

PART FIVE

ETHICAL PROBLEMS

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13. Preventing CBW (a) J. H. Humphrey

In discussing what might be done about the danger that chemical and biological weapons may become accepted as part of the normal armoury of nations, it will be more useful if we consider them from the point of view of those who regard it as their business to prepare for wars as well as from that of those who regard resort to war as an unnecessary and unacceptable way of settling differences between nations. So long as national governments, and those who maintain them in office, continue to prepare for war rather than repudiate it, arguments about whether one way of killing people or of putting them out of action is more beastly than another are liable to appear academic and to be ineffective.

While I accept that to take part in the development and use of chemical and biological weapons poses ethical problems for the scientists involved and that to take part in 'public health in reverse' is indeed directly contrary to a physician's role, the ethical problems seems to me to be personal and not essentially different from those which face a physicist or engineer working on ballistic missiles or a bomb sight. Further, I doubt whether to those at the receiving end an attack with chemical or biological weapons could be much more unpleasant than one with napalm or saturation bombing with anti-personnel missiles. Once the weapons are such that the person who uses them is not made aware of the direct consequences of his actions, and especially if he has been taught to regard his enemies as creatures whose lives are incomparably less important than his own, he can escape such emotions as pity, disgust, or horror which might make him hesitate to use the weapons except perhaps in the heat of battle. To me and, I suspect, to military planners it seems illogical to set chemical and biological weapons in a category apart from other modern weapons on grounds of beastliness alone. The question is, are there other grounds on which these weapons can be distinguished? I think there are.

The first and most important, as explained by Dr Brownlie, is that the people in all countries and the politicians in their public

pronouncements recognize such a distinction—even though it may be illogical and based on an accident of propaganda and history. The terms of the Geneva Protocol, publicly supported at the United Nations in December 1966, by the representatives of all the major powers including the United States and Japan, forbid the first use of chemical and biological weapons in warfare, although they do not forbid research on or possession of such weapons. Despite its obscurities and the tenuousness of any guarantees of observance the Geneva Protocol provides a statement of good intentions which it has not been possible to achieve in respect of any other weapons.

The second is that investment in CBW, although by no means inconsiderable, is still small compared with investment in conventional and nuclear weapons. At present, so far as one can tell, CBW is regarded rather as a useful adjunct to the existing armoury, although the situation might change if both wars and the nuclear stalemate continue. Some of the advantages claimed for weapons of this kind have been set out in General Rothschild's book *Tomorrow's Weapons*, and include cheapness, minimal destruction of property and fixed installations, flexibility (including the capacity to reach persons protected against all but very powerful conventional weapons), and, in a strange way, humaneness, since the non-lethal weapons may incapacitate the enemy sufficiently to destroy his fighting power temporarily. Although lethal chemical and biological weapons could conceivably be used against more or less specific targets, they are nevertheless essentially indiscriminate in their action and are classified as weapons of mass destruction. The status of non-lethal chemical and non-lethal biological weapons (if the latter are under serious consideration) has been left blurred, and it is arguable whether they should be defined as weapons of mass destruction. These are the weapons which are put forward by their protagonists as being humane. Since few people—at least in peacetime—relish the idea of killing, the humaneness claimed for CBW could lead to its being regarded as acceptable, despite the Geneva Protocol. I find it hard to understand—and this doubt is confirmed by the example of the use of non-lethal chemical weapons in Vietnam—how non-lethal weapons can deter or defeat a determined enemy, except when used as a means of making conventional weapons more effective. This is a matter which requires careful discussion and hard thinking.

The third difference is that much of the research which goes into the development of chemical and biological weapons, or into defence against them, is of a very similar nature to research which

would legitimately be pursued without any consideration of CBW. For example, the toxic properties of the organo-phosphorus insecticides need to be studied for the sake of the persons who make and use them; similarly important is work aimed to discover antidotes and to devise adequate protective clothing. The defoliants used in Vietnam are standard agricultural chemicals, and spraying them from aeroplanes to defoliate trees—rash though this may appear to ecologists—has already been done in Africa in attempts to clear the tsetse fly, vector of trypanosomiasis, from parts of the 'tsetse belt.' What sets apart work on chemical weapons is the deliberate and secret investigation of properties which increase their toxicity for man, the preparation and manufacture of devices for use in war, and the stockpiling of chemicals for this purpose. Similarly the development of biological weapons requires research into factors controlling the pathogenicity of microbes and their mode of dissemination; study of techniques for rapid detection and identification; large-scale culture methods; preparation of protective vaccines; and so on. Nearly all the research required could quite properly be undertaken as non-military projects in universities, medical research institutes, or enterprises engaged in the manufacture of vaccines. Even intensive investigations on uncommon and exotic highly virulent microbes could be entirely justifiable in a wholly peaceful world, both on scientific grounds and because of the possibility that some time, somewhere, such microbes might become disseminated and give rise to serious epidemics such as have repeatedly ravaged man and other animals in the past. As with chemical weapons, microbiological research and development become biological weapon research only insofar as techniques are devised for deliberately spreading pathogenic infective agents in war.

