Please return to J. Lederberg

Version discussed with US colleagues – not at Moscow!

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General considerations of biological warfare, arms control and proliferation.

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1. BW – define, distinguish from CW, toxin weapons.

Biological Warfare (BW) is defined as the use of a living microorganism or virus for military purposes. It is distinguished from chemical warfare (CW) which uses the toxicity of specific chemical (but nonliving) chemical substances. CW and BW are often confused, especially in the light of toxin weapons which are chemical substances produced as a by-product of biological fermentation. (Because the production facilities for either would be quite similar to an outside view, biological agents and toxins are treated in common fashion by the BW disarmament treaty of 1972.)

What sets BW apart is the infectivity of the agent: in principle one particle of a virus or a bacterium entering the human body could be sufficient to infect that individual by virtue of the exponential replication of the invading particle. This confers a very high potency in lethal doses per gram on biological agents. It also opens up the likelihood of spread from one infected individual to another, namely the initiation of an epidemic.

Most of this discussion will be centered around the use of BW against human targets. Similar principles would apply to attacks against crop animals and plants: in fact there may be fewer hindrances to such attack because of the specificity of the targets and the expectation that retroactive or collateral spread could be contained.

Fortunately there has been no historical experience of the use of BW on a significant scale in modern times; for that reason there is no empirically founded doctrine for the military use of BW, a fact which alone may be the main hindrance to its proliferation. By the same token this makes BW arms control a matter of the most urgent concern.

2. Treaty status: disarmament re actual weapons. # Agent stockpiles difficult to define or verify. # R&D of any kind not effectively covered. # Potentiality for quick breakout.

BW and CW are both governed by the Geneva protocol of 1925. De facto, the Geneva protocol is a no first use agreement, binding on the signatories with respect to one another. It does not prohibit the development, stockpiling, or transfer of CW or BW agents. It has therefore been enforced primarily by mutual deterrence based on the prospect of retaliation against a first use. Starting with the use of "poison gases" like chlorine and

phosgene in World War I, followed by lewisite and mustard gas, CW does have an actual history in military application and doctrine which has impelled most countries to demand a very high standard of verification as a precondition to further arms control in that arena. To the extent that BW was not tested in battle, the signatories to the BW convention of 1972 were willing to commit to disarmament of these weapons. Despite many uncertainties with regard to the verifiability of that disarmament they relied on shared motivations for cooperative verification as the principal method of enforcement.

The BW disarmament treaty prohibits the production, stockpiling, and deployment of biological weapons, defining these as living agents of kinds and amounts that had no peaceful application. Under this doctrine, research and development is not regulated since the testing of offensive agents on a small scale would be a necessary component of defensive developments. This circumstance leaves open the possibility of a technology race within the legal limits of the BW treaty. Such a race in BW weapons R&D has now generated much concern because of the potentiality of rapid breakout after R&D had been consummated.

3. Military utility of existing (known) entities: hardly for # tactical use: large collateral damage; danger of spread and # retroaction; unpredictability of damage effects.

To return now to military considerations in the use of BW, in contrast to CW or other weapons: since disease depends on extensive biological multiplication of a single particle, there will always be a latent period of days to weeks after exposure, before the target is impaired (possibly excepting massive doses of the noxious organisms). Compared to physical and chemical agents, biological agents depend for their efficacy on a complex range of interacting factors. Therefore, their actual performance applied to large population targets is poorly predictable. A given infection may have no consequence or it may initiate a large epidemic, spreading to many other individuals. New technologies might result in the development of organisms whose latent period is accelerated. Nevertheless, they are not likely to fundamentally alter the limited utility of BW for tactical purposes.

4. Role as strategic or doomsday weapon. # Similarity to nuclear winter; Alternative resort to counter SDI.

On the other hand BW could be used with great effectiveness in attacking large populations, in undermining the economic functioning of an adversary, in the chronic depletion of fighting capability of units in confined areas. BW would be especially devastating in combination with physical weapons that damaged the infrastructure, nutrition, sanitary and health

systems of a target country.

