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Protection Pending: Changing the Lock on Pandora's Box

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Research of the Program in Arms Control, Disarmament, and International Security

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For nation shall rise against nation, and kingdom against kingdom:
and there shall be famines, and pestilences . . .
Matthew 24:7

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Devin T. Hagerty

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Biological weapons constitute a real but under-studied threat to international security and U.S. national security. Unlike chemical weapons, their effects may be just as devastating as nuclear weapons; but unlike nuclear weapons, biological agents receive relatively little attention from scholars and policy analysts. This study is thus an attempt to address a somewhat neglected subject. The author, Christian Enemark, particularly examines the various difficult issues that would inevitably arise out of attempts to give the Biological Weapons Convention more "teeth," that is, to make it as verifiable as possible. In doing so, he analyzes both the political and technical challenges that lie ahead. Enemark's paper—along with Jeffrey Heftman's 1997 study of the Conventional Weapons Convention ("An Evaluation of the Chemical Weapons Convention and the U. S. National Interest," *ACDIS Occasional Paper*, 1997) —represents a continuing effort by ACDIS to disseminate excellent scholarship on all weapons of mass destruction, both nuclear and non-nuclear.

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Christian was first inspired to write this paper in late 1997 when he was an Intern with the Australian Department of Foreign Affairs and Trade in Canberra. While conducting research for the Department into the challenges of controlling weapons of mass destruction, he came across the worrying gap in the global arms control regime that presently exists concerning biological weapons, or germ warfare. Determined to help raise public awareness of this problem, he set about examining and evaluating the international ban on these horrific weapons.

At law school Christian is still passionate about arms control and is a member of Greenpeace Australia and the Australian Institute for International Affairs.

According to ancient legend, the opening of Pandora's Box released into the world all the scourges and diseases which afflict mankind. Today, the world faces the threat of the opening of a modern Pandora's Box containing the same afflictions but manifested in the cruel reversal of medical science—deliberate disease, or biological warfare. If the international ban on biological weapons is not strengthened so as to tighten the lock on this modern-day Pandora's Box, there is a grave danger that the uncontrolled proliferation and use of these horrific instruments of mass destruction will afflict the world.

Until recently, the threat of biological weapons (BW) has received little international attention compared with other weapons of mass destruction (WMD). Concern about nuclear weapons (NW), and more recently about chemical weapons (CW) has dominated efforts in non-proliferation research and policy-making. Arguably, the great moral abhorrence attached to BW has tended to narrow what public discussion has occurred on this sensitive topic. Today, the threat of BW is real and yet there is no means of knowing whether a country is in breach of the international ban on these horrific weapons. This paper is premised on a determination to give the problem of BW proliferation the attention it deserves. A mere description of the threat of BW will not suffice. This work sets out to investigate an important means by which the threat to global security posed by BW could be substantially reduced: the conclusion of a workable verification Protocol to strengthen the Biological Weapons Convention (BWC).

The task of strengthening the BWC with a verification regime is an urgent one. Notwithstanding the possibility of a Nuclear Weapons Convention in the future, the BWC represents the last and most challenging step in eradicating the threat to global security posed by WMD. This study does not propose that a strengthened, verifiable BWC would constitute a complete solution to the problem of BW. Rather, the particular contribution of this paper is that it presents, analyses, and assesses the possible components of a BWC verification regime as a serious and worthwhile multilateral solution that substantially reduces the threat of BW proliferation and use.

Verifying compliance has been a difficult and complex aspect of negotiations on strengthening the Convention. Although technical feasibility will largely determine the workability of any measures proposed for a verification protocol, this is a secondary consideration. The greatest determinant of success at strengthening the BWC with a legally binding instrument will be political commitment. Approaching verification as primarily a political challenge, this paper will address the question of why it is taking so long to bring into force a strengthened, verifiable BWC. The delay in strengthening the BWC is generated by debate and controversy which centers around two fundamental questions concerning BWC verification:

1. Can the BWC be strengthened?
2. How should the BWC be strengthened?

This paper contributes to the debates over BW non-proliferation by arguing that arrival at a verification protocol for the BWC is both technically and politically possible. Faced with the enormity of the threat of BW proliferation, the Convention can be strengthened so as to reduce this threat. Yet debate and controversy over the above two questions continues such that it is still taking a long time to bring into force a strengthened, verifiable BWC.

When the BWC was negotiated, and the Convention opened for signature in 1972, BW were seen to have little military utility, being regarded as difficult to produce and deliver, and to control after deployment. It was mainly for this reason that it was thought unnecessary at the time to include provisions in the Convention for verifying compliance by state parties (member states). However, improvements in biotechnology since then have made BW a more feasible choice for those countries seeking to develop a WMD capability at moderate cost.

Under the BWC as it exists at present, if a party or non-party to the treaty decides to cheat, it will probably easily avoid detection. Furthermore, as controls on other WMD start to come into effect, BW may become the weapon of choice for terrorists or so-called "rogue" regimes. For example, the Chemical Weapons Convention (CWC), in force as of April 1997, makes CW far more difficult to acquire. Combine this with the much greater quantities of agent required for a militarily significant CW program, as well as current progress in nuclear arms control measures, and BW may seem more attractive to a country or group seeking a WMD capacity. These considerations underline the urgent need for the rapid conclusion of a workable verification protocol to strengthen the BWC.

The issues of most concern to this work are divided into three sections. Before consideration of the specific issues surrounding verification of the BWC as a means of strengthening the Convention, it is first important to understand both the nature of the problem of BW proliferation and the international context in which a solution to the problem must be found. Part One places the problem of BW proliferation in perspective and highlights the necessity for a verification regime, which accounts for the peculiar nature of BW. This section includes an overview of the BWC verification challenge and an examination of the nature of BW and their likely effects in an attack. Of particular concern is the threat of BW as manifested in terrorism, arguably the most frightening post-Cold War challenge facing the BWC regime. Part One concludes with a discussion of the prospects for arms control and verification in the post-Cold War era. This places the BWC verification challenge in political perspective.

Part Two of this paper addresses the question, which must be asked even before considering how best to go about strengthening the BWC: is BWC verification possible in the first place? In other words: *can the BWC be strengthened?* Having established that the threat to global security of BW is real, Part Two sets out by examining arguments over the most effective means of averting that threat. Those who favor military and civil defensive measures to thwart BW attack argue that BWC verification measures are insufficient reassurance that the threat of BW proliferation and use is being adequately addressed. Responding to this position are those who argue that BW defense would only exacerbate the problem. This section goes on to show that BWC verification measures are not only technically possible, but they can operate in a way that does not compromise confidential business or national security information. Part Two concludes by discussing the possible implications for the BWC of the United Nations Special Commission (UNSCOM) weapons inspections experience in Iraq. This very important and topical comparison is applicable also in later sections.

Part Three addresses the most complicated, controversial, and multifaceted question facing the BWC negotiators: what measures should be included in a BWC verification protocol? That is, *how should the BWC be strengthened?* This section starts out by examining the areas of concern regarding each of the most likely verification measures to be included in a protocol: declarations, on-site inspections (OSIs), and investigations of unusual or suspicious outbreaks of disease. The conduct of such measures would have to be administered by an international organization, yet there are disagreements over what that organization should be and how it should be run. Part Three concludes with a consideration of the vexed questions of technology transfers and export controls. This issue is especially significant in that developed and developing countries are strongly divided as to the importance of technology transfers to the overall workability of a verification protocol.

Having considered the myriad issues at stake in BWC negotiations, Part Four concludes that verifying compliance with the BWC is indeed technically and politically possible. To demonstrate this conclusion, this section includes a five-point outline of how the Convention should be strengthened.

PART ONE

The Problem of Biological Weapons Proliferation

The Biological Weapons Convention

Under the Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction (BWC), member states undertake never to develop, produce, stockpile or otherwise acquire or retain biological agents or toxins, or their delivery systems. When the BWC was opened for signature in 1972, it was unique among existing arms control treaties in that it prohibited an entire class of weapon. There are currently some 138 states party to the BWC, with 18 additional countries who have signed but not ratified the Convention.[1]

The BWC contains no legally binding instrument for verification of compliance with its provisions. This fundamental weakness has contributed to a destabilization of confidence in the Convention caused by unverifiable allegations of BW development over the past twenty years. With the indefinite extension of the Nuclear Non-Proliferation Treaty (NPT) in 1995, the opening of the Comprehensive Nuclear Test Ban Treaty (CTBT) for signature in 1996, and the entry into force of a verifiable CWC in 1997, there is now a real need to address the problem of BW which remains as the last "available" WMD. If action is not taken urgently to strengthen the BWC with a workable verification regime, some states may be encouraged to exploit this weak link in the global WMD non-proliferation regime and acquire BW, with consequent damage to regional and world security.

At the Third BWC Review Conference (RevCon) in 1991 an Ad Hoc Group of Governmental Experts (VEREX) was mandated to examine potential verification measures from a scientific and technical viewpoint.[2] BWC member states at the special BWC RevCon considered the VEREX report in September 1994. Here, delegates agreed to set up an Ad Hoc Working Group (AHG), with a mandate to draft a legally binding instrument for the BWC. Part of this mandate is to investigate "a system of measures to promote compliance with the Convention, including, as appropriate, measures identified, examined, and evaluated in the VEREX Report. Such measures should be:

- applied to all relevant facilities and activities,
- reliable, cost-effective, and non-discriminatory,
- as non-intrusive as possible, consistent with the effective implementation of the system, and
- should not lead to abuse."[3]

Reaching agreement on a verification regime for the BWC will require trade-offs between different countries' interests concerning costs of verification measures, intrusiveness, probabilities of detecting violators, and strength of deterrence.[4] Such is the challenge in achieving wide political acceptance of measures forming part of a verification protocol to strengthen the BWC.

The AHG is competing for time in an already crowded arms control agenda at the Conference on Disarmament in Geneva. Although there has been considerable progress to date, the AHG will not be able to complete its work by the target date of 1998. At the 1996 Fourth BWC RevCon, delegates agreed that a verification protocol should be ready before the next review conference in 2001.[5] Given the urgency of the BW situation, it is crucial that a workable protocol be agreed upon and implemented quickly.

Biological Weapons and Their Effects

Biological Weapons

In contemplating a workable verification protocol for the BWC, it is essential to identify the peculiarities of the development, production, and storage of BW, as distinct from chemical and nuclear weapons. In 1969 the Secretary–General of the United Nations (UN) issued a report which showed that BW had a potential strategic impact parallel to that of NW. Furthermore, evidence available to the Secretary–General showed that BW were

far cheaper than conventional, chemical, or nuclear weapons.[6] BW are easier to make than NW and, with recent advances in biotechnology and genetics, they can spread destruction more efficiently than CW. The effects of a BW attack are so great in proportion to costs of production that BW are sometimes referred to as "the poor man's atomic bomb." Further, as controls on other WMD start to come into effect, BW may become the weapon of choice for terrorists or aggressive regimes.

The potential danger from BW is considerable. There is no longer any real necessity to maintain a stockpile of actual weapons. A biological agent can be produced in militarily significant quantities rapidly and can then be dispersed using a simple spray system.[7] BW can be classified as strategic weapons because of their potential to be used against populations rather than on the battlefield. It is for the mass destruction of populations far removed from the aggressor's country and troops that BW are most likely to be useful. Other strategic applications of a militarily significant BW program include attacks on agriculture or livestock. For example, the discovery by UNSCOM inspectors of Iraqi investigations into wheat smut (a plant disease) suggested that Iraq knew that BW were more than antipersonnel weapons; they could also be used against crops as part of economic warfare.[8]

The BW problem is complicated by the dual-use nature of the equipment and technology used for both legitimate medical research and weapons. In addition the BWC itself permits the development of biological and toxin agents in small quantities for peaceful and defensive purposes. Such legitimate research projects and closely related commercial activities could, however, provide cover for an offensive BW program.[9] Advances in biotechnology have seen the wide dissemination of equipment and expertise throughout industrialized and many Third World countries. Even without such expert knowledge, many of the more deadly BW agents can be produced in sufficient quantities for terrorist use by relatively primitive means.[10]

The secrecy surrounding BW programs suggests that, unlike their more "glamorous" nuclear counterparts, BW have no prestige value on the world stage. Rather than being a source of national pride, these weapons have been largely stigmatized and tend to evoke moral revulsion. Notwithstanding the stigma attached to these horrific weapons, there are incentives to acquire a BW capability: BW are perceived as highly lethal; technologically simple; inexpensive; and difficult to detect.[11] Indeed, the number of states suspected of developing a BW capability has doubled since the BWC came into force in 1975.[12] According to the August 1993 U.S. Office of Technology Assessment report, "Proliferation of Weapons of Mass Destruction—Assessing the Risks," countries suspected of having clandestine offensive BW programs include: China, Egypt, India, Iran, Israel, Libya, North Korea, Russia, South Korea, Syria, Taiwan, and Vietnam.[13]

In addition, despite continuing inspections by UNSCOM since the end of the Gulf War, the UN suspects that Iraq still retains a BW program. U.S. government sources suggest that around 100 countries possess the indigenous technological capacity to launch such programs.[14] Even so, Roberts points to the large gap between the number of states capable of producing BW, and those actually doing so. Compared with nearly universal access to biomedical technology, materials, and expertise suited to the production of BW agents, today there are relatively few BW States.[15]

There is an argument that, as the emergence of BW is really a new threat, this undermines the adequacy of traditional approaches such as arms control and deterrence.[16] Rather, the new threat must be countered by resort to new approaches such as active countermeasures and passive defense measures. However, poorer countries are far less well equipped to deal with BW through advanced defensive measures. Given the need for universality in global non-proliferation efforts, multilateral arms control is likely to remain the best approach. In the case of BW, this means a combined international effort towards strengthening the BWC—a global ban that has hitherto failed to prevent violations of its provisions.

Effects of Biological Weapons

BW are munitions or other delivery systems, such as spray tanks, filled with biological agents of warfare—living organisms that depend for their effect on their ability to multiply inside a victim, or infective materials derived from them (toxins)—intended to cause disease or death among humans, animals, and/or plants.[17] Examples of BW agents include bacteria (anthrax, brucellosis, tularemia, plague), viruses (encephalitis,

smallpox, rickettsia), and fungi (moulds that cause stem rust of wheat and rye). Toxin warfare agents include botulinum toxin, ricin, and saxitoxin.[18]

Fortunately, despite their strategic potential, BW have never been used in modern warfare, with the exception of the possible covert use of anthrax in the Rhodesian civil war of 1978–1980.[19] Anthrax, a common BW agent, is a useful example that illustrates the probable mass effects and individual symptoms of a BW attack.