A fourth feature of chemical and biological weapons is that their manufacture does not require elaborate or highly specialized installations which would be difficult to conceal. Indeed the potential activity per unit weight of these weapons, especially of biological weapons, is so great that quite small factories or parts of factories could suffice to supply the military requirements. Apart from the need for precautions essential for the handling of highly dangerous materials nothing obvious need distinguish such factories from others making ordinary fine chemicals or, say, antibiotics or bacterial vaccines. Consequently, inspection and verification to ascertain whether the ingredients of such weapons were being made would present much greater difficulty than in the case, for example, of fissile material for nuclear weapons.

With these four general points in mind, it seems to me that there are a number of ways in which the further development of chemical and biological weapons might be halted and the danger of their further use in war diminished.* The first is by ensuring that the support publicly given to the Geneva Protocol by almost all the national delegations at the General Assembly of the United Nations in December, 1966, is strengthened and not eroded. This means that the issues involved must be clearly discussed and widely enough understood to put political pressure on the governments of those countries which have not ratified the Protocol to do so. Without minimizing the unpleasantness of CBW or the ethical objections to weapons of this kind, I think that the most valid reason for doing this is that the Geneva Protocol, if not a giant confidence trick, is a real beginning in that limitation of weapons which all countries in the United Nations have declared they wish to seek. Until the difficulties presented by inspection and verification have been got round it may be difficult to extend the Protocol to forbid research on or possession of chemical and biological weapons, although states could be encouraged to renounce these for themselves, as Austria has done.

But even if all countries had adhered to the Geneva Protocol allegations of infringement in times of tension or war might still be made, and would require rapid investigation, since the right of retaliation in kind would remain. There is need for a recognized organization prepared to do this. It might be the International Red Cross Organization, or perhaps the World Health Organization because of its accepted expertise in epidemiology and its non-partisan reputation.

All this would minimize the danger of the future use of CBW, but it would not prevent countries from researching on and preparing such weapons as a precautionary measure to permit retaliation. The next and more important goal is for all countries to renounce the use of CBW altogether. This would imply that no secret research, by government or industry, could be done on potential weapon agents, and that open research on them in scale and content must have a clearly non-military aim. Renunciation of CBW could be made soon—indeed it might become much more difficult later—because no country has yet made such a major in-

* Many of the issues mentioned here have been raised under the stimulus of discussions held under the auspices of the Pugwash Movement.

vestment in these weapons as to feel its security threatened by renouncing them as part of a general agreement. It would be a gesture of mutual confidence which could lead to other and more important steps towards disarmament in more sensitive areas.

Finally, what should be the future of the establishments which have been built up to study and prepare for national defence (and, to a greater or lesser degree, offence) in relation to CBW? It is important to consider this question, since on the one hand they are likely to have a powerful vested interest in their own continued existence, with the possibility of arguing for this at the top level, and on the other hand they represent a sword which could be changed, with a minimum of beating, into a magnificent ploughshare. I will consider our own establishments, the MRE and the CDEE at Porton Down. I will start with the assumption that their own public image of themselves is broadly correct. That is, that their function is to study potential offensive agents only in relation to devising means of defence against them; that the great bulk of the original scientific work done there is published; and that most of the scientists take jobs there not only to earn a reasonable salary, but because they are given excellent facilities to study scientifically interesting problems and because they have a genuine belief that their work is important for the military defence of the country. Furthermore, I know that they are willing to help other civilian institutions with advice and the provision of materials and facilities. Nevertheless, in accepting this image I think it necessary to make two reservations. The first is that the study of defensive measures may not be so innocent as it might appear if studies of offensive measures and discoveries relating to these are left to our American allies on a reciprocal basis. In the absence of other information it may be wiser to assume that the collaboration which began during World War II has not ended.