For the foreseeable future, the dangers of spread and retroaction from a strategic BW attack would give this the characteristics of a doomsday weapon, i.e. a last resort of threatened mutual suicide. This may not be fully understood by an attacking power, so the doomsday effect may be inadvertent; the attacking power might be misled into believing that retroaction could be controlled on the basis of half-way and hard-to-test technological innovations. On the other hand, prior to a demonstration of the controlled damage that a BW attack might deliver, this might be unrealistically under-estimated by the party under threat. Hence BW has many characteristics that will hinder a rational calculus between adversaries under stress, mostly in a direction that is full of risks of unintended consequences and crisis-instability.

With respect to retroaction, BW resembles the nuclear winter scenario, the threat of which has not noticeably affected the doctrine for nuclear arms buildup ~~or their~~ military use, ~~doctrines~~. This leaves modest optimism that the fear of retroaction will automatically restrain investment in and plans for the deployment of BW, were the treaty restraints to weaken.

Another gloomy prospect is that the successful development of defense systems against ballistic missiles, if shown technologically feasible, will add further motivation to the superpowers to develop alternative weapons that will enhance the destructive power of warheads delivered by other platforms.

5. Hazard from proliferation. Low cost of entry.

Nuclear powers armed with multiple delivery systems can deter attack without taking the risks of recourse to BW. The real hazard is proliferation, as the cost of entry into BW-capability is relatively low, so that less industrially advanced states, even small terrorist organizations or individuals could inflict great damage on a modern state. BW would probably find its greatest applicability as a clandestine sabotage weapon in the hands of desperate and irresponsible groups who felt they had nothing to lose.

Countries with poorly developed public health infrastructure are generally even more vulnerable, as they are to natural epidemics. (On the other hand some populations with poor sanitation may have developed immunity to some biological agents that would be more devastating to an economically more advanced country.)

Almost anyone with a fragmentary medical education would have learned enough to design and produce biological weapons of great destructiveness. After all, much of medicine is learning the characteristics of naturally occurring lethally infective

microorganisms. The technology of growing these 'germs' is also quite simple, apart from safety precautions that might be neglected, or obviated by immunization. Some individuals can always be found who have a solid immunity by having survived a prior natural infection with a given pathogen. Terrorist groups are also well habituated to clandestine modes of delivery.

It is a mistake to believe that new and sophisticated technologies are needed to practise BW. In 1346 the Tartars attacking the Venetian outpost at Kaffa (Feodosia) on the Black Sea concluded their siege by catapulting corpses of their own troops into the fort. The result was to bring plague into the Venetian defending force, which they carried back with them to Italy, introducing the great Black Death into Europe.

The recent use of CW in the Iran-Iraq war, in contravention of the Geneva Protocol, is a serious contemporary threat to the treaty restraints on proliferation that may also open the door to BW uses in warfare.

International cooperation to limit proliferation will be be very difficult, however, in a climate of mutual suspicion fanned by the continuation of clandestine R&D in military biotechnology, and in the absence of procedures for consulation and for confidence building.

6. Civil defense: low key essential

As almost always happens with hypothetical threats, the prospect of BW terrorist attack has not yet motivated ~~serious~~ uniform civil defense measures, e.g. the protection of municipal water supplies -- which in the U.S. has been left mainly to local officials, and is therefore quite variable from one city to another. One difficulty is to arouse considered responses, without generating undesirable publicity: none of us wishes to be responsible for inspiring the use of BW by a terrorist group. There is a formidable and useful challenge to technology to design more effective means of monitoring water supplies, and of ensuring that they are safe with respect to both naturally occurring and maliciously injected pathogens. Similar steps must also be considered for the food chain, and for atmospheric transfer.

7. Role of new technology. R&D congruent with biomedical research. # {secrecy as hallmark}

The added input of biotechnology is fairly small compared to the revolution in modern politics and warfare that would follow the introduction (even serious testing) of BW, whether with existing or advanced agents.