Japan, Britain, the Soviet Union, and the United States have weaponized anthrax, so its attributes as a BW agent are well known. Anthrax spores are extremely hardy and they retain their virulence during storage.[20] The spores are disseminated through the air in a cloud of particles that remains suspended in the atmosphere for long periods and can be inhaled deep into the lungs. According to the U.S. Office of Technology Assessment, 100 kilograms of anthrax, released from a low-flying aircraft over a large city on a calm, clear night, could kill 1 to 3 million people. This figure is comparable to the likely casualties from a one-megaton hydrogen bomb.[21] Such a well-executed BW attack would produce a massive, nearly simultaneous outbreak of disease in the infected population. A room no larger than a garage could contain a production plant with sufficient capacity to create in a few weeks enough anthrax to destroy a dozen large cities.[22]

Within the first forty-eight hours after inhalation of anthrax spores, the early signs of infection resemble a mild cold, including fever and chest pain. Acute illness sets in within three to five days with vomiting, chills, and high fever. This is followed by a series of quite gruesome symptoms: the skin erupts with blisters and turns black and leathery; the lungs fill with fluid; the brain tissue swells; and the extremities turn blue from lack of oxygen. Finally, the victim goes into shock followed by coma and death.[23]

The Threat of Biological Terrorism

In the last decade since the end of the Cold War, potential users of BW have expanded to include a wide range of non-State actors: international terrorist groups, domestic extremists, religious cults, and even individuals. Indeed, prospective BW users need only to possess the technical skills of an undergraduate biologist and a physical facility with the sophistication of a microbrewery.[24] There having never been a major BW terrorist attack, we know very little for sure about what the nature of such an attack would be. It would be correct to assume, however, that an act of biological terrorism could potentially result in millions of casualties.

The options are greater for where and when an act of BW terrorism can be conducted. Compared with conventional weapons that may be detected by x-ray machines or metal detectors, there is presently no reliable, widely used detection system for pathogenic BW agents. In releasing the BW agent, its dispersal has to be controlled and effective. Contrary to popular perception, a large U.S. city water reservoir would not be an attractive target for terrorist contamination. Success would require a huge amount of BW agent, which would then have to pass through water purification procedures.[25] A release of aerosolized particles into the air is the more likely tactic to be employed by determined terrorists.

Because BW agents are invisible, odorless, and tasteless, no one would know that a terrorist attack was underway. In the aftermath of a terrorist BW attack, physical injury, disruption of daily routine, and increased demands on public health facilities could place overwhelming pressures on national medical systems. Simon points out the general lack of preparedness by major cities for a BW attack. He observes that defensive BW military training has hitherto focused on defending against BW perpetrated by enemy troops in a battlefield setting.[26] Arguably, BW use will more likely take the form of a terrorist attack in a civilian setting. Holloway and his co-authors argue that disaster plans for managing a BW attack must be developed alongside the provision of realistic training so as to ensure an effective response to a terrorist event.[27] Terrorism is also a form of psychological warfare. When BW threaten a large civilian population, panic will be a particular risk. The experience of CW use by terrorists (for example the sarin nerve gas attack in the Tokyo subway in March 1995) suggests that psychiatric casualties are also likely among those exposed and unexposed to a BW attack.

The Japanese sect Aum Shinrikyo (Supreme Truth) sent a team to Zaire in 1992 to assist in the treatment of individuals infected by Ebola. It is claimed that the aim of this expedition was to obtain a sample of the deadly virus so that it might be taken back to Japan for culturing purposes. BW was Aum Shinrikyo's weapon of choice and unconfirmed reports suggest that Aum had attempted to produce and disseminate both botulinum

toxin and anthrax.[28] Its work on developing BW was close to completion in March 1995, the time of the sarin attack on the Tokyo subway.[29]

Given its preponderance of power in the post-Cold War international scene, the United States is likely to remain a major target for terrorist attacks. In response to the growing threat of BW terrorism, the U.S. government has developed a national system of operations for emergency medical services to respond to BW use. In the event of a terrorist incident, which exceeded local and state-level response capabilities, federal agencies would provide specialized teams and equipment to help manage the consequences of a BW attack, and to treat, decontaminate, and evacuate casualties.[30]

In his address to the UN General Assembly in September 1996, U.S. President Clinton emphasized the importance of preventing "rogue" states and terrorists from obtaining WMD.[31] At the fourth BWC RevCon the United States argued strongly that each member state's law enforcement apparatus should be used to enforce the Convention against anyone under its jurisdiction—including terrorists—who might flout its provisions.[32] Under Article IV of the BWC member states pledge to take all necessary steps to prevent the development or retention of BW by anyone within their respective territorial jurisdictions. The BWC Fourth RevCon underlined the importance of Article IV. Member states recognized "the need to ensure, through the review and/or adoption of national measures, the effective fulfillment of their obligations under the Convention in order, *inter alia*, to exclude use of biological and toxin weapons in terrorist or criminal activity."[33]

The United States implemented Article IV when Congress passed the Biological Weapons Act of 1989. A further example of a counter to terrorist use of BW is the U.S. Anti-Terrorism and Effective Death Penalty Act of 1996. This legislation requires the regulatory control of stores and transfers of certain listed biological agents.[34] Even if all BWC member states enact domestic legislation, that does not preclude the possibility that some person or group will attempt to obtain and use BW. That is, the full implementation of Article IV is not a complete deterrent to terrorist use of BW. However, such legislation may limit access to cultures of pathogenic organisms and thus reduce the likelihood that terrorists will acquire BW agents in the first place.

It is not certain why there has never been a major BW terrorist attack. One reason could be that preparing for and conducting an act of BW terrorism is not without its difficulties for the terrorists themselves. In preparation for and implementation of a BW attack, there is a danger that they could be killed while handling the biological agents intended for their victims. Nevertheless, safety and containment technology is available for those terrorists who can afford it. Others still may be determined to produce BW with little regard for their own safety. Consequently, the threat of terrorist BW attack in the future is very real and underscores the urgency of concluding a BWC verification protocol that can reduce the risks.

Arms Control and Verification in the Post-Cold War Era

In principle and practice, verification involves monitoring treaty-limited items and activities, and assessing compliance on the basis of that monitoring and other relevant information. One of the goals of verification measures is to deter member states from violating a treaty. This objective presumes that verification will be reasonably effective.[35] Kadlec and his co-authors define "effective verification" as:

> An arms control concept in which determination of compliance can be made by using a series of measures such as declarations of activities, visits to facilities, or other information that would yield accurate and unambiguous data about the nature of activities of potential concern.[36]

Even without an effective verification regime, the BWC has established an international norm to bar the possession of BW, and has provided an important symbol of most of the world's abhorrence of these weapons.[37] However, against the threat of a determined power seeking to possess a BW program, norms and symbols are far from enough. Legal inhibitions and international norms alone cannot hope to restrain the development and proliferation of BW. Historically no weapon has ever been invented which was too awful to use. International conventions designed to protect the civilian from direct attack have repeatedly been flouted. The use of the atomic bomb at the end of World War II was justified on the basis of its military effectiveness. Virtually no thought was given to prior inhibitions about using WMD on civilian targets. Similarly, the moral standard against BW use has diminished, not advanced. If the world is to be spared the threat of BW, efforts need to be

applied to overcoming the technical, organizational, economic, and political difficulties, which stand in the way of establishing the BWC as a strong, universal, and effectively verifiable arms control treaty.

A commitment to arms control involves a shift in national policy from unilateral measures emphasizing weapons procurement to multilateral measures emphasizing caps or reductions. As a consequence, Lowenthal argues, "arms control remains at the core, a highly contradictory pursuit—an attempt to reduce weaponry in agreement with the power or powers whose weapons and policies helped drive one to arm in the first place."[38]

Even in an inherently anarchic international political system, a deep level of international cooperation will nevertheless be required to ensure a strong global security regime. Arms control and verification are but one means of expressing a state of political relations. Lowenthal warns that political relations change over time, even as prior agreements remain in place. Agreements written during one period are inevitably subject to the political vagaries of the next.[39] Accordingly, the BWC of 1972 must now be changed in line with new developments in world politics.

A recognition of post-Cold War political realities is a vital precondition for the successful operation of the BWC regime. In the last decade, regional instabilities and conflict have replaced the period of relative bipolar stability between the two superpowers. Importantly, the end of the Cold War has seen the rise of ethnic conflict and an increase in the number of non-state actors seeking to destroy hated enemies. Roberts observes that existing proliferation trends are conspicuous for their regional clustering.[40] There is a great danger that regional conflicts in which non-nuclear WMD are used could escalate into a global security risk. This contrasts with the comparatively straightforward East–West nuclear arms race that characterized the Cold War.

The Cold War division of West and East has now been largely replaced by a North–South configuration. In the new international system, the perspectives, interests, and security needs of developing countries now play an increasingly significant role.[41] During the Cold War, developing countries were loosely combined under the rubric of non-alignment. In international negotiations, the Non-Aligned Movement (NAM) adopted as its foundation a moral neutrality between the Eastern and Western blocs. While vestiges of these diplomatic groupings are still of relevance in BWC negotiations, the political device of non-alignment is now lost.[42] Chubin is concerned that developing countries are often depicted in the West as the "new threat," with some being characterized as "rogue states."[43]

Certain events have raised concern in the international community over BW proliferation: In particular allegations of the manufacture of biological agents at a military institution at Sverdlovsk in the Soviet Union following an outbreak of anthrax there in April 1979[44] and revelations since the end of the Gulf War that Iraq had been conducting a BW program, the extent of which is still not fully known. With these and other lingering and unresolved concerns, the incentive for member states to strengthen the BWC is obvious: uncontrolled proliferation of BW would pose a grave threat to global stability and security.

Historically, effective efforts to improve or establish arms control arrangements occur only in "good patches" where a degree of trust between the countries concerned already exists.[45] The present is one such "good patch": the new post-Cold War international environment presents fresh opportunities for cooperative nonproliferation policies toward ending the threat of BW, now and into the future. The end of the superpower standoff means that non-proliferation policies need no longer be subordinated to Cold War objectives. In addition countries' foreign policy and intelligence resources can now be redirected from Cold War efforts to efforts dealing with the proliferation of WMD.

The international community is showing an increased willingness to work together to enhance their mutual security through disarmament treaties.[46] Verification measures are vital to these treaties because they inspire confidence that other member states are in compliance. Further, there is a cumulative benefit in binding nations into a verification regime to monitor compliance with an international treaty. Over time, a "web of deterrence"[47] builds up which becomes ever stronger. The challenge for the BWC will be to oversee the initiation of a verification protocol while avoiding early compliance problems which might undermine the legitimacy of the Convention and member states' confidence in multilateral arms control agreements generally.

Notes

1. Fourth Review Conference of the Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, *List of States Parties to the Biological Weapons Convention* (as of 25 November 1996), 3 December 1996, BWC/CONF.IV/INF.2.

2. Ad Hoc Group of Governmental Experts to Identify and Examine Potential Verification Measures from a Scientific and Technical Standpoint (VEREX), *Report*, Geneva, 24 September 1993, BWC/CONF.III/VEREX/8, 1.

3. Special Conference of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, *Final Report*, Geneva, 19–30 September 1994, BWC/SPCONF/1, 10.

4. Marie Isabelle Chevrier, "The Control of Biological Weapons," *Arms Control Towards the Twenty-First Century,* eds. Jeffrey A. Larsen and Gregory J. Rattray (Boulder: Lynne Rienner, 1996), 216.

5. Stockholm International Peace Research Institute, *SIPRI Yearbook 1997: Armaments, Disarmament and International Security* (New York: Oxford University Press, 1997), 455.

6. Graham S. Pearson, "Biological Weapons: the British View," *Biological Weapons: Weapons of the Future?* (Washington, D.C.: CSIS, 1993), 9.

7. Graham S. Pearson, "A Strengthened Biological Weapons Convention is Essential, Feasible and Achievable," *UNIDIR Newsletter* 33, 1996, 8.

8. Zilinskas, Raymond A., "Iraq's Biological Weapons: The Past as Future?" *Journal of the American Medical Association* 278 (5) (6 August 1997): 419.

9. International Institute for Strategic Studies (IISS), "Biological Weapons: New Threats or Old News," *Strategic Survey 1996/97* (London: Oxford University Press, 1997), 39.

10. Robert H. Kupperman and David M. Smith, "Coping with Biological Terrorism" in *Biological Weapons: Weapons of the Future?* ed. Brad Roberts (Washington, D.C.: CSIS, 1993), 38.

11. Chevrier, *Arms Control*, 209.

12. "The Whore of Babylon and the Horseman of Plague," *The Economist* 343, issue 8012, 12 April 1997, 80.

13. IISS, "Biological Weapons," 38. Numerous other sources give estimates of the possible number of BW States ranging from eight to a dozen or more.

14. H. Lee Buchanan, "Poor Man's A-Bomb?" *Proceedings*, (U.S. Naval Institute) 123:83–6 (April 1997): 84.

15. Brad Roberts, "Evaluating Global Non-Proliferation Instruments" in *Keeping Proliferation at Bay: Papers From the ARF Track Two Seminar, Jakarta,* ed. Ramesh Thakur, (Jakarta: CSIS, forthcoming), 5.

16. IISS, "Biological Weapons," 32.

17. Brad Roberts, "New Challenges and New Policy Priorities for the 1990s" in *Biological Weapons: Weapons of the Future?* ed. Brad Roberts (Washington, D.C.: CSIS, 1993), 69.

18. Jonathan B. Tucker, "The Biological Weapons Threat," *Current History* (April 1997): 167.

19. Jonathan B. Tucker, "Putting Teeth in the Biological Weapons Ban," *Technology Review* 100, (9) (January–February 1998): 43.

20. Zilinskas, "Iraq's Biological Weapons," 420.

21. Tucker, "Putting Teeth," 32.

22. Victor A. Utgoff, "The Biotechnology Revolution and Its Potential Military Implications" in *Biological Weapons: Weapons of the Future?* ed. Brad Roberts (Washington, D.C.: CSIS, 1993), 29.