The existence of an agreement between Britain, Canada, Australia, and the United States, and of shared proving grounds for CBW research at Suffield, Alberta, and Innisfail, Queensland, are examples. It is important to know what are the general terms and duration of this quadripartite agreement. The second reservation is that the output of published work from Porton would appear somewhat meagre if it represented the total useful output from an ordinary research institute with a comparable staff and facilities, and this is bound to give the impression that more goes on there than is revealed. Despite these reservations, the fact remains that at Porton are collected teams much of whose work has a direct relation to the problems of

civilian life, but has much less impact on these than it might do if the primary object of the establishments were not to undertake partly classified work for the Ministry of Defence.

I do not of course, know, what classified work goes on at Porton nor what is the purpose of keeping it secret. Let us suppose, hypothetically, that significant defensive advances have been made, such as the development of a very effective general purpose gas-mask or of a rapid and extremely sensitive method for detecting airborne microbes. Would the revelation of such developments diminish their defensive value? Or might not this actually be increased, by showing that it would be difficult for one country to steal a march on another in this field? The answers do not seem to me to be obviously 'yes' and 'no' respectively.

It would be unrealistic to expect that the Ministry of Defence could abolish its establishments at Porton out of hand, or even declassify all the past work which has been done there, unless other countries known to be interested in CBW such as the United States and the USSR were prepared to do likewise. However this does not mean that no initiative can be taken. Provided that our Government were not contemplating becoming engaged in a war within the next few years involving CBW—despite the Geneva Protocol—and especially if it were meanwhile prepared to make a real effort at the international level to reach agreement to renounce these weapons, I suggest that for a trial period of not less than five years all the future work carried out at Porton should be declared declassified. Because, I suspect, biological weapons are presently less important than chemical weapons it might be easier to declassify the MRE first. The CDEE might follow suit later, after allowing time to observe whether there was a favourable international reaction to the first initiative, and time to sort out possible complications about chemical weapons shared with our allies. Work on the defence of man and animals against highly virulent and pathogenic organisms or work on toxic chemicals could proceed much as at present and might well be more effective because collaboration with other workers would be easier and more natural. Of course the results would not be the exclusive property of the Ministry of Defence, but there would be nothing to prevent the armed forces from obtaining advice and making use of them as they wished. Even during the trial period I would like to see at least a part of MRE positively devoted to international collaboration, for example with the World Health Organization over problems of mutual interest (of which there are many) or with the

Food and Agriculture Organization over such projects as the large-scale production of micro-organisms as food additives for regions where dietary protein is inadequate. Similarly part of the Chemical Defence section might act as a Research Association for the by no means economically insignificant protective clothing industry (which at present has none). Collaboration of this sort would not only have the advantage of promoting goodwill but could help towards defraying the cost of keeping Porton going.

To make such a gesture would carry some risk, but it would be an act of leadership by this country which could produce quite disproportionate gains by helping to break the deadlock over disarmament. Furthermore, by making the gesture for an initial trial period, without disbanding the teams which have been built up, even the risk would be minimized.

(b) M. Meselson

Half a century has passed since the world's only major outbreak of poison gas warfare. Large-scale germ warfare has never been attempted. Gas and germ warfare are explicitly prohibited by international law in the Geneva Protocol of 1925. Considering the enormous scale of gas warfare in World War I, it is remarkable how well the Protocol has been respected. There have been only two instances of verified poison gas warfare since 1925—in Ethiopia, and in the Yemen. In Vietnam the United States has been employing a powerful but generally non-lethal anti-riot agent, maintaining that the Protocol does not forbid it.

When compared with the recent history of other forms of warfare the record shows that the governments and peoples of the world have come to practise and expect a degree of restraint against the use of chemical and biological weapons not found for any other class of weapons, except nuclear ones. The chief factor justifying that restraint is the same for both nuclear and CB warfare—apprehension that, once begun, it would open up an unfamiliar and highly unpredictable dimension of warfare that might lead to the extermination of very large numbers of troops and civilians, especially one's own.

Destructiveness of CBW

There is no doubt that existing nuclear weapons could destroy entire populations. Although the performance of chemical and biological weapons in any particular attack would be less predic-

table than that of nuclear weapons, they too have very great potential for mass killing. The most effective method of strategic CBW attack would presumably entail the production by bombers or missiles of a cloud of toxic or infectious material over or upwind from a target, to be inhaled or absorbed through the skin by persons in the attacked population. Although masks, protective suits, and special shelters can provide effective protection against known chemical and biological agents, the cloud would readily penetrate dwellings and other ordinary structures.