In the near future the main application of new technology in this sphere will be the production of more reliable prophylaxis,

protecting the attacker from retroaction to his own people, primarily by immunization. This is a mission parallel to that of peaceful biomedical research! This difficulty of ascription poses a most serious problem to the design of measures needed to build mutual confidence and to regulate R&D to guide it to peaceful purposes. The only hallmark of more fundamental research as peaceful is open publication:: even this is complicated by the intervention of commercial exploitation of biotechnology, which may be associated with trade secrets for limited periods of time.

It would not be fruitful to disseminate details of speculations about how BW might be made more militarily effective. Some that have been mentioned in past years include:

- Non-lethal but incapacitating infections (reducing total risks from retroaction)
- Shortening latent period after infection
- Agents better adapted to aerosol or other transmission
- Agents difficult to diagnose
- Agents difficult to treat with existing medications
- Agents designed to defeat physical protection or other countermeasures
- Agents expected to be specific against populations of defined genetic characteristics, or with prior exposure to specific dietary or other antigens.

Unhappily, past experience suggests that military users of new weapons will not always be sensitive to the long-range ecological implications of their use. An attacker may be optimistic about self-protection, but end up starting the evolution of an epidemic disease which becomes a disaster for all concerned -- the inadvertent doomsday mentioned above. It is hard to imagine any weapon more difficult to test properly than a BW intended to be controlled by immunization of the attackers.

8. US-USSR steps?

Threats to humanity from the further development and proliferation of BW are related to two closely intertwined issues, neither of which is sufficiently addressed by existing treaties:

a. The sparking of a bipolar technology race in biological weapons development, accompanied by deep-seated anxieties and suspicions within each country. These anxieties in fact

contaminate the entire atmosphere with respect to arms control.

b. Threats from the proliferation of BW capability and use to other parties.

It will be most difficult to deal with either issue if the other is not addressed.

To deal with a), we should find means to restore a cooperative framework of verification, to deal (for example) with the U.S. questions about the 1979 Sverdlovsk incident, and with USSR concerns about US biotechnology development. This should include a strengthening and exercise of the provisions for mutual consultation mentioned in the 1972 BW treaty. The forthcoming quinquennial review of the BW treaty would be an especially propitious occasion.

US-USSR cooperation in international medical research in infectious diseases would be an important way to bring the humanitarian scientific communities of the two countries in closer convergence, and improve mutual understanding of the objectives of microbiological research programs in each country.

For b), much more exploration and imagination is necessary; however nuclear non-proliferation is already a matter of shared interest on the part of the US and USSR, and may be a model for cooperative measures. Technology for civil defense may be an area of specific joint interest; this technology is substantially what is needed to improve public health in regard to old and new (cf. Legionella, AIDS) diseases of natural origin as well.

9. US-USSR CISAC role

For many reasons, including the need for specialized expertise, I acknowledge that this committee is not the place for detailed questionning about the substance of quarrels like those over the Sverdlovsk incident. I would suggest that Soviet members of CISAC use their own means of inquiry to inform themselves about that incident, so they can reach their own conclusions about the most practical forum for quieting the concerns that have arisen in the U.S. There has been a great deal of comment in the U.S. about these, and about allegations of secret military biotechnology R&D in the Soviet Union. It might be valuable for you to become informed about the temper of these concerns, again for you to reach your own conclusions as to their underlying validity, and about the best measures from your side to quiet them. I will express a personal opinion that the published explanations of 'Sverdlovsk' were not a scientifically satisfying report; and I have brought a copy of that for you to reach your own conclusions.

After you have had time to crystallize your own information and standing on these matters, I hope we can discuss them further. Meanwhile, I stand ready to furnish all available information to help enlarge your personal information and perspective about the concerns we have on this matter. I hope I have been able to convey to you that regardless of the underlying substance, the inability to get an open discussion of BW problems has been a serious source of erosion in public confidence about arms control in the U.S. Obviously we have a reciprocal responsibility to understand and discuss where your corresponding concerns are lodged.