23. Tucker, "The Biological Weapons Threat," 167.

24. Buchanan, "Poor Man's A-Bomb," 84.

25. Jeffrey D. Simon, "Biological Terrorism: Preparing to Meet the Threat," *Journal of the American Medical Association* 278 (5, 6) (August 1997): 429.

26. Ibid.

27. Harry C. Holloway, Ann E. Norwood, Carol S. Fullerton, Charles C. Engel, and Robert J. Ursano, "The Threat of Biological Weapons: Prophylaxis and Mitigation of Psychological and Social Consequences," *Journal of the American Medical Association* 278, (5, 6) (August 1997): 426.

28. Robert P. Kadlec, Allan P. Zelicoff, and Ann M. Vrtis, "Biological Weapons Control Prospects and Implications for the Future," *Journal of the American Medical Association* 278 (5, 6) (August 1997): 354.

29. Graham S. Pearson, "The Complementary Role of Environmental and Security Biological Control Regimes in the 21st Century," *Journal of the American Medical Association* 278 (5, 6) (August 1997): 370.

30. Jonathan B. Tucker, "National Health and Medical Services Response to Incidents of Chemical and Biological Terrorism," *Journal of the American Medical Association* 278 (5, 6) (August 1997): 362.

31. Malcolm R. Dando and Graham S. Pearson, "The Fourth Review Conference of the Biological and Toxin Weapons Convention: Issues, Outcomes and Unfinished Business," *Politics and the Life Sciences* 16 (1) (March 1997): 108.

32. John D. Holum, remarks of the Director of the U.S. Arms Control and Disarmament Agency*, United States* (Geneva: BWC 4th Review Conference, November 1996), 4.

33. Fourth Review Conference of the Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (biological) and Toxin Weapons and on Their Destruction, *Final Document*, 25 November–6 December 1996 (Geneva: BWC/CONF.IV/9), 17.

34. Pearson, "The Complementary Role," 370.

35. Joseph F. Pilat, "Arms Control, Verification, and Transparency," in *Arms Control Towards the Twenty-First Century,* eds. Jeffrey A. Larsen and Gregory J. Rattray (Boulder: Lynne Rienner, 1996), 80.

36. Kadlec and others, "Biological Weapons Control," 352.

37. IISS, "Biological Weapons," 39.

38. Mark M. Lowenthal, "The Politics of Verification: What's New, What's Not," John G. Tower, James Brown, and William K. Cheek, eds., *Verification: The Key to Arms Control in the Late 1990s* (Washington, D.C.: Brassey's, 1992), 23.

39. Ibid., 24.

40. Roberts, "Evaluating Global Non-Proliferation Instruments," 6.

41. Shahram Chubin, "The South and the New World Order," in *Weapons Proliferation in the 1990s* ed. Brad Roberts (Cambridge, Mass.: Massachusetts Institute of Technology (MIT) Press, 1995), 411.

42. Ibid., 415.

43. Ibid., 416.

44. Charles C. Flowerree, "Verification of Chemical and Biological Weapons: Lessons Learned," in *Verification: The Key to Arms Control in the Late 1990s* eds. John G. Tower, James Brown, and William K. Cheek (Washington DC: Brassey's, 1992), 190.

45. B. Hammer, *Arms Control and Disarmament*, Lecture to Joint Services Staff College, 1 August 1994, 3.

46. Pearson, "Biological Weapons," 5.

47. Ibid., 17.

PART TWO

Can the Biological Weapons Convention be Strengthened?

Introduction

In addressing the question "can the BWC be strengthened?" Part Two examines whether verification of the Convention is possible and therefore worthwhile. Part One presented the great challenges facing a verification regime, including reducing the likelihood of BW terrorism. Having outlined what BW non-proliferation policy aims to prevent, and the context in which such policy must be implemented, the first section of Part Two opens by examining what many regard as a BW response option preferable to verification of the BWC: military and civil defensive measures. Policies of unilateral defense as the alternative to a multilateral approach to the BW problem have a lot of support. Given that the issue of BWC verification is problematic and controversial, it is important to assess the extent to which defensive measures constitute a viable and worthwhile response to the threat of BW attack.

The second section examines the technical issues of BWC verification and argues that measures for verifying compliance with the Convention are largely possible from a technical and scientific viewpoint. Furthermore, as the third section shows, such verification is possible with little substantial risk to confidential security and business information. The last section of Part Two examines the very real issues of detecting BW currently facing UNSCOM weapons inspectors in Iraq. Lessons from the UNSCOM experience are of great relevance in deciding what measures should be included in, and what measures excluded from, a workable verification regime to strengthen the BWC.

Assessing the Adequacy of Defensive Measures

Article I of the BWC permits the development and production of BW for defensive purposes, and does not limit research and manufacture of BW equipment or protective BW training by armed forces. Some authors have argued for strong defense measures as the preferred means of avoiding a biological attack. This section assesses the strengths and weaknesses of the argument that the use of active and passive defense measures can adequately address the threat of BW.

Regarding active defense, the Cold War arms control strategy of deterrence is largely inappropriate for dealing with the threat of BW. Deterrence relies on the credibility of the threat of second-strike retaliation. In signing and ratifying the BWC and CWC many states, for example the United States, have given up the ability to respond in kind to BW and CW use. Consequently, for WMD deterrence purposes, the United States is limited to nuclear response options. However, this deterrence strategy has some fundamental difficulties. While a nuclear response may be seen as credible and proportional in retaliation against the use of BW against an urban population, such a response could be regarded as less credible and grossly disproportionate if initial use of BW were to be confined to the tactical release of biological agents on the battlefield. This problem is compounded by the fact that retaliation necessarily requires knowledge of who has launched an attack, and where they are situated. In the case of a non-state terrorist attack for which no one claimed responsibility, a second-strike retaliation against an unidentified aggressor would make no sense.

Turning to the much broader issue of passive defense, there is an argument to be made that the maintenance of effective biological defense, including vaccines, contributes to national security.[1] Effective defensive measures have a two-fold effect: firstly, they reduce the range of materials that may be used by a potential aggressor; and secondly, they reduce the utility of BW to an aggressor, who cannot be sure that use of their BW will be militarily effective.[2] It is hoped that planning and investing in the right training and defense measures diminishes the likelihood that BW will be used, and reduces the risk of disruption and casualties if BW is used.

There are three major strategies available for avoiding or alleviating the effects of deliberate disease: firstly, preventing exposure to the agent; secondly, rendering the potential target population resistant to the agent; and thirdly, alleviating the effects of the disease with drugs and other therapeutic measures.[3] Passive

defenses include a wide range of measures and equipment: respirators, protective shelters fitted with air filters, decontamination equipment, vaccination and antibiotics, and detection systems.

The U.S. Defense Advanced Research Projects Agency (DARPA) spends money on innovative technology for detecting and neutralizing BW. In 1998 the proposed budget for DARPA BW defense research was $61.6 million.[4] In particular, DARPA invests in projects aimed at improving defenses against multiple BW agents by gaining a better understanding of how pathogens attack the body. Stephenson recognizes vaccines as being the best defense against BW for troops in the field but acknowledges that existing vaccines offer protection against only a few of the potential hazards of BW attack.[5] With regard to vaccination against an array of different BW agents, Buchanan acknowledges that it is not known how many vaccines can function concurrently within the body without compromising the immune system.[6]

According to Buchanan, the United States can develop vaccines for almost any defined biological agent. He claims that the United States already has an almost-good-enough vaccine for the currently weaponized forms of anthrax.[7] However, it is in the nature of biological warfare that an aggressor will try to outsmart a nation's defenses by using an undefined BW agent. Indeed, while an anthrax vaccine would reduce the impact of an anthrax attack, that particular pathogenic organism is one of the more common BW agents. A determined BW aggressor would most likely use a BW agent that was less well understood.

Successful BW defense would require the pursuit of a technological agenda which enabled a nation's defense capabilities to outperform its adversary's offensive capability. Buchanan argues emphatically that BW defense is possible and that technologies with very high potential already exist. The success of such defense would demand a concentration of effort in both government and industry, and an extended commitment to maintaining the credibility of those defenses.[8] This means a requirement for effective defense that there be heavy investment in personnel protective measures. Further, sustaining credible defenses would need continuing spending on research and development to keep up with the possibility of emerging threats. Against these considerations, the steady post-Cold War decline of Western defense budgets may threaten the requisite industrial support base and continued funding for BW defense.[9]

Whatever the scale and concentration of such defense, it remains that the use of passive defense measures may not be very effective or reliable in deterring BW proliferation and use. Protection against BW may be possible if the specific agent to be used is known well beforehand. However, in reality, it is uncertainty about the nature of the threat that is more likely to be the case. The development of biological defenses is made all the more difficult because of genetic engineering—by means of which highly complex biological species may be devised for weapons use. The more unfamiliar a biological agent is to a defender, the harder it is to predict and counter its effects.

King and Strauss argue strongly against the effectiveness and wisdom of defensive biological programs designed to provide reliable defenses of civilian populations against BW attack. Recognizing large civilian populations as the most likely and most vulnerable targets of an attack with BW agents, they argue that "the notion of an effective defense against such agents has no basis in existing theory or technology. Neither individuals nor populations can be vaccinated against all possible naturally existing strains and variants of viruses that might be used as weapons."[10]

Technological advances in the future may make defense against a wide range of pathogens possible, yet such advances would reflect progress in the whole field of biotechnology—progress which would also see the potential for the devising of more new agents for BW use. When one envisages such an ongoing situation in which defensive certainties are always trying to catch up with offensive possibilities, there are indeed strong grounds upon which to doubt the theory behind "effective" BW defense. A desperate race to outmatch an opponent's biological capabilities would most likely result in exacerbating rather than countering BW proliferation.

Further to this point is the concern that national BW defensive programs, misconstrued as offensive by other nations, will lead to continued accusations of BWC violations. There is a danger that the resulting demands for increased BW research funding could lead to a biological arms race.[11] For this reason, Falk and Wright argue that the U.S. government should eliminate its program of medical defense against BW.[12] They

observe that the secrecy that always surrounds such BW defense programs actually works to destabilize the BWC regime.[13]

The by-products of ostensibly defensive BW research include the knowledge and techniques necessary for large-scale production of pathogenic organisms. Developing a vaccine generally requires growing a microorganism in sufficient quantities to provide the doses necessary to inoculate thousands of people. For offensive purposes, "the preparation of the infectious agent and the vaccine against it are intimately associated both technically and strategically."[14] Moreover, as Woodall points out "Any military vaccine production facility . . . would be capable of rapid conversion to offensive agent production."[15] Indeed, if stated intent is all that distinguishes a nation's BW program as either defensive or offensive, then a program for BW defense may easily be misconstrued (accidentally or deliberately) by adversary nations and thought to be offensive and provocative in its intent.

This section has focused on defensive measures that might be adopted by developed countries, in particular, the United States, to thwart a BW attack. While developed countries may be the most likely targets for terrorist use of BW, developing countries are also vulnerable to such an attack. Developed countries would be disinclined to share information about their defense technologies out of fear that publication of the same would provide opportunities for an aggressor to circumvent those defense measures. Without implementation of Article X of the BWC (to be discussed later) there could be no exchange of BW defense technology between richer and poorer countries. Citizens in countries without this technology would remain vulnerable to a BW attack. Consequently, developing countries have a real interest in a multilateral solution to the threat of BW proliferation through the strengthening of the BWC. Without adequate active or passive defense measures, they would be the most vulnerable in the event of BW use.

Technical Issues of BWC Verification

In September 1991 the Third BWC RevCon mandated an Ad Hoc Group of Governmental Experts (VEREX) to examine potential verification measures from a scientific and technical viewpoint. The VEREX report did not equivocally state that "effective" verification for the BWC was possible. However, it would be unreasonable to expect that, for verification to be worthwhile, a verification regime needs to guarantee that a banned BW program would be detected. Verification of this particular Convention is so much more complicated relative to other arms control measures. Inasmuch as verification is intended only to strengthen (not to guarantee) the BWC, there is a valid argument to be made that verifying compliance with the BWC is technically possible.

Firstly, the VEREX process did determine that certain measures in combination could help increase transparency and enhance confidence that members of the BWC were fulfilling their obligations.[16] In other words, VEREX recognized that there was scope for verification measures to strengthen the BWC. Secondly, advances in biotechnology have made it possible to identify biological agents on-site. This allows for the swift resolution of compliance concerns at an inspected facility. Thirdly, several countries have participated in trial inspections and have been satisfied with the ability of inspectors to gather and evaluate BWC-related information during OSIs.[17]

Methods of detecting existing biological agents and toxins have improved in recent years. However, the identification of "new" BW may prove problematic.[18] Improving detection methods dealing with existing agents is of immediate importance, although ongoing priority should be given to dealing with possible newly developed agents. Soon after the BWC took effect in 1975, the advent of recombinant DNA technology raised the possibility of engineering new pathogens that could be made more lethal and more controllable. The advent of this technology has since led to a reassessment of BW, which had previously been, thought to be of little military utility. For military purposes, genetic engineering is the creation of genetically altered viruses and bacteria in order to enhance their potency as weapons. One method of genetically altering potential BW agents is to create something known as a recombinant "chimera" virus. An example of this is to splice the DNA of the Venezuelan equine encephalitis (VEE) brain virus into the DNA of smallpox—the result is a complex and lethal VEE-smallpox chimera.[19]

Nuclear, Biological, and Chemical weapons are often classified together as "NBC weapons," and dealt with collectively. This joint classification tends to obscure the fact that each WMD is based on very different

technical principles. It follows that measures for verifying compliance with arms control and disarmament treaties concerning these weapons also requires distinct technical approaches. Insufficient distinction is often made between chemical and biological weapons in much public discussion of WMD proliferation. The misunderstandings that arise from this can impact on efforts to resolve the problem of BW. While the BWC will need a unique verification regime, it is nevertheless important to recognize that inspection measures under current verifiable treaties, such as the NPT and CWC, are valuable models for the Convention in that they are accepted elements of international arms control regimes today.