An attack by a single bomber, dispensing one of the more deadly nerve gases, could kill most unprotected persons within an area of at least five square miles, this being the size of the zone of high mortality caused by the Hiroshima and Nagasaki atomic bombs. Although nerve gases are among the most poisonous substances known to be suitable for military use, it may well be possible to devise weapons containing far more poisonous materials, perhaps toxins or related substances. Weapons based on such super-poisons might become as destructive to unprotected populations as thermo-nuclear weapons of equal size.

Poisonous as nerve gases are, virulent micro-organisms and viruses can be a million or more times more so, in terms of the amount that can cause incapacitation or death. Although many infectious agents are rapidly inactivated or lose their virulence when dispersed in the atmosphere, this obstacle to the development of biological weapons can probably be circumvented or overcome with sufficient research effort. If so, biological weapons could surpass thermo-nuclear bombs in terms of the area coverage possible for a weapon of specified size. However, even after very extensive research, the performance of biological weapons is likely to remain subject to great uncertainty. Their effects would depend in large measure on poorly understood and highly variable factors that determine man's resistance to infection. A biological attack intended to be highly lethal might actually kill very few persons, and, conversely, an attack expected only to cause temporary incapacitation could cause high mortality.

Although biological warfare agents might be chosen from among those that are not highly contagious under natural circumstances, this would not preclude the unexpected initiation of a widespread epidemic under the very unnatural conditions inherent in military use. Indeed, it is possible that bacteria or viruses disseminated in an aerosol cloud could subsequently emerge from the exposed population of humans, insects, birds, rodents, or other animals with in-

creased persistence, contagiousness, and virulence to man. Large-scale operations in regions populated by many persons or animals would be more risky than small operations in desolate places, and viruses might be more hazardous than bacteria. However, we cannot evaluate the risks with any confidence in any of these situations. Therefore, the field testing of live biological weapons and especially the outbreak of actual biological warfare would constitute a menace to the entire human species.

The uncontrollability of CBW

A major uncertainty in predicting or controlling the course of CBW, once it is begun, would arise from the great variety of possible weapons and targets, from the incapacitating to the highly lethal and from the local battlefield to entire continents. Once begun at any level in earnest it would be very difficult to predict how far CBW might go. Distinctions and stopping places would be very difficult to define and to keep. The preparations and training required for one form of CBW would facilitate and therefore tempt escalation to larger scale and more deadly CBW operations. The breakdown of barriers to weapons once regarded as illegal and peculiarly uncivilized can inspire and encourage methods of warfare even more savage than those underway at the time.

The vulnerability of troops or civilians to CBW attack depends very much on the availability and effectiveness of protective facilities, the rigour of defensive training and discipline, and the performance of early-warning systems. All of this may act to place an unusually high premium on surprise or clandestine attack and on the use of novel or unexpected agents or means of dissemination. Once the effect of surprise has worn off and defensive precautions have been instituted, CB warfare might continue on a large scale but with relatively inconclusive effects until new weapons are introduced or until conventions against the attack of previously inviolate targets are transgressed.

The difficulty of allowing the limited employment of gas without running the risk of bringing the whole chemical and biological arsenal into use has been concisely stated by T. C. Shelling in his book *Arms and Influence* (Yale University Press, 1966).

'Some gas' raises complicated questions of how much, where, under what circumstances; 'no gas' is simple and unambiguous. Gas only on military personnel; gas used only by defending forces; gas only when carried by projectile; no gas without warn-

ing—a variety of limits is conceivable . . . But there is a simplicity to 'no gas' that makes it almost uniquely a focus for agreement when each side can only conjecture at what alternative rules the other side would propose and when failure at co-ordination on the first try may spoil the chances for acquiescence in any limits at all.

These principles appear to have been understood by the leaders of both sides in World War II, during which neither lethal nor non-lethal gases were employed. At the outbreak of the War, both sides exchanged assurances that they would observe the Geneva Protocol of 1925. Later, in 1943, President Roosevelt declared:

Use of such weapons has been outlawed by the general opinion of civilized mankind. This country has not used them and I hope that we never will be compelled to use them. I state categorically that we shall under no circumstances resort to the use of such weapons unless they are first used by our enemies.

Although many rules of war were violated in that conflict, it is fortunate for all sides that the rule against gas was observed. Germany had secretly developed and produced a large quantity of nerve gas. Although the Allies had no weapon of comparable deadliness, they could have produced vast quantities rather soon after becoming aware of its existence. Since the previous restraints against anti-city warfare had already broken down, the introduction of nerve gas in the midst of World War II would almost certainly have caused a death toll vastly greater than it was.

