PROCEEDINGS OF THE
FOURTEENTH PUGWASH CONFERENCE
ON SCIENCE AND WORLD AFFAIRS

April, 1965

M. Meselson

A PROPOSAL TO INHIBIT THE DEVELOPMENT OF BIOLOGICAL WEAPONS

Introduction

Biological weapons possess a dangerous potential as a cheap means of inflicting massive civilian casualties. The potential of micro-organisms and viruses as cheap casualty-producing agents arises from the extreme smallness of the amount which might suffice to infect the population of a large area. This may be seen from the following comparison of illustrative payload requirements for aerial attack with a nerve gas and with thermonuclear and biological weapons, assuming that the latter can be brought close to their full potential efficiency.

Weapons	Approximate requirement per square kilometre*
	(grammes)
Nerve Gas (Sarin)	10^{6}
Hydrogen Bomb	$10^{2} - 10^{3}$
Bacteria	10^{-1}
Viruses	$<10^{-3}$

* Values for chemical and biological agents assume:

(i) Formation of a uniform cloud extending to an altitude of 100 metres.

(ii) Ten minutes of exposure without protection.

(iii) Average lethal inhaled dose of sarin is 10^{-3} grammes.

(iv) Average inhaled dose of 100 viruses of bacteria will initiate infection in most of the population. It is not assumed that infection is contagious.

One may hope that the difficulty of perfecting reliable and efficient biological weapons will prevent their potential from being attained - but it is unwise to rely on the inability of modern technology to overcome such difficulties.

For many of the same reasons that the security of the citizens of all nations requires that the spread of nuclear weapons be stopped, it is also in the common interest that biological weapons not be introduced into the arsenals of the world. In particular, the great powers have probably the least to gain and the most to lose from such a development. At present this does not seem to be well understood by the government of the United States and the same may be true in the U. S. S. R., although information on Soviet policy is too scarce to allow a reliable evaluation. However, effective measures for inhibiting the development of biological weapons could be instituted if governments were to realize their common interest in doing so. Some of these measures could be initiated now on a trial basis by a group of smaller nations. Their example could have a powerful effect in inducing other nations, including the great powers, to follow suit.

The main purpose of this paper is to outline a plan whereby a group of smaller powers, representative of Eastern, Western and Non-aligned nations, might undertake to set such an example. Proposals along these lines have evolved during discussions at the 11th Pugwash Conference in Dubrovnik, during further discussions in the Pugwash Special B. W. Working Group at Karlovy Vary and at the meeting of the Pugwash Study Group on Biological Warfare in Geneva.

Incapacitating and Lethal, Tactical and Strategic Biological Weapons

The dangers to world security posed by all classes of biological weapons are closely interrelated. Both in public opinion and in actual military practice, it would almost certainly be impossible to maintain any lasting separation between incapacitating and lethal biological warfare, or between tactical and strategic employment. The great variety of possible agents forms a continuous spectrum, from the temporarily incapacitating to the highly lethal. The facilities and techniques required for the development, production and use of biological weapons would have many essentials in common, regardless of the specific agent or use involved. Once any nation develops a biological weapon and uses it effectively in war, the probability would be very great that others would follow suit - for many nations would have the capability of reproducing the requisite technology. And, once the various restraints on the practice of any form of biological

warfare are broken down, the entire spectrum of biological weapons may then come into use. Thus, the initiation of biological warfare of any sort risks uncontrollable escalation and opens the possibility of greatly changing the nature of warfare, with results difficult to foresee.

Chemical Warfare

Although the problems of controlling chemical and biological weapons are strongly interrelated, the proposals to be outlined here deal specifically with biological weapons. Mainly, this is because the greater casualty-producing potential which can be foreseen for them at the present time would qualify them for attack on large civilian populations. However, measures successful against biological warfare are likely to provide experience and create attitudes which can facilitate steps for the prevention of all forms of toxic warfare.