Strengthening the BWC means finding a reliable way of verifying compliance with its provisions. The task of drafting a verification regime into a legally binding instrument has been given to the Ad Hoc Group (AHG). Discussions by the AHG on measures to promote compliance with the BWC have tended to focus on four main issues:

- declarations of relevant facilities with the capacity to develop and/or produce a militarily significant quantity of BW agent
- routine on-site inspections (OSIs) of these declared facilities
- challenge OSIs in cases of compliance concerns
- investigations of alleged use of BW and investigations of unusual disease outbreaks.[20]

Because inspections are so central to the verification process, this section focuses on technical issues as they arise regarding OSIs. VEREX determined that a comprehensive package of measures needs to be available for inspectors to draw on according to the particular circumstances of an inspection.[21] Possible inspection measures include:

International exchange visits

Interviewing

Visual inspection

Identification of key equipment

Auditing

Sampling and identification

Medical examination.[22]

The feasibility of these proposed measures to be used during OSIs under a BWC verification regime has been demonstrated in other arms control regimes. These include the International Atomic Energy Agency (IAEA) nuclear safeguards system, provisions for verification under the CWC, and measures employed for treaty enforcement under the authority of the UN Secretary–General.[23]

Unlike verification of the CTBT where significant information on nuclear detonations can be obtained remotely, hard evidence regarding questions of compliance with the BWC can really only be gathered on-site. From the point of view of member states, OSIs are beneficial to the BWC in that they address compliance concerns, as well as building confidence in the accuracy of declarations and the value of the Convention as a whole.

Routine Inspections

At the 1996 Fourth BWC RevCon, a number of delegations supported the concept of a system of routine OSIs based on declarations of biotechnology facilities. These delegations argued that such a system, triggered by declarations, would encourage greater accuracy in declarations, provide further transparency and confidence in the bona fide nature of declared activities, and act as a deterrent to would-be BW proliferators.[24] The effectiveness of routine OSIs at a practical level has been demonstrated by practice compliance inspections (to be discussed later).

Routine OSIs would gather information to validate declarations and some of this information, allowing for provisions to protect commercial and national security confidentiality, would be disseminated to member states. This would enable them to assess the compliance of other Members of the BWC. Potential cheaters would gain

an insight into the risks of abusing facilities subject to routine OSIs and may be deterred from doing so.[25] In addition, conducting regular routine OSIs would work to establish the normal *modus operandi* of biotechnology institutions in a given country. As an ongoing process, such a system of routine OSIs would contribute to the training and efficiency of BWC inspectors.[26]

So-called "clarification" OSIs are a valuable supplement to a system of routine OSIs. Their purpose would be to build further confidence in the effectiveness of declarations. A clarification OSI would be intended to clarify any ambiguities, gaps, or uncertainties relating to a declaration submitted under the BWC verification regime. Such an inspection could be conducted to identify a site which has not been declared but which should have been. A clarification OSI would also be of value to a member state which was simply uncertain of implementation requirements under the verification regime, but which did not see any real political imperative to request a challenge inspection into a non-compliance concern.[27]

If during a routine OSI under the CWC, activities or items inconsistent with the declarations are discovered, inspectors "have the right to request clarification," but not to investigate further.[28] The reason for this provision in the CWC could apply also to the BWC: Pearson argues that clarification OSIs will be more effective if the member state being inspected has been able to prepare for the visit and has its relevant experts available.[29] By contrast, in the case of a politically triggered challenge OSI, short notice of an inspection, which allows little time for preparation, is an indispensable approach for the conduct of a timely investigation into a non-compliance concern.

Challenge Inspections

A vast majority of the delegations to the BWC negotiations agree that an effective verification protocol must include provisions for rapid investigation of evidence that a country is developing and/or producing BW in violation of its treaty obligations.[30] A challenge OSI would require a political trigger; an inspection request from a member state which has compliance concerns about the activities at a declared or undeclared facility in another's territory.

Biological facilities can be cleaned up much more rapidly than nuclear and chemical facilities. Virtually all traces of any development, manufacturing or storage of BW agents could be removed from a facility, within a few hours of receiving notice of an inspection, by using available clean-in-place systems.[31] Accordingly, given the importance of rapidly initiated challenge OSIs to address BWC compliance concerns, there is a strong argument that a request for a challenge OSI should automatically trigger such an inspection. This would enable inspectors to investigate swiftly any suspect activity within hours rather than days.

There is concern, however, that such a quick response would allow no check on mischievous inspection requests. At the very least, the unfavorable political fallout from a mischievous request for a challenge OSI should deter many member states from abusing the procedures. Any future BWC Organization (BWCO) should also develop checks in these procedures to deter further such requests, such as a requirement for the challenging State to pay the costs of a challenge OSI. At the same time, checks against abuse of the challenge OSI system should not be so punitive as to be counterproductive. A tougher penalty imposed by the Organization, such as suspending the right of a member state to request challenge OSIs, runs the risk of allowing genuine violations of the BWC to go unchecked.

Ultimately, the strongest prevention against ill-informed or mischievous challenge OSI requests will be a requirement that adequate evidence be the basis for such a request. The complementary system of routine OSIs will contribute to an increased understanding, by member states and others, of the kind of evidence which inspectors would be looking for in a case of non-compliance.

Protecting Confidential Information

Some countries are reluctant to accept a treaty verification regime that includes facility inspections that could possibly result in the loss of proprietary data. In order to overcome such concerns, comprehensive confidentiality provisions should be contained within the BWC verification protocol. There is initial reassurance for many concerned manufacturers and researchers in that most biotechnology facilities would not have to be

declared and subsequently subjected to routine OSIs. Under the envisaged declaration triggers, the BWC would really only apply to facilities that have the capacity to produce militarily significant quantities of BW. That is, facilities capable of mass-producing medicines, antibiotics, and vaccines by fermentation. For such facilities that remain as subjects for inspection, site-specific managed access arrangements could be of great value in maintaining a good working relationship between facilities and inspectors. Compliance with the BWC could be confirmed to inspectors' satisfaction without compromising confidential business information (CBI).

The biotechnology industry is a very important growth industry in many countries, where trade secrets are created with millions of dollars of investment. With drug development being so research intensive in the pharmaceutical and biotechnology industries, the financial stakes are high. According to the Pharmaceutical Research and Manufacturers Association (PhRMA), U.S. pharmaceutical manufacturers spend 19.4 per cent of sales on research and development, compared with an average across all industries of 3.8 per cent.[32] It is feared that, under a comprehensive verification regime involving OSIs of biofacilities, trade secrets might easily be stolen or unwittingly compromised by inspectors.[33] Consequently, when inspecting biotechnology facilities, there is a vital need to ensure the protection of commercially sensitive information.

Aside from the question of financial loss, Huxsoll argues that if legitimate research is stopped because company researchers refuse to tolerate the inconvenience of an OSI, or they feel that their integrity is being unnecessarily challenged, a brain drain from biotechnology research may result.[34] This view carries no real weight when one considers that biotechnology facilities are already subject to a variety of regular and intrusive inspections by a multitude of national and international organizations concerned with health, safety, and production standards.

It is important to note that pharmaceutical and other biotechnology companies do not only fear loss of income resulting from hindrance to or compromise of research. They also fear damage to their reputations by being suspected of association with BW. For this reason, companies have an interest in allowing OSIs to go ahead so as to demonstrate their compliance with the BWC. If inspectors do have a compliance concern, companies have an incentive to co-operate so as to resolve the concern immediately, thus avoiding the inconvenience and embarrassment of follow-up inspections.

Most pharmaceutical industry representatives favor the concept of "managed access," an approach developed for OSIs under the CWC. During a routine OSI conducted according to managed access arrangements agreed to between facilities and inspectors, compliance with the BWC could be confirmed to inspectors' satisfaction without compromising CBI. Under this approach, the inspection team and the host country negotiate the amount of access to be provided to sensitive areas of the inspected site. For example, facility managers supervising an OSI might switch off computers, lock up documents, place shrouds over special equipment, and approve the on-site sampling and analysis procedure.[35]

Already, trial inspections of BWC-relevant facilities have demonstrated in certain cases that OSIs are possible without risk to CBI. In early 1994, practice compliance inspections (PCIs) were conducted in the UK and involved four interrelated issues:

- access to facilities, documentation, and personnel
- commercial confidentiality
- logistics
- compliance assessment.

Among the conclusions reached after conducting these PCIs were:

- Given the potential dual-use nature of many biological agents and of much related equipment, inspection teams need evidence from all aspects of the facility under investigation if they are to reach an informed judgment on its compliance with BWC provisions.
- Provided that the facilities being inspected make preparations and use managed access, the risks to commercially sensitive information are reduced.
- Portable identification kits for identifying potential BW agents would be of immense value for both the inspection team and the inspected facility. In addition, the use of on-site laboratory facilities may also help to verify more quickly the presence of relevant biological agents. (Such OSI measures would

alleviate any concerns on the part of facility managers over removing samples off site for identification purposes.)

- All the verification measures used were mutually reinforcing.[36]

Tucker acknowledges the view that managed access may not be effective in catching BWC violators because such an arrangement assumes a large degree of good faith and co-operation between inspectors and the inspected party.[37] Nevertheless, the CWC provides a valuable model for protecting CBI in the biotechnology industry. In force as of April 1997, the verification provisions contained within the CWC include a carefully negotiated set of measures that strikes a balance between ensuring that OSIs are effective and protecting sensitive information not related to CW. The innovative and comprehensive confidentiality provisions contained within the CWC merit careful consideration when deciding on a set of measures for strengthening the BWC.[38]

Of course, a BWC verification protocol must have its own unique measures, appropriate and adapted to its task. The challenge now is to reach a widely acceptable compromise that achieves the dual objectives of detecting BWC violations and protecting CBI. Perhaps the development of accurate but inexpensive biosensors for the identification of biological and toxic agents will offer a technical solution that will make it easier for the AHG to negotiate successfully such a compromise.[39] In the meantime, the political challenge is to present OSIs as worthwhile BWC verification measures that protect sensitive information.

United Nations Special Commission in Iraq: Lessons for the BWC

Without a BWC verification regime in place, any international investigations of illicit BW production have to take place outside the Convention. The situation of the UN Special Commission (UNSCOM) in Iraq is unique in its circumstances. UNSCOM operates under the mandate of UN Security Council (UNSC) Resolution 687, which was one of the conditions imposed on Iraq under the Gulf War cease-fire. Iraq has resented the infringements of sovereignty implied in the Resolution and has cooperated only superficially with inspection teams. Whereas Iraq is a defeated nation that has been forced to submit to intrusive inspections, the BWC scenario is fundamentally different—this Convention is a disarmament agreement entered into freely by member states.

At the outset, there is an obvious difference between UNSCOM measures and a future BWC verification regime. Part of the Commission's primary objective has been detecting evidence of the Iraqi BW program. Since UNSCOM measures occurred after Iraq's violations of international law, it is not possible to assess their deterrence value. By contrast, the objectives of a BWC verification regime would include both deterring BW programs and detecting them.

Western intelligence agencies knew about Iraq's offensive BW program before the start of the Gulf War.[40] Yet Iraq successfully deceived UNSCOM inspectors and concealed from them information about its BW program for four years after the end of the war. An immediately apparent lesson for the BWC is that a determined proliferator who is dedicated to conducting a BW program will probably escape detection unless a good intelligence system is in place. In time, the UNSCOM experience showed that even in a situation in which Iraq was clearly seeking to retain a BW capability, compliance concerns could be readily identified through inconsistencies in the information available to UNSCOM.[41] Although UNSCOM has not yet managed to verify everything about the Iraqi BW program, much has been gained from the experience.

UNSCOM has developed new approaches to achieve its mission, employing methods and technologies for BW verification that previously had not been tried in the field. The makeup of UNSCOM inspection teams, the preparation and support required, the interviewing process, and procedures for sampling and analysis are all of interest for comparison with likely BWC verification measures. Many of the techniques that UNSCOM inspectors have developed could be used under a BWC verification regime without necessarily having to deploy the intrusive powers that the Commission possessed in Iraq.

The UNSCOM experience in Iraq serves to underline the vital necessity for OSIs in achieving transparency and determining whether facilities are involved in prohibited BW programs. The value and importance of regular OSIs is evident from observations made by UNSCOM that discrepancies in numbers of biological

facilities continue to arise with regard to Iraq's declarations. The UNSCOM report of April 1997 states that "Iraq has still not declared all sites where dual-use biological equipment is present. The Commission's resident monitoring team continues to identify such sites that should have been declared by Iraq."[42] Currently some 86 biological sites are being regularly monitored under the UNSCOM ongoing monitoring and verification (OMV) plan with over 150 visits being carried out to these sites in a six month period.[43] This enables UNSCOM to reach correct assessments of the significance of Iraqi activities in the biological area.[44]

Three particular lessons from the UNSCOM experience stand out as being relevant to the BWC. They relate to biological safety, sampling procedures, and dealing with obstructions. First, through OSIs, UNSCOM has gained an accurate appreciation of the manner in which Iraq approaches biological safety and the handling of pathogens. For Bailey it is quite credible that Iraq would undertake BW activities with very little regard to safety measures.[45] The lesson from this is that an absence of high containment safety equipment, or vaccination programs for workers, does not rule out the possibility that BW is being produced at a given facility.

Second, UNSCOM inspectors used the ELISA (enzyme-linked immunosorbant assay) test to analyze samples for the presence of botulinum toxin, anthrax or plague. Because the equipment for ELISA is bulky, samples had to be taken to UNSCOM headquarters in Baghdad. Other samples taken during inspections had to be analyzed in laboratories in the UK, thus precluding the quick follow-up of any findings.[46] Such a system for sampling and analysis would be unacceptable under a BWC verification regime. The removal of samples off site would endanger CBI and prolong unnecessarily the inspection process.

Third, Iraqi officials employed various tactics in order to avoid giving information to UNSCOM inspectors. One such tactic was to pretend not to understand English and to request an interpreter. Another was to feign incompetence in an attempt to lower the expectations of inspectors as to what technology the Iraqis were capable of managing. Apparently in order to remove incriminating evidence of BW, some buildings were razed and soil removed.[47] One inspection and excavation team was delayed for several hours while senior officials assessed the religious implications of disturbing an inspection site that, it was claimed, was a Muslim burial ground. For St. Onge, the lesson from this incident is that "a simple knowledge of local customs, signs of respect, and ways of doing things will go a long way in easing tensions and promoting a sense of cooperation."[48] In November 1997 Iraq barred U.S. experts from participating in UNSCOM inspections. Iraq's reasons for doing this are uncertain, although it is probable they were worried the Americans were close to finding banned BW-related activities.