Chemical and biological weapons by their very nature are suited to the attack of large areas; their natural targets are people rather than military equipment; important military personnel can be equipped and trained to use protective devices far more easily than can civilians. For all of these reasons, civilians are the most natural and most vulnerable targets for CBW attack. If the barriers against CBW are broken down, civilians are likely to become its main victims.

The myth of humane CBW

It is well known that some chemicals such as tear gas are able to incapacitate a man for a short time with little risk of killing. Some people have concluded from this that the introduction of non-lethal chemicals and even of biological weapons thought to be non-lethal might actually make war more humane. The argument has shown considerable appeal both for thoughtless zealots who

wish to advance the practice of CBW in any form and also for persons who genuinely hope to make war less savage. Although it is true that some chemical warfare agents are relatively non-lethal in themselves, it seems to me almost certain that their use would definitely not make wars on the whole less savage and would in fact risk making them much more so, should it trigger the use of lethal CB weapons.

It is naïve to expect that in a real war non-lethal agents would be used by themselves. Once introduced into a combat area, the pressure would be very great to utilize them in any manner that increased the overall effectiveness of general military operations. Non-lethal chemical weapons would be used to increase the effectiveness of lethal ones. Tear gas can reduce the accuracy of enemy rifle fire, allowing one's own forces to approach more closely, increasing the accuracy and intensity of their counterfire. It can be used to force men out of protective cover and into the line of fire or the path of bomb and shell fragments. Under the desperate pressures of a war fought with artillery, bombs, napalm, and other lethal weapons, it is only reasonable to expect that "non-lethal" weapons once introduced will come to be used in order to kill. This has happened in Vietnam where the U.S. forces have spread riot gas over large areas to force persons from protective cover to face attack by fragmentation bombs. It happened in World War I when both sides used tear gas and other non-lethal chemicals in grenades and artillery shells to facilitate conventional infantry and artillery operations. This is not to say that non-lethal weapons would necessarily make war any more savage than it already is. However, it seems unrealistic to expect that they would make it any less so.

In any case, if tear gas or similar agents should prove at all effective when first used both sides would introduce protective devices and tactics, making subsequent use of such agents much less effective. Thus, except perhaps when they are first introduced, non-lethal chemical weapons are unlikely to have much effect except to set the stage for more deadly CBW operations.

The conduct of non-lethal CBW can greatly facilitate preparations and training for the use of lethal chemical and biological agents. When combatants learn to protect themselves against the effects of mild or 'conventional' agents the temptation will be strong and the means will be at hand to experiment with more deadly ones. During the first year of World War I both sides used tear gas and other harassing agents until the Germans introduced lethal

chlorine gas. Following that, both sides tested a large number of poison gases seeking to find ones that would be decisive in battle. The first attack with poison gas had a devastating effect. The Allied front was broken, and 5000 of the 15,000 gas casualties died. However, even though more effective gases were introduced in great quantity by both sides, advances in defensive preparations prevented gas from being a decisive weapon in World War I. Advocates of "humane" gas warfare often point out that, at least toward the end of World War I, gas produced casualties with proportionately less mortality than did high-explosive weapons. However, this was not because commanders on both sides wished to fight without killing, but rather because the most effective gases then known caused more wounds than deaths. Modern nerve gases are vastly more lethal than the old World War I gases. Can anyone have much confidence that skin-penetrating nerve gas would not have been used in World War I had it become available in 1917?

Chemical and biological weapons and minor powers

The development and initial production of a new weapon usually requires much greater sophistication and effort than is needed to reproduce a weapon already possessed by another. The accessibility of chemical and biological weapons to smaller powers will depend very much on the CBW programmes of great powers and, for a limited time, on measures to keep the results of those programmes secret. With chemical and biological weapons as with other weapons, great powers will probably lead the way unless they deliberately refrain from doing so.

The chemical compositions of several nerve gases are published in the open literature, and detailed manufacturing procedures could be specified by competent chemists and chemical engineers. Although no thorough cost-analysis has been published, it would appear that a considerable number of smaller nations could produce and integrate nerve gas weapons into their artillery and air forces without great economic strain. Commercial transport aircraft could be modified without great difficulty to drop or spray the gas. No small power is definitely known to produce nerve gas or to have been supplied with it by another, although there have been newspaper reports that Egypt has used a nerve gas on a small scale in the Yemen conflict.