Inhibiting the Development of Biological Weapons

Effective measures to prevent the use of biological weapons must include provisions to inhibit their development. The control of development is essential because:

(a) At present, it is quite possible and even rather likely that no country has succeeded in developing operational biological weapons. The development of a reliable biological weapons system suitable for large-scale military operations would require a major research effort and a difficult testing programme. However, if the necessary research and testing is accomplished in any one country, the technology would almost certainly diffuse in time to others.

(b) Even if a state undertakes only a development programme it seriously risks breaking down the existing barriers in military, political, and public opinion to the use of biological weapons. This is especially true for states whose activities are relatively open to public view, as they must attempt to justify their actions in both domestic and world opinion.

Biological Weapons and National Defence

A common national attitude toward any potentially powerful weapon holds that it must be developed to offset its possible development by an enemy. In spite of its outward symmetry, this attitude is without any necessary logic. In the particular case of biological weapons, it neglects the following over-riding considerations:

(a) The possession of one's own biological weapons would not constitute a defence against enemy biological weapons.

(b) The use of biological weapons, should they be allowed to come into existence, would be deterred insofar as deterrence is effective, by weapons already in existence, especially nuclear weapons.

(c) One's own development efforts will help place biological weapons in the hands of others, both by the inevitable leakage of military technology in spite of security precautions and also by stimulating independent efforts in other states.

Defensive preparations usually benefit from experience gained in the parallel development of offensive weapons. But this consideration is less important in the case of biological weapons. The number of different micro-organisms and their mutants which are potential biological agents is so great that it is not practical to attempt to develop and administer a specific preventative or therapy for the effects of each. Defensive preparations should concentrate instead on the early detection and identification of potential agents and on the provision of mechanical protection such as masks and filtered air supplies to prevent all micro-organisms from reaching the population. Also, future research may discover super broad spectrum anti-microbial therapies. The important point is that these defensive efforts can be conducted largely or entirely without secrecy, and are closely related to problems in medicine and public health in which openness and co-operation are beneficial to all.

The wisest policy for a nation wishing to defend itself against the possibility that biological weapons will be developed and used against it or its allies, is to avoid pioneering that development itself, while at the same time keeping watch on developments in other countries. Emphasis should be placed on the development of rapid detection and warning systems and of protective measures. Contingency plans should be formulated to provide protection to the population in case a situation should arise in which such action seems advisable. This in fact appears to be

the present policy of certain nations which have the capability to engage in weapons development. The effectiveness of such a restrained national policy would be greatly enhanced if it were coupled with measures to foster restraint in others. Such measures should aim as far as possible to eliminate secrecy and the suspicion of secrecy from all biological and medical research with potential military applications. The following proposals for a small nation pilot agreement are designed to set an example which could stimulate other nations to take similar steps.

A Pilot Agreement

General considerations

There are many useful components which could be built into an agreement to inhibit the development of biological weapons - and various alternative combinations of these may be imagined. However, the design of an agreement is best left to discussion among representatives of the participating nations themselves. At this early stage, it would seem more useful only to list some of the components which ought to be considered and to put forth some general considerations.

The acceptability and durability of an agreement may be greatly increased by introducing measures of mutually beneficial cooperation and exchange wherever possible. For example, exchanges of personnel between national epidemiological surveillance services may provide as much, or more, reassurance of compliance with certain provisions of the control agreement as would a visit by an adversary inspection team. Although provisions should be made for inspection when needed, the need for inspection can be reduced and inspections can be made more efficient by proper use of information obtained in large part from the participating countries themselves. Consider, for example, the problem of determining whether or not work on bacterial toxins is devoted to peaceful purposes. Unless a well-advanced military effort were underway, it might be impossible to conclude from inspections alone whether or not the effort was directed toward peaceful ends. Even if there were indications of weapons development, it might be very difficult to prove and to convince others that a violation had occurred. The situation would be quite different if governments were required to provide the control agency with detailed information concerning the location, size and general nature of establishments dealing with bacterial toxins. Incorrect statements could be detected with a minimum of formal inspection. If evidence of an undeclared facility should appear, either as the result of an inspection or otherwise, the burden of explaining the inconsistency falls upon the government in

question. To put the matter differently, the repeated confirmation of information supplied by governments acts to build mutual confidence that the terms and spirit of the agreement are being observed by all participants.