The role played by the United States in the post-Cold War world is of great significance to the broader issue of BW proliferation. From the point of view of developing countries, a multilateral verification regime such as that envisaged for the BWC is preferable to the alternative: the United States and its allies acting as international law enforcers. Rosenberg argues that a unilateral U.S. approach to nonproliferation tends to foster defiance rather than cooperation; developing countries are driven to act against their own interests in order to rescue their national self respect. As a consequence, such a situation props up tyrants rather than replacing them.[49]

There is concern that a defiant Iraq is holding on to its BW program in the hope that the Security Council will eventually tire and UNSCOM will be disbanded.[50] Arguably, BW could still provide some sort of strategic shield for Iraq. If BW are all that remain of Iraq's WMD capacity, perhaps the country's leadership would rather have something than nothing. Iraq probably retains hidden stores of freeze-dried organisms from its former BW program. Further, its human, biological, and industrial resources are still intact should Iraq ever choose to reconstitute this program and resume the manufacture of BW agents.[51] The U.S. intelligence community estimates that Iraq could recommence its BW program within weeks after the lifting of international sanctions currently imposed against the country.[52] Even so, intent remains the vital criterion. Possessing limited natural resources and in need of economic development, Iraq might make a valid claim that it needs to enhance its capability in applied microbiology and biotechnology. Until such a claim appears credible, and Iraq's intentions peaceful, UNSCOM may have to continue its inspections—perhaps until there is a change of leadership in Iraq.

Valuable lessons for specific BWC verification measures may be derived from the UNSCOM experience. The most important lesson is that neither the OSIs nor the OMV plan applied to Iraq under UNSCOM could ever have a place in a future BWC verification regime. Member states would never accept measures that treated

them as defeated powers in terms of access. Indeed, it is inconceivable that any sovereign state would voluntarily submit itself to a verification regime as intrusive as that of UNSCOM. While the lessons of UNSCOM are of considerable relevance to the BWC, such coercive verification is clearly very limited in its application. Having established that an UNSCOM-like approach is not the way to go about verifying compliance with the BWC, attention now turns to the question of exactly how the BWC should be strengthened.

Notes

1. Graham S. Pearson, "Vaccines for Peace: An Incentive for Developing Countries," *Politics and the Life Sciences* 12 (1) (February 1993): 88.
2. Ibid.
3. Jonathan King and Harlee Strauss, "The Hazards of Defensive Biological Warfare Programs," in *Preventing a Biological Arms Race,* ed. Susan Wright (Cambridge, Mass.: MIT Press, 1990), 126.
4. Joan Stephenson, "Pentagon-funded Research Takes Aim at Agents of Biological Warfare," *Journal of the American Medical Association* 278 (5) (6 August 1997): 373.
5. Ibid., 374.
6. Buchanan, "Poor Man's A-bomb," 83.
7. Ibid.
8. Ibid., 86.
9. Edward M. Spiers, *Chemical and Biological Weapons: A Study of Proliferation*, (London: Macmillan, 1994), 151.
10. King and Strauss, "The Hazards of Defensive Biological Warfare Programs," 127.
11. Ibid., 131.
12. Richard Falk and Susan Wright, "Preventing a Biological Arms Race: New Initiatives," in *Preventing a Biological Arms Race,* ed. Susan Wright (Cambridge, Mass.: MIT Press, 1990), 343.
13. Ibid., 349.
14. King and Strauss, "The Hazards of Defensive Biological Warfare Programs," 121.
15. Jack Woodall, "An Exceptional Window of Opportunity: Comments on 'Vaccines for Peace,'" *Politics and the Life Sciences*, 12 (1) (February 1993): 91.
16. VEREX, *Report*, 8–9.
17. Chevrier, "The Control of Biological Weapons," 214.
18. Richard Latter, *Biological Weapons: The Growing Threat*, Paper 124 (London: Wilton Park, 1997) 3.
19. Richard Preston, "The Bioweaponeers," *The New Yorker*, 74 (3) 9 March 1998, p. 62.
20. Annabelle Duncan and Robert J. Mathews, "Development of a Verification Protocol for the Biological Weapons Convention: Progress During 1996," *Verification 1997*, (London: Verification Technology Centre, 1997), 109.
21. VEREX, *Report*, 5.
22. Ibid., 3–4.
23. Pearson, "A Strengthened Biological Weapons Convention is Essential, Feasible and Achievable," 14.
24. Duncan and Mathews, "Development of a Verification Protocol for the Biological Weapons Convention," 112.
25. Graham Pearson, *The Necessity for Non-Challenge Visits*, Briefing Paper No. 2, (Bradford: Department of Peace Studies, University of Bradford, September 1997), 7.
26. Latter, *Biological Weapons: The Growing Threat*, 12.
27. Pearson, *The Necessity for Non-Challenge Visits*, 21.
28. Text of the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction, Extract from Conference on Disarmament Document CD/1170, Verification Annex, Part 2, paragraph 51.
29. Pearson, *The Necessity for Non-Challenge Visits*, 26.
30. Annabelle Duncan and Susan Hamilton, "Biological Weapons Control," *Australasian Biotechnology*, 7, (3) (June 1997): 162.
31. Pharmaceutical Research and Manufacturers Association, *Reducing the Threat of Biological Weapons—A PhRMA Perspective*, statement to the NGO segment, BWC 4th Review Conference, 25 November 1996, Geneva, 3.
32. Tucker, "Putting Teeth in the Biological Weapons Ban," 43.
33. Roberts, "New Challenges and New Policy Priorities for the 1990s," 88.
34. David L. Huxsoll, "The US Biological Defense Research Program," in *Biological Weapons: Weapons of the Future?* ed. Brad Roberts (Washington D.C.: CSIS, 1993), 64.
35. Tucker, "Putting Teeth in the Biological Weapons Ban," 43.

36. J. R Walker, "Update: Verification of the Biological and Toxin Weapons Convention and the UK's Practice Compliance Inspection Programme," in *Verification 1995*, eds. J. B. Poole and R. Guthrie (Boulder: Westview Press, 1995).

37. Tucker, "Putting Teeth in the Biological Weapons Ban," 44.

38. Graham S. Pearson, *Strengthening the Biological Weapons Convention: The Importance of On-Site Investigations*, Briefing Paper No. 1, (Bradford: Department of Peace Studies, University of Bradford, July 1997), 9; Duncan and Hamilton, "Biological Weapons Control," 162.

39. Tucker, "Putting Teeth in the Biological Weapons Ban," 45.

40. Kadlec and others, "Biological Weapons Control," 354.

41. Pearson, "The Complementary Role of Environmental and Security Biological Control Regimes in the 21st Century," 370.

42. Pearson, *The Necessity for Non-Challenge Visits*, 9.

43. Graham Pearson, "Non-Challenge Visits," 8th Workshop of the Pugwash Study Group on the Implementation of the Chemical and Biological Weapons Conventions: Strengthening the Biological Weapons Convention, 20–21 September 1997, Geneva, 6.

44. Pearson, *The Necessity for Non-Challenge Visits*, 10.

45. Kathleen C. Bailey, *The UN Inspections in Iraq: Lessons for On-Site Verification* (Boulder: Westview Press, 1995), 95.

46. Ibid., 50.

47. Ibid., 45.

48. Allen A. St. Onge, "United Nations Biological Warfare Inspectors in Iraq: Implications for Biological Arms Control," *Politics and the Life Sciences*, 14 (2) (August 1995): 261.

49. Barbara Hatch Rosenberg, "North Versus South: Politics and the Biological Weapons Convention," *Politics and the Life Sciences* 12 (1) (February 1993): 77.

50. "The Whore of Babylon and the Horseman of Plague," 80.

51. Zilinskas, "Iraq's Biological Weapons," 422.

52. Kadlec and others, "Biological Weapons Control," 354.

PART THREE

How should the Biological Weapons Convention be strengthened?

Introduction

The most complicated question facing BWC negotiators is "how should the BWC be strengthened?" Much debate and controversy continues in international forums over what measures should be included in a BWC verification regime. Although each member state formulates its position on the BWC with regard to its own security and national interests, constructive compromise leading to eventual agreement is possible. Domestic considerations still have to be weighed against international circumstances and diplomatic pressure such that national positions are subject to change. This has been demonstrated in negotiations over other arms control agreements, in particular the CWC. This treaty came into force in 1997 after negotiations in which issues similar to those arising at BWC RevCons were resolved satisfactorily. That said the challenge of strengthening the BWC has its own unique difficulties. Aside from the peculiarities of BWC verification, this Convention represents a mopping up of the last WMD. Countries that reluctantly acceded to the provisions of the NPT, the CTBT, and the CWC appear more determined to emphasize their own interests with regard to verification under the BWC.

Political feasibility will be the greatest determinant of success for the BWC. The deterrence value of verification measures will be greatly enhanced if states engage the BW problem politically. In order to eliminate the incentives for some states to pursue a BW program, they will require credible assurances that their security is provided for by other means.[1] Other political considerations come into play such that deciding on a system of measures for verifying compliance essentially entails a trade-off between costs, intrusiveness, probabilities of detecting violations, and strength of deterrence.[2]

Part Three examines the principal issues and areas of contention with regard to BWC verification. The first section looks at the issue of member states' declarations—which biological facilities and activities are to be reported to the BWC Technical Secretariat. The second section discusses the verification measure that generates the greatest amount of disagreement—on-site inspections (OSIs). OSIs fall into two categories: routine visits and short-notice challenge inspections. In addition to OSIs at biotechnology facilities, section three examines the proposed measure of field investigations to resolve uncertainties over unusual or suspicious outbreaks of disease, which might have resulted from a breach of the BWC.

Having addressed the specific verification measures envisaged under the BWC, attention turns to more general concerns as to how the Convention should be strengthened. The fourth section discusses the issues and disagreements which arise over how, and by whom, the BWC ought to be administered. Part Three concludes by examining the broad question of whether technology transfer under Article X of the Convention or export controls on potentially BW-related materials is the better approach to strengthening the BWC.

Declarations

Declarations are mandatory reports, submitted on a periodic basis, which describe various aspects of a state's biological infrastructure. They serve two basic purposes: firstly, declarations provide a baseline of information about legitimate biological activities within each country; secondly, they constitute a reference document that can be used in conjunction with OSIs and other verification measures.[3]

Consideration of requirements for declarations must be guided by practicality. A requirement to declare all facilities of possible relevance to the BWC would be ineffective and impractical because of information overload and the huge expense of routine OSIs to declared sites. Furthermore, there would be great scope for uncertainty among member states that all such sites had been declared. In practice, an effective verification regime is one in which declared facilities are those of most concern to the BWC.[4] The key objective in developing declaration triggers is to avoid capturing a vast number of irrelevant facilities. For a state to mount a militarily significant offensive BW program, large-scale production facilities would be required. Accordingly

although research and development (R&D)-sized facilities could produce BW, declaration triggers and OSIs will most likely tend to focus on large biofacilities. The current negotiations in the AHG are approaching a consensus that declarations should be made of the following:

- Maximum containment (BL4)[5] facilities
- Military biological defense programs and facilities
- Past biological and toxin offensive and defensive programs
- Vaccine production facilities.[6]

With regard to declarations and lists of illegal biological agents and toxins, a consensus may be emerging that the BWC verification regime must be adjustable to new circumstances and not limited by past experience.[7] Indeed, advances in biotechnology will require that adjustments be permitted in the verification arrangements so as to capture new BW agents and production techniques, and thus ensure the continued effectiveness of the BWC into the future.

On-site Inspections

Routine inspections

Achievements in other arms control areas, in particular the entry into force of a verifiable CWC, have demonstrated that countries are willing to endure intrusive OSIs in order to demonstrate their treaty compliance and achieve a higher level of security.

The sole purpose of routine OSIs would be to verify that the activities being undertaken at the declared site were in accordance with the information provided on the declaration; it would not be to determine the exact product of the facility, or the scale or nature of production.[8] Such an approach, coupled with the development of site-specific agreements for each site visited, would contribute much to alleviating industry concerns over protecting CBI. With only declared facilities being inspected, routine OSIs would not be politically triggered. Conducting regular routine OSIs would simply work to establish the normal *modus operandi* of biotechnology institutions in a given country. Given these assurances, routine OSIs should be welcomed by member states as opportunities to demonstrate compliance with their BWC obligations.

Conducting routine OSIs would appear easiest by subjecting to a higher frequency of inspections those facilities thought to be of greatest concern to the BWC. However, such an approach is necessarily subjective and arbitrary, and would create only artificial confidence in the verification regime. It is important that facilities be selected for an OSI using a formula designed to ensure that no one State receives more than its fair share of visits.[9] This will of course depend on what the member states can agree is "fair." One way to achieve this would be to have facilities selected at random by the Technical Secretariat of the BWC Organization (BWCO). However, purely randomized routine OSIs would mean that the great majority of visits would be to facilities in Western countries where proliferation of BW is of least concern.

In the interests of fairness, in randomly selecting facilities for routine inspections, there should be a mandate built into the protocol for the Technical Secretariat (accountable only to the BWCO) to exercise considerable discretion. If the selection of random routine OSIs were to be guided by the Organization's information resources, and considerations of equitable geographic distribution and non-discrimination among inspected member states, this could be another mechanism for ensuring an equitable verification regime. A perfectly fair treaty is one in which the obligations assumed by member states are equal. Ideally, these obligations are equal in practice as well as in principle. Of course, an ideal is rarely attainable in international politics and Roberts reminds us that "we should not let legitimate expectations for just, equitable agreements . . . obscure the important work of maintaining regional and global stability."[10]

It is important to note that the commitment of non-Western states to the BWC is not tempered by the double standard that applies in the nuclear domain where, under the NPT, the right to possess NW has been retained by those countries which had them before 1967. By contrast, the BWC is an international treaty intended to disarm all States without exception. However, some developing countries may fear that the CTBT problem of discrimination-in-practice could well apply to the future BWC verification regime. Although the CTBT is non-discriminatory in principle, the extra ability of certain States to continue testing via computer

simulation—thus being able to conduct virtual experiments with more powerful weapons—means that the Treaty is discriminatory in practice.

With regard to the BWC, some developing countries might argue that their limited resources would make it difficult to implement the domestic measures envisaged for BWC verification. If developed countries were to provide assistance to poorer countries in setting up domestic organizations to deal with the Convention, this would largely avoid the problem of a BWC that discriminated in practice against developing countries. For the sake of universality and non-discrimination, developing countries should also be able to participate fully in the operation of the international BWC verification regime. Participation in routine OSIs by experts from a variety of countries would act as a confidence-building measure to reassure member states that the BWC provisions were being adhered to. These experts would be able further to assist developing States in administering their domestic treaty obligations.