The acquisition of nerve-gas weapons would greatly increase the destructive potential of a small nation's military forces, but it might also greatly reduce its overall security by provoking its neighbours

to arm themselves similarly. This they might do by producing the gas themselves or by demanding it from their great power allies. If nerve gas warfare should ever break out between two small states, the population of one or both could be largely annihilated within a short space of time, and the intense feelings provoked around the world might well ignite a much larger conflict.

The attempt to develop biological weapons of reasonably assured characteristics would require a costly and technically sophisticated effort and an elaborate testing programme. Indeed, only use in war itself would provide the kind of information that responsible military men would require before placing much reliance on a radically new type of weapon. It seems unlikely that a small power would attempt the development of biological weapons except perhaps as a deterrent threat. However, this would be an extremely risky posture for a small power unless large powers had already legitimized the possession and threatening display or use of biological weapons.

Why single out CBW for special prohibitions?

As long as wars continue to be fought with high explosive weapons and napalm, what sense does it make to maintain special constraints on CBW? The question is understandable, but it seems to me that some substantial answers are contained in the remarks above. We realize that special rules are required for nuclear weapons. The distinction between conventional weapons and nuclear ones of any size is a real one, and the importance of maintaining it is generally understood. Chemical and biological weapons share with nuclear ones the attribute of potentially overwhelming destructiveness. Biological weapons could pose a threat to the entire human species. Both chemical and biological weapons place a high premium on clandestine and surprise attack, thus lessening stability. Once developed, chemical and biological weapons can be exceedingly cheap, relatively easy to produce, and quick to proliferate. They would threaten civilians especially. Their use would violate the oldest major arms control treaty still in force.

Preventing the use of chemical and biological weapons

It is important for nations to understand that it is in their long-term interest to prevent the use of chemical and biological weapons. This principle could be understood better and more widely than it is today. Discussions and publications by private persons can help.

Studies by competent national and international organizations could command wide attention and respect.

The United Nations might consider forming contingency plans for the investigation of allegations concerning the use of chemical and biological weapons. Some of the political difficulties standing in the way of such investigation might be eased if the machinery were partly set up in advance and if its purpose were to establish whether or not chemical and biological weapons had been used rather than to identify the user. It might be agreed that the request of the alleged victim would be sufficient to initiate an investigation. If this were not acceptable it might be required, instead, that all combatants in a given conflict agree to the holding of any inspection. At least this would place the aggressor in the position of having to oppose an investigation.

Some nations or areas might declare themselves to be free of chemical and biological weapons. The Austrian State Treaty prohibits that country from developing or possessing such weapons. West Germany has given assurances to its allies in the Western European Union that it will not produce chemical and biological weapons, and the Union's Arms Control Agency conducts periodic inspections throughout its European territory to provide assurance that no member is producing these weapons. Obviously, there would be many problems and choices involved in setting up CBW-free areas. However, the possibility should be carefully investigated. A start in this direction has been made by the Pugwash Biological Warfare Study Group which has conducted experimental inspections for the non-production of biological weapons in NATO, Warsaw Pact, and unaligned countries.

As in most arms-control matters, the decisions lie mainly with the super powers, although the initiative may be taken in part by other nations. Nevertheless, it is vital that the super-powers understand that the use of chemical and biological weapons anywhere in the world would constitute a threat to their interests. Possessing nuclear weapons, they do not need chemical and biological weapons as a major deterrent.

There may be a certain symmetry in the view that biological weapons are needed to deter the possible use of such weapons by an enemy. However, in the nuclear environment, the proposition is devoid of logic. The super-powers have no need for biological weapons, and by producing and displaying them they would only make trouble for themselves in the future.

The Geneva Protocol provides a relatively clear and unique

standard to guide both the practice and the expectations of nations. The Protocol has been ratified by all major powers except Japan and, ironically, the nation which proposed it at Geneva—the United States. Many of the states organized since World War II, including the People's Republic of China and both Republics of Germany, have ratified the Protocol or have agreed to be bound by the ratification of their predecessors. Less than two years ago, in December, 1966, the General Assembly of the United Nations passed without opposition a resolution calling for strict observance of the Geneva Protocol and appealing for universal accession to it. The United States and Japan voted in support of the General Assembly resolution along with 99 other states. It is important to secure the actual ratification of Japan, the United States, and other nations that have not yet ratified the Protocol. Means should be found to make clear that viruses as well as bacteria and non-lethal as well as lethal chemical and biological weapons are meant to be included under its prohibition. But great care must be exercised to make sure that attempts to further clarify the scope of the Protocol do not result in weakening its universal authority.