (as well as microbial agents) are clearly also included under the provisions of the Geneva Protocol. Our discussion may be moot if a general Chemical Disarmament treaty is concluded. But until that eventuates, there is a zone of definitional ambiguity about just which chemical substances are "toxins" under the BWC. So far, this is purely hypothetical: we are not aware of any allegation about "development, production, stockpiling, acquisition or retention" of substances in the gray zone, nor has any country asserted that its possession of a toxin-related chemical was permissible under the treaty.

The difficulty arises from the existence of toxic chemicals which resemble, in structure or in pathological effect, the toxins of biological origin which are clearly forbidden. For example, a synthetic polypeptide may well be identified which comprises the active site of the botulinum toxin. Indeed, it is often discussed that such a substance, especially if built along with skin penetration aids, might be far more potent than nerve gas, and as such would be an attractive target for chemical weapons development (a dangerous vertical proliferation). Further developments in the understanding of molecular structure may allow non-polypeptide structures to be designed which bear no direct analogy to botulinum toxin, but which are conceptually derived from insights into how this toxin works. Mycotoxins and zootoxins likewise could have synthetic molecular variants that are conceptually but not structurally related to biological prototypes.

As the BWC is silent or vague, there has been a certain amount of discussion about more precise definitions to clarify the existing uncertainties. At the Quinquennial Review, it was agreed that synthetically produced analogues are covered; but this begs the question of what is an analogue. Three lines of further progress can be envisaged:

- 1) Within the negotiating framework of the CW disarmament discussion, interim declarations that disavow any novel chemical agents other than those now in admitted stockpiles or closely related to them. This would leave mustards and organophosphates as a class under the same heading as existing chemical weapons, but would label all novelties (including synthetic peptides) as already forbidden by the BWC. Such entities would be encumbered with the same verification problems, no better, no worse, as biological agents and toxins.

Get formal declarations of stocks ASAP.

\* I wouldn't want to waste much energy on refining definitions. But as the matter has come up four times to this. (2) is scientifically the most economical; (1) ought to be done anyhow.

or, as a specific and emphatic subset of the class of novelties:

2) Defining as subsumed by toxins, under the BWC, any chemical substances targeted against specific cellular receptors other than those (cholinesterase) associated with nerve gas.

or

3) More specific designations of oligopeptides and other chemical categories. This would not be foolproof, but would promptly cover the most likely, immediate prospects. Non-polypeptide myco- and zoo-toxins generally offer no dramatic advantage in lethality compared to nerve gas; hence there is less motivation to invest in synthetic chemicals that mimic their activity.

While CW-disarmament must be concurred with multilaterally, the high technology associated with toxin extensions would lend great value to interim declarations initiated on a bilateral basis. These might be revocable in the unlikely event that third parties were found to be proceeding along these denied paths. Since we are dealing with still hypothetical innovations, there should be far less reluctance to accept these restrictions than would apply to well established chemical weapons.

The broadening of the toxin provisions lends nothing to the verification dilemmas, but would be a confidence building measure especially if it is associated with free scientific discussion of permitted R&D on toxic activities and their receptors.

Joshua Lederberg  
3 March, 1989