For Pearson, one of the compelling arguments for the universality of the BWC regime is that it provides a means whereby small states can enlist the aid of the international community in the event of BW use against it.[11] Roberts agrees that "Developing countries have an interest as strong as the developed ones in the effective functioning of that regime, not least because they are the least well-equipped to deal with the destabilizing consequences of its disintegration."[12]

Industrialized countries have many more biological facilities and laboratories that would require declarations under a verification regime. If routine inspections of declared facilities were conducted on a purely random basis, most of the OSIs would take place in Western countries.[13] This would run against a prevailing view that developing countries are more likely to have BW. Chevrier argues that, because Western countries are generally not suspicious of the activities of other Western countries, they would complain that selecting facilities for OSIs on a purely random basis is a waste of time and money.[14] One way to avoid the enormous costs of random routine inspections would be to target routine OSIs towards those facilities in developing countries thought to be of greatest concern regarding BW production.[15]

However, remembering that developing countries will play an important role in the BWC verification regime by contributing to its universality, these countries would object to such a built-in weighting system that unfairly targeted them for inspection. This system would burden developing countries with disproportionate inspection costs as well as arousing the suspicions of the rest of the international community. Further, there is a danger that if OSI costs prove to be too great for developing countries, they will refuse to participate and drop out of the BWC. Some nations may not join in the first place if verifying compliance with the provisions of the BWC appears too costly. For these reasons, a non-discriminatory approach built into the BWC verification protocol is essential. Routine OSIs would help to create this by making sure that every member state could actively participate in the implementation of the protocol.

Challenge Inspections

At the 1996 Fourth BWC RevCon, there appeared to be an increasing acceptance of the necessity of challenge OSIs to enable suspicions of BW violations to be adequately investigated, and that challenge OSIs will form a central element of a workable verification protocol.[16]

One can envisage a situation where a decentralized and unstable State might request an OSI on its own territory. Although this would be an admission that the government did not have total control over its own territory, it would be preferable to the international embarrassment and isolation suffered by being the subject of a challenge OSI during which a rogue, terrorist-run facility was discovered. Although there is no disagreement regarding the right of a country to request an investigation into alleged use of BW on its own territory, controversy still exists over the right of one Member state to request such an investigation on the territory of another.[17]

Verifying compliance with the BWC through OSIs is closely related to the distinct technical principles of BW. It is in the nature of BW that evidence of production can be cleaned up very quickly. Time-lines should therefore be short for all inspections of biological facilities if they are to be meaningful.[18] Accordingly, given the importance of rapidly initiated challenge OSIs for compliance verification under the BWC, there is a strong argument that a request for a challenge OSI should automatically trigger such an inspection. In other words, the

mechanism for triggering an OSI should be based on an approach that would facilitate the swift dispatch of inspectors to deal with cases of alleged non-compliance. The inspectors should be given access to facilities and areas of concern and be equipped with the tools necessary for the accomplishment of their tasks. In practice the cleaning up of BW facilities is not always complete, particularly if the cleaning process is rushed. The shorter the notification period for a challenge inspection, the greater the possibility that a BWC violator will make a mistake and leave behind traces of illicit BW production.[19]

Ill-informed or mischievous challenge OSI requests would be increasingly avoided if there were a requirement written into the protocol that adequate evidence be the basis for such requests. On this point, routine OSIs can strengthen confidence in a system of challenge OSIs. Over time, through the conducting of routine OSIs, the BWC Organization and member states would acquire a greater appreciation of the kind of evidence which inspectors would be looking for in a case of non-compliance. This would enable concerned parties to reach accurate judgments about the activities by a given State, thus avoiding false suspicions of non-compliance with the Convention. Member states participating in routine OSIs would themselves acquire a greater understanding of what would be inside or outside of legal limits on biotechnology programs. This greater understanding would lessen the likelihood of ill-informed requests for a challenge OSI, in addition to tightening disincentives to produce BW in the first place.

Investigations of Unusual Disease Outbreaks

There is increasing worldwide concern over new and emerging diseases that threaten the health and well being of the global community. Part of this concern is a desire to prevent deliberate disease in the form of BW. An unusual disease outbreak could be the result of the emergence of a disease not common to a particular area, or it could be the result of the release of BW agents in violation of the BWC. An epidemiological investigation would be required to differentiate between these two possibilities. Effective surveillance and prompt investigation of unusual or suspicious outbreaks of disease can potentially deter the use of BW by identifying, albeit imperfectly, deliberate or unintended release of BW pathogenic agents.[20] Further, these field investigations would provide greater transparency of national biological events, and could increase confidence in member states' compliance with the BWC.[21]

In 1979 there was an outbreak of anthrax in the Soviet city of Sverdlovsk (now Ekaterinberg, Russia). The United States alleged at the time that the cause of this outbreak of disease was an explosion in a Soviet BW production plant, and that this indicated a Soviet violation of the BWC. The Soviets responded with the explanation that the anthrax outbreak was the result of ingestion of tainted meat.[22] In 1992, after years of controversy, Russian President Boris Yeltsin admitted that the Soviet Union (one of the three co-depositary governments for signatures to the BWC) had maintained a BW program in violation of the Convention, and that Russia had continue the program. It is one of the lessons of the Sverdlovsk incident that when a BWC compliance question arises, any response mechanism will require the capability to investigate promptly unusual and suspicious outbreaks of disease.[23] Towards this end, effective epidemiological surveillance addresses the need to detect, identify, and monitor BWC violations that result in disease outbreaks. With such a mechanism in place, occurrences like the accident at Sverdlovsk could not easily be denied or obstructed for twelve years.

Another example of an unusual disease outbreak occurred in Cuba. In late 1997 Cuba claimed that a grayish mist released from a small U.S. fumigation aircraft over Cuban territory in October 1996 was responsible for the infestation of the plant virus *thrips palmi* that began there two months later.[24] This virus is indigenous to Asia, but present in nearby Haiti, Dominican Republic, and Jamaica. Cuba has since lodged a formal BWC compliance complaint against the United States with the UNSC and the issue is still unresolved. Notwithstanding the possibility that Cuba's claim was ill-informed or frivolous, it is important to note that the United States is a permanent member of the Security Council with power of veto over resolutions emanating from that body.

The above two incidents highlight the shortcomings of the present BWC compliance complaint procedure under which allegations of treaty violations are referred to the UNSC. The United States, Russia or any other permanent member of the Council may veto any resolution to conduct a UN investigation into an unusual disease outbreak. Under the organization of a future BWC verification protocol, no single member state should

retain the means by which to thwart such an investigation. The workability of the protocol will depend in large measure upon this organizational difficulty being surmounted.

Steps having been taken recently to improve the epidemiological surveillance of disease by the World Health Organization (WHO), the BWC Fourth RevCon declared that such a response to worldwide infectious disease could offer opportunities for strengthening the Convention as a whole.[25] With regard to investigations of unusual outbreaks of disease, Indonesia expressed concern over hasty challenge OSIs being directed at developing countries. Indonesia pointed out that developing countries are unable to maintain the same standards of health and sanitation as developed countries. For this reason, Indonesia favors a system in which an in-depth investigation of the disease situation is first conducted by a competent international authority, such as the WHO, which would determine whether an outbreak of disease was natural or the result of BW.[26]

Whether future disease investigations are conducted by a separate BWC Organization or by some other international body such as the WHO, it is clear that the present system is unsatisfactory. A strengthening of the BWC will require that Article VI of the Convention, with its provision that compliance complaints be lodged with the UNSC, be replaced by a more equitable measure. This leads to broader questions over the kind of organizational approach, which will contribute most successfully to the workability of a verification protocol to strengthen the BWC.

An International Organization for the BWC

As more arms control and disarmament treaties enter into force, there is a concern that another treaty verification regime will become a large administrative burden. It may be a problem finding sufficient numbers of properly trained inspectors for the various new OSI demands. As a consequence, some observers have doubts about the scrutiny that each treaty will receive from a limited and overstressed international bureaucracy.[27] Other critics of the creation of another international bureaucracy to oversee verification of the BWC point to the high costs involved. The international community is already committed to a range of arms control organizations which will be costly to implement, including the IAEA, the CTBT Provisional Technical Secretariat, and now the Organization for the Prohibition of Chemical Weapons (OPCW). Gee estimates the annual verification costs for a BWC Organization (BWCO) at around $U.S. 70 million.[28]

As a means of overcoming these and other organizational problems, some observers have favored the collaboration of international bodies charged with treaty verification.[29] This would be an opportunity for one organization to exchange experiences in verification measures and to share information that can be useful for the missions of other organizations. Indeed, in countries where there are only a few big industrial areas, there may be an overlap of sites requiring OSIs, for example, for both BWC and CWC verification. However, these considerations must be balanced against the need for an organization that is politically acceptable and properly adapted to the peculiar nature and requirements of its task.

United Nations Security Council

One alternative to a new international organization in the service of the BWC is to rely exclusively upon the existing treaty enforcement machinery of the UN. In grave cases, the UNSC is the highest authority on actions to enforce compliance with international arms control and disarmament treaties. Those who would like to see the development of verification of treaty compliance as a new and important area of UN disarmament activity prefer this option. In particular, Russia is presently inflexible in its insistence on retaining the Security Council as the organization where formal compliance complaints are to be lodged. It regards as unnecessarily burdensome a new international body to handle declarations and OSIs. Russia would prefer that the Security Council refer the problem to the technical staff within an existing organization.[30]

However, that the UNSC should assume a particular policy position on behalf of a huge number of States, and derive enforcement actions from its own decisions, might detract from the legitimacy of such enforcement.[31] Moreover, in the Security Council, even a resolution in response to a clear finding of a breach of a treaty could still be blocked by the veto of a permanent member. Since permanent membership of the Council is dependent upon being one of the five declared nuclear powers, this very much represents a Cold War configuration of global security decision-making. For this reason, many countries might feel that UNSC

enforcement of arms control treaty obligations is inappropriate and not adapted to the changed global balance of power circumstances of the post-Cold War world.

Furthermore, it is worth emphasizing that fundamental flaw in the current BWC arrangements as explained in the previous section. Under Article VI of the BWC, compliance complaints are lodged with the UNSC. However, this mechanism is patently deficient if the alleged violator is a permanent member with power of veto, as was the case when the Soviet Union was accused of BWC violation over the Sverdlovsk anthrax incident. Clearly, a strengthened BWC requires an organizational structure that is divorced from the Security Council.

Biological Weapons Convention Organization

In order to ensure international confidence, a credible BWC needs a strong institutional infrastructure to deal with its provisions. Today, biological facilities worldwide are increasingly subject to inspections for health, safety, and quality control reasons, resulting in benefits for both the community and the environment.[32] However, these inspections do not have the necessary technology or the mandate to detect a BW program.

Implementing a verification protocol for the BWC will require the establishment of a new international organization. A BWC Organization (BWCO) would need its own pool of expertise; permanent staff members accountable only to the Organization. Under this Organization, it is envisaged that an international Technical Secretariat, established to put into practice the provisions of an agreed protocol, would conduct a program of infrequent visits to facilities.[33] This would require training of inspectors, both initial and subsequent. Such training of inspectors is a major undertaking and potentially quite expensive. With qualified inspectors already being used to verify compliance with other international arms control and disarmament treaties, there may be difficulty recruiting the necessary talent and expertise to make the BWCO effective.

While undertaking efforts to surmount this problem, the Organization should also endeavor to recruit staff on as broad a geographical base as possible. For the sake of universality and non-discrimination, developing countries should be able to participate fully in the operation of the international verification regime. Participation in routine inspections by experts from a variety of countries would act as a confidence-building measure to reassure member states that the BWC provisions were being adhered to. Inspectors from these countries would benefit from participating in routine OSIs, which would serve as opportunities to keep inspectors and the BWCO up-to-date on technological developments and approaches being taken by a State in the area of biotechnology.[34]

Over time, by conducting routine OSIs, the BWCO would build up an appreciation of the national pattern of activities in that area. This would aid its ability to reach accurate judgments about the activities of a given member state, thus avoiding false suspicions of non-compliance with the BWC. Such an appreciation will be crucial should that State ever be subject to a challenge inspection.[35] In this respect, the direct and vital link between challenge and routine OSIs is of great importance for the operation of the BWCO.

Organizational challenges will arise when a verification regime has to be implemented. Many States will need to improve their arms control expertise in order to meet their expanding and increasingly complex obligations in demonstrating compliance with the BWC. Under the BWC verification system, each member state would designate a government agency to serve as a National Authority. This body would be responsible for liaison with industry and other relevant groups concerning declarations to the BWCO of relevant activities and facilities within the territory of that country. Ideally, the establishment and operation of a National Authority to monitor domestic compliance with the BWC should not be viewed as overly expensive or burdensome. Yet countries with a relatively decentralized political system, or a poorly resourced administrative bureaucracy, may have difficulty putting all the necessary procedures in place for an effective National Authority.

The effectiveness of verification and OSIs would be enhanced if such countries were afforded international assistance in this area. To this end, an interactive relationship between the BWCO and National Authorities will be of central importance in addressing the problem of capturing illegal BW activities. A BWCO could directly benefit member states in that routine OSIs would enable the Organization to assist them in preparing national

declarations, and in providing information to States about initiatives being carried out by other international bodies and known to the BWCO.[36] for example, the WHO.

Further, it is possible that other international organizations might be able to assist in organizing verification measures for the BWC.[37] In view of the applicability of work in the biological field done by other organizations (such as the WHO, Food and Agricultural Organization, and International Epizootics Organization), South Africa[38] and India[39] argue that a future BWCO responsible for implementing a verification protocol would be most effective if it maintained a direct link with these organizations, thus avoiding duplicity and rationalizing the use of resources. Another proposal is for the establishment of an international Vaccines For Peace (VFP) program to undertake research and production of vaccines to be administered by the WHO.[40] However, in the case of formal ties with the WHO, there is a danger that performing a verification role for the BWC would compromise the exclusively humanitarian objectives of that organization. Likewise, the success of other organizations depends largely upon operating only in accordance with their own limited mandate.