Specific measures

Before an official approach is made to governments, tentative recommendations concerning the details of an agreement should be formulated by an unofficial group of persons from the prospective participating states. The unofficial group might conduct one or more co-operation or inspection exercises to gain experience and to demonstrate the feasibility of specific activities. Some of the components for the control agreement which the unofficial group should consider for recommendation to their government are as follows:

1. A declaration by each state that it is not developing biological weapons. A declaration to this effect would form part of the control agreement itself. Negotiation of the agreement would be facilitated by making such declarations in advance. Private assurances given between states might be adequate for this purpose.

2. Establishment of a control commission. The agreement might go so far as to provide for the establishment of a commission with responsibilities for measures of co-operation and exchange and for mutual assurance of compliance with the declaration not to develop biological weapons. The composition and procedures of the commission, its responsibilities and the extent of its authority, its financing, its liaison with participating governments and possibly with international agencies such as the World Health Organization, are matters to be carefully worked out so as to ensure a high degree of harmony between participating states in the implementation of the agreement. It might be best for a commission to devote its initial efforts mainly to modest programmes of co-operation and exchange, and to develop its control activities only gradually. At some stage, however, the commission could be in a position to report at regular intervals that, to the best of its knowledge, biological weapons are not being developed in any of the participating countries. If, once such regular reporting has begun, the commission should find itself unable to certify compliance with the control agreement, the commission would describe the reasons for its inability to do so and would provide recommendations for overcoming the difficulty.

3. Measures of co-operation and exchange. These might include the exchange of personnel between national epidemiological surveillance services and between institutes dealing with micro-organisms of possible military interest. Consultation and co-operation might be undertaken on problems of early detection and identification of air-borne pathogens responsible for diseases and epidemics in man, animals and crops.

4. Information and research. In meeting its control responsibilities, the commission might obtain information from many sources, including scientific, technical and other generally available publications, questionnaires returned by participating states, study exercises and inspections. The commission might also conduct, or seek to have conducted, studies pertinent to its responsibilities.

5. Questionnaires. Questionnaires submitted periodically by the commission to the participating governments might concern facilities for and organization of research, testing, and production concerned with microbiology, immunology, epidemiology, aerosols, etc. Information regarding facilities might include:

(a) location;
(b) size;
(c) floor plan, if permitted;
(d) nature of work;
(e) number and training of personnel;
(f) safety precautions and waste disposal provisions;
(g) number and kinds of experimental animals bred, kept and disposed of;
(h) scientific and technical publications;
(i) restrictions on allowable inspection by control commission.

Information might also be requested regarding the number of cases of certain designated diseases. Routine public health service reports might serve this purpose.

6. Personnel. The commission could maintain records containing up-to-date professional biographies of persons highly skilled in microbiology, epidemiology, and possibly certain other fields. Records could also be kept of students receiving advanced degrees in the above subjects. It is essential that the compilation and maintenance of personnel records be conducted so as to protect the privacy of the persons involved. For example, the commission might be confined to draw its information from public sources such as professional journals, membership lists of scientific societies, graduation lists, etc.

7. Protection of commercial secrets and provision for settling damage claims. If the right of obligatory inspection is given to a control commission, measures must be worked out in advance for the protection of commercial secrets and for the adjudication of disputes and damage claims, should they arise.

Scale of the required effort

The adequate functioning of the control commission would require only a modest effort. A great deal could be accomplished by a full-time director acting on behalf of a board of commissioners which meets periodically. In addition, a board of advisers should be formed to provide technical advice when needed. Members of the advisory board might be asked to take part in inspections. The exact scale of the effort is likely to be much less important than the degree to which the sustained attention of a few persons can be maintained.