It has been proposed that a new international organization for the BWC would benefit from sharing appropriate technical facilities and support services with the OPCW[41] in The Hague. Arguably, an association with the OPCW would be considerably less costly than creating a new international organization for the BWC. However, such an organizational measure runs the risk of not being appropriate or adequately adapted to the peculiar issues associated with BW. The considerable differences between biological and chemical weapons warrant their separate treatment. By contrast, UNSCOM is an example of where one organization was charged with addressing all three types of WMD.

United Nations Special Commission in Iraq

Further lessons may be derived from the UNSCOM experience for the purposes of considering the organization of a future BWC verification regime. Broadly speaking, the very existence and continuing operation of UNSCOM in Iraq makes it a political device. However, in its day-to-day organization, the Commission it is not a political body. Its statements and reports are based upon facts and scientific judgments. The staff is made up of specialists from around the world possessing high-level professional, technical, and scientific skills. Unlike many other international bodies, UNSCOM is not burdened with a complex and hierarchical bureaucratic structure. Rather, the decision making process is relatively simple, with specialists having direct access to the Commission Chairman.[42] Such attributes and arrangements seem highly desirable for the purposes of establishing a BWC Organization that commands the respect and confidence of those who deal with it.

UNSCOM takes a multidisciplinary approach to arms control so as to match Iraq's own broad approach to WMD—nuclear, chemical, and biological. Installations for each type of weapons program were often found in the same general area and could be dealt with under a single organizational mandate. No existing international treaty compliance regime is as flexible or as wide-ranging as UNSCOM in its mission. Acknowledging that a multidisciplinary approach would makes arms control treaty negotiations much more complex, Zilinskas cites the UNSCOM experience as having demonstrated the usefulness of such an approach.[43]

However, given the inevitable complexities of establishing and maintaining a WMD super-organization, it is most likely that any multidisciplinary approach to arms control will take place by way of informal tip-offs and unofficial discussions between staff from each of the major international organizations. For example, inspectors and bureaucrats from the OPCW, the WHO and the BWCO might refer to their organizational counterparts any suspicions about activities outside their particular mandate to investigate. This informal approach, combined with intelligence sharing, would be preferable to the unwieldy alternative of dealing with a single, three-tiered WMD disarmament regime.

Biotechnology facilities worldwide are already subjected to a variety of OSIs by national and international organizations concerned with health, safety, and production standards. However, these organizations do not possess adequate technology or the necessary mandate to detect a BW program. In order to ensure international confidence, a credible BWC needs a strong institutional infrastructure to deal with its provisions. Monitoring communicable diseases on the one hand, and monitoring compliance with the BWC on the other, are two such important issues as to warrant their separate and undivided treatment. There is a danger that the worldwide

respect for integrity accorded the existing international organizations mentioned above would be compromised were they to fulfil a role for the BWCO which was outside of their special mandate.

Given the urgency of the BW situation and its now conspicuous threat to global security, the temptation to cut corners must be resisted. An entirely separate BWCO would have the advantage of having a clear, single purpose—overseeing verification of the BWC—and its organizational structure should be established and tailored to respond to the peculiar and specific demands of verifying compliance with the Convention.

Article X and Export Controls

Under Article X of the BWC, member states undertake to facilitate and participate in the fullest possible exchange between countries of biological equipment, materials, and technology intended for peaceful purposes. This provision is a device for implementing the Convention in a way that avoids hampering the economic or technological development of member states, and which promotes international cooperation in the field of peaceful biological activities. Article X has never been implemented despite calls from developing countries to do so. Developed countries have so far resisted all efforts to make technical assistance mandatory, preferring voluntary assistance. Indeed, there are already extensive and sizeable national foreign aid programs between developed and developing countries. Such programs are generally focused on providing assistance to countries to promote improved health and to protect the environment.[44]

At the BWC Fourth RevCon in 1996, there was much discussion of the relationship between Article X and its counterpoint Article III. Under Article III of the BWC, member states undertake not to transfer to any recipient whatsoever any of the biological agents, weapons, equipment or means of delivery specified in Article I of the Convention. They also agree not to assist, encourage, or induce any State or other organization to manufacture or acquire prohibited BW agents, technology, and equipment. Article III is frequently interpreted as a way of restricting arms and technology transfers to developing countries.

The primary means by which Article III is implemented are export controls. The Australia Group (AG) is the principal international arrangement relating to licensing of transfers of biological materials (pathogens and toxins) and dual-use equipment (for example, fermenters and spray-dryers) that could be instrumental in the development and production of BW. These transfer restrictions are seemingly at odds with the provisions of Article X of the BWC, however supporters of the AG (consisting of some 30 participating nations) can rely on Article III to uphold their cause.

Export controls are frequently alleged to inhibit trade despite the absence of evidence to support such an accusation. In fact, it is often easier to argue the opposite case. In 1992, the value of U.S. trade not conducted in the chemical and biological domains because of license denials was $U.S. 7 million, compared with $U.S. 319 million in approved trade.[45] In his statement to the Fourth BWC RevCon, the U.S. Ambassador described how the United States in 1995 “approved well over $250 million in export license applications relevant to the Convention” and “denied applications worth a grand total of $2443.”[46]

The evidence suggests that export controls are in fact trade enablers. Indeed, Roberts argues that export controls actually benefit economic interests. Without an effective licensing system, trade, and investment flows between countries could well be eroded by any public backlash which resulted from the reporting of individual firms to be engaged in assisting secret programs to build banned weapons. Such a backlash would induce legislators to introduce even tougher restraints on trade than those implemented under export control regimes.[47]

Members of the AG regard export controls as the most effective way to halt proliferation of BW, at least temporarily. Tucker argues that while supply-side measures such as export controls can buy time, they do not represent a long-term solution to the BW proliferation problem. More promising are demand-side non-proliferation strategies, which create disincentives for pursuing BW in the first place.[48]

While Western opposition to the lifting of export controls may be directly linked to security concerns, Chevrier argues that Western “opposition to technical assistance is rooted more generally in frugality and exercising control of funds.”[49] If this is indeed one reason behind reluctance to dismantle export controls, Sen insists that developing countries have a right to compete with developed countries in the emerging market for products and services generated by technology.[50] The implementation of Article X is widely regarded by poorer

countries as a means of achieving that right. Economic development is vitally important for a country's competitiveness such that "Technology transfer is the grail that leads many of the developing countries to attend the BWC review conferences: biotechnology is considered an urgent necessity for economic and social development."[51]

In considering the controversy over Article X and export controls, it is important to recognize some of the broader questions that arise. Chubin is concerned that developing countries are being sold short in the post-Cold War world. Whether or not they feel their security has been enhanced by the ending of the Cold War, developing countries are being told to keep up with the non-proliferation policies of developed countries or risk cutbacks to development assistance.[52] For Chubin, the restriction of technology transfers to developing countries runs counter to the spirit of liberal and open exchange that is part of the modern world. He argues that such an approach risks seeking to restrict dual-use technology for which developing countries may have legitimate commercial or developmental needs.[53]

Given the antipathy of developing countries to export controls, which are perceived as hindering their development, there is an arguable case to be made that such controls do more harm than good. The discriminatory implementation of Article III through export controls may work to reduce many countries' commitment to the BWC regime. In particular, Rosenberg highlights humanitarian concerns over the impact of export controls: "Any hardship imposed by export controls might . . . have greater impact in the public health sphere than on weapons programs, putting the nations imposing the controls in an inhumane position."[54] An example of this concern is the impact of UNSCOM biotechnology restrictions in Iraq: a March 1996 report by the WHO showed health conditions in Iraq to be deteriorating at an alarming rate.[55]

At the 1994 Special BWC RevCon, developed countries wished to avoid a commitment to activate the provisions of Article X. These countries continually stressed that the provision of technical assistance would not further the purposes of verification. They argued that discussion of ways to activate Article X only diverted attention from the more important central problem of verifying compliance with the BWC.[56] Brazil responded by arguing that developing countries needed the technical assistance afforded by Article X provisions in order to participate effectively in a verification regime. Rather than diverting attention from verification, Brazil argued, the implementation of Article X was a vital precondition for a workable verification protocol.[57] On this point, it is indeed conceivable that some countries might need technical assistance in preparing their BWC declarations. Further, the setting up and maintenance of their respective national BWC liaison authorities may well require a cooperative relationship with, and assistance from, developed countries with arms control experience.

Chevrier argues that developed countries would be better served if they ceased devoting their diplomatic resources to resisting technical assistance altogether. Rather, they should allocate some of their resources to searching for a compromise and ascertaining which options for implementing Article X would be most acceptable to them.[58] using this approach, there is a valid case to be made that much cooperation and good will on the part of developing countries could be gained from abolishing biological export controls. Translated into increased commitment to the BWC, this would go further in preventing proliferation than any short-term security advantage conferred by controlling dual-use exports.[59]

For the present, while not a permanent solution to the problem of BW proliferation, export control regimes are likely to remain intact. Many countries regard them as a valuable deterrent and disincentive for BW production, and as a measure that maintains at least some member states' confidence in and commitment to the BWC. However, a resolution of the Article X question will be of great importance before negotiations can be fast-tracked to settling on a workable verification protocol to strengthen the BWC. Export controls are temporary non-proliferation measures at best, and a hindrance to cooperation at worst. If steps are not taken urgently to resolve this vexed issue then perhaps, as societies become more open and with improved communication technologies, arrangements such as the Australia Group may be made obsolete by the rapid global diffusion of technology which they attempt to control.

Notes

1. Utgoff, "The Biotechnology Revolution and Its Potential Military Implications," 34.
2. Marie Isabelle Chevrier, "From Verification to Strengthening Compliance," 215.
3. Anna Johnson–Winegar, "The Role of Declarations in UNSCOM's Program in Iraq," *Politics and the Life Sciences* 14 (2) (August 1995): 237.
4. Graham Pearson, *Discriminating Triggers for Mandatory Declarations*, Briefing Paper No. 3, (Bradford: Department of Peace Studies, University of Bradford, September 1997), 7.
5. BL4 (Biosafety Level 4): Maximum containment laboratories and facilities with highly specialized architectural, sterilization, and ventilation features to work with dangerous and/or exotic biological agents that pose a high individual risk of life-threatening disease both for the laboratory worker, the community and the environment. Ad Hoc Group, *Procedural Report*, BWC/AD HOC GROUP/39, ninth session (Geneva, 2 February 1998), 29, footnote 18.
6. Ad Hoc Group, *Procedural Report*, ninth session, 27–30.
7. Latter, *Biological Weapons: The Growing Threat*, 13.
8. Duncan and Hamilton, "Biological Weapons Control," 162.
9. Annabelle Duncan, *Views on a Verification Protocol for the Biological Weapons Convention*, 10–11 June 1995, Stockholm: Seminar on CBW Verification, 4.
10. Roberts, "Evaluating Global Non-Proliferation Instruments," 9.
11. Pearson, "A Strengthened Biological Weapons Convention is Essential, Feasible and Achievable," 14.
12. Roberts, "Evaluating Global Non-proliferation Instruments," 9.
13. Chevrier, "From Verification to Strengthening Compliance," 214.
14. Ibid., 215.
15. Ibid.
16. Duncan and Mathews, "Development of a Verification Protocol for the Biological Weapons Convention," 112.
17. Ibid., 116.
18. Duncan, *Views on a Verification Protocol for the Biological Weapons Convention*, 4.
19. Tucker, "Putting Teeth in the Biological Weapons Ban," 44.
20. Kadlec and others, "Biological Weapons Control," 351.
21. Ibid., 355.
22. Chevrier, "The Control of Biological Weapons," 213.
23. Raymond A Zilinskas, "UNSCOM and the UNSCOM Experience in Iraq," *Politics and the Life Sciences* 14 (2) (August 1995): 234.
24. Susan Wright, "Cuba Case Tests Treaty," *Bulletin of the Atomic Scientists* 53 (6) (Nov.–Dec. 1997): 18.
25. *Final Document*, BWC/CONF.IV/9, 25 November–6 December 1996, 25.
26. Ambassador Agus Tarmidzi, *Indonesia*, statement at BWC 4th Review Conference (Geneva, November 1996), 3.
27. Lowenthal, "The Politics of Verification," 23.
28. John Gee, "A Strengthened Biological Weapons Convention: Lessons To Be Learned from the Chemical Weapons Convention," *UNIDIR Newsletter* 33, 1996, 20.
29. Harald Müller, "Specific Approaches: Nuclear, Chemical and Biological Proliferation," in *Disarmament and Arms Limitation Obligations: Problems of Compliance and Enforcement*, ed. Serge Sur, (Aldershot: UNIDIR, 1994), 269.
30. Wright, "Cuba Case Tests Treaty," 19.
31. Müller, "Specific Approaches," 268.
32. Pearson, A strengthened Biological Weapons Convention Is Essential, Feasible and Achievable," 14.
33. Duncan and Hamilton, "Biological Weapons Control," 162.
34. Pearson, "A Strengthened Biological Weapons Convention is Essential, Feasible and Achievable," 11.
35. Ibid., 14.
36. Ibid.
37. Richard Latter, *An End to Chemical and Biological Weapons?* Paper 63 (London: Wilton Park, 1992), 20.
38. J. S. Selebi, Permanent Representative of the Republic of South Africa, *South Africa*, a statement at BWC 4th Review Conference, (Geneva, November 1996), 4.
39. Arundhati Ghose, *India*, a statement at BWC 4th Review Conference (Geneva, November 1996), 5.
40. Pearson, "Vaccines for Peace," 87.
41. Nicholas A. Sims, "Organizational Aspects with Regard to Possible Verification Tasks under the Biological Weapons Convention," in *Views on Possible Verification Measures for the Biological Weapons Convention,* ed. S. Johan Lundin (New York: SIPRI, Oxford University Press, 1991), 48.

42. Rolf Ekéus, "The UN and Arms Control in Iraq: A New Role?" interview by Robert C. Loehr and Eric M. Wong, *Journal of International Affairs* 49 (1) (summer 1995): 173.
43. Zilinskas, "Iraq's Biological Weapons," 423.
44. Dando and Pearson, "The Fourth Review Conference of the Biological and Toxin Weapons Convention," 122.
45. Roberts, "Evaluating Global Non-Proliferation Instruments," 7.
46. *United States*, Fourth BWC RevCon, 2.
47. Roberts, "Evaluating Global Non-Proliferation Instruments," 8.
48. Tucker, "The Biological Weapons Threat," 172.
49. Chevrier, "From Verification to Strengthening Compliance," 216.
50. Samir K. Sen, "Controlling Non-Nuclear Weapons of Mass Destruction: Problems and Prospects in a Changing World," *Comparative Strategy* 15 (April–June 1996): 174.
51. Rosenberg, "North Versus South," 72.
52. Chubin, "The South and the New World Order," 416.
53. Ibid., 420.
54. Rosenberg, "North Versus South," 73.
55. "Council Approves Export/Import Monitoring Mechanism to Ensure Iraq's Weapons Programme Is Not Developed," *UN Chronicle* 33 (2) (1996): 16.
56. Chevrier, "From Verification to Strengthening Compliance," 212.
57. Ibid., 212.
58. Ibid., 216.
59. Rosenberg, "North Versus South," 73.

PART FOUR

Conclusions

The Biological Weapons Convention in its present form is incapable of verifying compliance by its member states. If action is not taken urgently to strengthen the BWC with a workable verification regime, some States may be encouraged to exploit this weak link in the global WMD non-proliferation regime and acquire BW, with consequent damage to regional and world security.

This paper has set out to explain why it is taking so long to bring into force a strengthened, verifiable BWC. The problems associated with BWC verification are complex and the challenge is to find measures, which will strengthen the Convention in a way that satisfies all its members. An effective verification protocol reassures States that each is in compliance with the BWC and does so in a way that avoids exacerbating international tensions. The key issue will be avoiding discrimination. To this end, the BWC has an excellent starting point compared to other arms control agreements—it is intended to be a truly universal agreement, binding all States equally. Reaching agreement on a verification regime for the BWC will require compromise between different countries' interests concerning costs, intrusiveness, probabilities of detecting violators, and strength of deterrence. Such is the challenge in achieving wide political acceptance of measures forming part of a verification protocol to strengthen the BWC.

It is important to view the problem of BW proliferation in perspective. In contemplating a workable verification protocol for the BWC, it is essential to identify the peculiarities of the development, production, and storage of BW. Nuclear, Biological, and Chemical weapons are often classified together as "NBC weapons," and dealt with collectively. This obscures the fact that each WMD is based on very different technical principles. BW are easier to make than NW and, with recent advances in biotechnology and genetics, they can spread destruction more efficiently than CW. Most importantly, the BW problem is complicated by the dual-use nature of the equipment and technology used for both legitimate biotechnology research and BW.

The international norm against BW use established by the BWC is insufficient protection. Against the threat of a determined power seeking to possess a BW program, norms and symbols are far from enough. Legal inhibitions alone cannot hope to restrain the development and proliferation of BW. Historically, no weapon has ever been invented which was too awful to use. International conventions designed to protect the civilian from direct attack have repeatedly been flouted. The effects of a BW attack on civilians are likely to be horrific, underscoring the importance of finalizing the negotiations to strengthen the BWC.

The most frightening challenge facing the BWC regime is the threat of BW as manifested in terrorism. There are moves to encourage all member states to review their legislation to ensure that effective measures are in place to address terrorist activities in accordance with Article IV of the Convention. Even if all BWC member states enact domestic legislation, that does not preclude the possibility that some person or group will attempt to obtain and use BW. The full implementation of Article IV is not a complete deterrent to terrorist use of BW. However, such legislation may limit access to cultures of pathogenic organisms and thus reduce the likelihood that terrorists will acquire BW agents in the first place. The threat of terrorist BW attack in the future is very real and further underscores the urgency of concluding a verification protocol for the BWC that can reduce the risks.

Efforts to strengthen the BWC take place within the context of the post-Cold War international situation such that the Convention of 1972 must be changed in line with new developments in world politics. A recognition of post-Cold War political realities is a vital precondition for the successful operation of the BWC regime. Certain factors temper considerations of how best to address the problem of BW. Most significantly, the Cold War division of West and East has now been largely replaced by a North–South configuration. In the new international system, the perspectives, interests, and security needs of developing countries now play an increasingly significant role. Overall, with States freed from previously overriding Cold War concerns, the end of the superpower standoff presents fresh opportunities for cooperative non-proliferation policies towards ending the threat of BW, now and into the future.

Having reached conclusions on the general problem of BW proliferation, attention now turns to the two questions that dominate negotiations on bringing into force a strengthened, verifiable BWC. Firstly, can the BWC be strengthened? Secondly, how should the BWC be strengthened?

In addressing the first question, this paper has shown how it is possible to strengthen the BWC through verification measures. An arms control approach is the most appropriate and adapted approach to the problem of BW proliferation—resort to defensive measures is unnecessary. Indeed, the use of these measures does not adequately address the threat of BW on account of their being of limited effectiveness or reliability in deterring BW proliferation and use.

Regarding active defense, the Cold War arms control strategy of deterrence is largely inappropriate for dealing with the threat of BW. Deterrence relies on the strength of the threat of second-strike retaliation. A BW or CW retaliation is out of the question for signatory nations to the BWC and CWC, so NW remains the only WMD second-strike option. Aside from the possibility that a nuclear response to a BW attack might be grossly disproportionate, there is the very real likelihood that the perpetrator of the attack will be unidentified and unable to be found. Against the BW problem, the threat of a second-strike nuclear response is redundant.

Passive defenses such as vaccinations also present considerable difficulties. While protection against BW may be possible if the specific biological agent to be used is known well beforehand, it is the uncertainty as to the nature of the threat that is more likely to be the case. When one envisages such an ongoing situation in which defensive certainties are always trying to catch up with offensive possibilities, there are indeed strong grounds upon which to doubt the theory behind "effective" BW defense. Such a race to outmatch an opponent's biological capabilities would most likely result in exacerbating rather than countering BW proliferation. In addition to the inadequacy of defensive measures, there is a concern that national BW defensive programs, misconstrued as offensive by other nations, will lead to continued accusations of BWC violations.

The problems with defense measures demonstrate that a multilateral treaty verification approach is the preferred option for addressing the threat of BW. Furthermore, developing countries have a real interest in a multilateral solution to the threat of BW proliferation through the strengthening of the BWC. Lacking the technology for active or passive defense measures, they would be the most vulnerable in the event of BW use.

Because a BWC verification protocol must include unique and appropriate measures which account for the dual-use nature of biological agents and equipment, verification of the BWC is much more complicated compared with arms control measures under other treaties. Yet, inasmuch as verification is intended only to strengthen (not to guarantee) the Convention, there is a valid argument to be made that verifying compliance with the BWC is technically possible. Verification measures including OSIs are capable of addressing compliance concerns and can be conducted in a way that does not endanger confidential information.

To protect CBI during OSIs, comprehensive confidentiality provisions, similar to those in the CWC, should be contained within the BWC verification protocol. The challenge now is to reach a widely acceptable compromise between the competing objectives of detecting BWC violations and protecting CBI. A "managed access" approach to OSIs has the potential to allow BWC compliance concerns to be resolved to the satisfaction of both inspectors and the inspected facility. Already, trial inspections of BWC-relevant facilities have demonstrated in certain cases that satisfactory OSIs are possible without risk to CBI.

The experiences of UNSCOM in Iraq have also shown that it is possible to verify compliance with the BWC. UNSCOM has demonstrated that even in a situation in which Iraq was clearly seeking to retain a BW capability, compliance concerns could be readily identified through inconsistencies in the information available to the Commission. Particular lessons from the UNSCOM experience relating to biological safety, sampling procedures, and dealing with obstructions are of great value in deciding how to approach a BWC regime. The techniques that UNSCOM inspectors have developed could be used under a BWC verification protocol without necessarily having to deploy the intrusive powers that the Commission possessed in Iraq.

In deriving verification lessons from the UNSCOM experience, it is nevertheless important to recognize the differences between the BWC and UNSCOM. Iraq was a defeated nation, which resented the infringements of sovereignty implied in Resolution 687 and cooperated only superficially with inspection teams. This contrasts fundamentally with the BWC—a disarmament agreement entered into freely. Neither the OSIs or the OMV plan applied to Iraq could ever have a place in a future BWC verification regime. Member states would never accept

measures that treated them as defeated powers in terms of access. While the lessons of UNSCOM are of considerable relevance to the BWC, such coercive verification is clearly very limited in its application. It is inconceivable that a sovereign State would submit itself to a verification regime as intrusive as that of UNSCOM.

This paper has shown that disagreements among member states over specific verification measures, as well as existing provisions of the BWC, have drawn out the process of finalizing a legally binding instrument for verifying compliance with the Convention. Each State formulates its position on the BWC with regard to its own security and national interests, and countries which reluctantly acceded to the provisions of other arms control treaties now appear more determined to emphasis their own interests with regard to verification under the BWC.

Nevertheless, there are grounds for supposing that constructive compromise and eventual agreement is possible. Countries have shown that they are willing to endure intrusive OSIs in order to demonstrate their treaty compliance and achieve a higher level of security. This has been demonstrated in negotiations over other arms control agreements, in particular the CWC. This treaty came into force in 1997 after negotiations in which issues similar to those arising at BWC RevCons were resolved satisfactorily.

Having tracked the debate and controversy over measures to be included in a verification protocol, this paper makes the following five-point conclusion in answer to the question "how the BWC should be strengthened?"

1. Declarations are closely related to inspections and influence the number, frequency and locations for routine OSIs. Consideration of requirements for declarations must be guided by practicality. The key objective in developing declaration triggers is to avoid capturing a vast number of irrelevant facilities. Only advanced facilities of sufficient size to produce a militarily significant BW program should be declared and subsequently subjected to routine OSIs

2. OSIs are a vital part of a verification regime because they improve the deterrence value of the protocol and increase confidence that other member states are in compliance with the Convention. The BWC Technical Secretariat should select sites for an OSI using a random formula designed to ensure that no State receives more than its fair share of visits. There should be a mandate built into the protocol for the Technical Secretariat to exercise considerable discretion in the selection of random OSIs. This random selection process would be founded on the BWC Organization's information resources, and should incorporate considerations of equitable geographic distribution and non-discrimination among inspected States. A built-in non-discriminatory approach is essential for the BWC verification protocol. Routine OSIs would help to create this by making sure that every BWC member state could actively participate in the effective implementation of the Convention. Given these assurances, routine OSIs should be welcomed by States as opportunities to demonstrate compliance with their BWC obligations. In cases of alleged non-compliance, given the short clean-up time for a BW program, a request for a challenge OSI should automatically trigger such an inspection. A requirement written into the protocol that adequate evidence be the basis for challenge OSI requests would largely prevent ill-informed or mischievous requests.

3. Effective surveillance and prompt investigation of unusual or suspicious outbreaks of disease can potentially deter the use of BW by identifying deliberate or unintended release of BW pathogenic agents. Such field investigations would also provide greater transparency of biological events in a particular country, and increase confidence in States' compliance with the BWC. Under the organization of a future BWC verification regime, no single member state should retain the means by which to thwart a disease investigation. Whether future investigations are conducted by the BWCO or by some other international body such as the WHO, it is clear that the present organizational system for addressing compliance concerns is unsatisfactory.

4. A strengthening of the BWC will require that Article VI of the Convention, with its provision that compliance complaints be lodged with the UNSC, be replaced by another organizational measure. The Security Council is an inappropriate depository organization for allegations of BWC non-compliance. Permanent members of the Council with power of veto are virtually immune from resolutions to

conduct investigations inside their territory or apply disciplinary measures against them. Other international organizations concerned with health, safety, and production standards already conduct a variety of inspections and visits to sites around the world. However, these organizations do not possess adequate technology or the necessary mandate to deter and detect BW programs. In order to ensure international confidence, a credible BWC needs a strong institutional infrastructure to deal with its provisions. An entirely separate BWC Organization would have the advantage of having a clear, single purpose—overseeing verification of the BWC—and its organizational structure should be tailored to respond to the peculiar and specific demands of verifying compliance with the Convention. Confidence in an efficient and equitable BWCO would be further enhanced if the Organization employed only its own inspectors and endeavored to recruit staff on as broad a geographical base as possible.

5. A resolution of the conflict between proposed Article X technology transfers and export controls will be of great importance before negotiations can be fast-tracked to finding a workable verification protocol to strengthen the BWC. Export controls are frequently alleged to inhibit trade despite the absence of evidence to support such an accusation. The opposite case, that export controls are trade enablers, is often easier to make. Nevertheless, many countries continue to criticize export controls for symbolizing a distrust between developed and developing countries. Given the antipathy of developing countries towards export controls, which are also perceived as hindering their development, there is an arguable case to be made that such controls do more harm than good. The discriminatory implementation of Article III through export controls may work to reduce many countries' commitment to the BWC regime. Conversely, much cooperation and good will on the part of developing countries could be gained from abolishing biological export controls. Translated into increased commitment to the BWC, this would go further in preventing BW proliferation than any short-term security advantage conferred by controlling dual-use biotechnology exports. Export controls are only temporary non-proliferation measures at best, and a grave hindrance to international cooperation at worst.

The threat of BW is real. Yet there is currently no way of knowing for sure whether a country is in breach of the international ban on these horrific weapons. This paper has proceeded with a determination to give the problem of BW proliferation the attention it deserves—to contribute to and broaden the hitherto limited public discussion of BW proliferation through a substantive study of how best to go about dealing with this problem. Continuing debate and controversy over this issue means that it is still taking a long time to bring into force a strengthened, verifiable BWC.

The two greatest determinants of success at strengthening the BWC with a legally binding instrument will be: first, the technical feasibility of verification and secondly, political commitment to a multilateral arms control approach as a worthwhile solution to the problem of BW proliferation. Accordingly, the particular contribution of this paper to the debates over BW has been to argue that arrival at a workable verification protocol to strengthen the BWC is both technically and politically possible. While a strengthened, verifiable BWC would not constitute a complete solution to the problem of BW, this paper has shown that a BWC verification regime is a serious and worthwhile multilateral solution that substantially reduces the threat of BW proliferation and use.

AG	Australia Group
AHG	Ad Hoc Group of the States Parties to the Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction
BW	Biological Weapons
BWC	Biological Weapons Convention
BWCO	Biological Weapons Convention Organization
CBACI	Chemical and Biological Arms Control Institute
CBI	Confidential Business Information
CTBT	Comprehensive Nuclear Test Ban Treaty
CW	Chemical Weapons
CWC	Chemical Weapons Convention
DARPA	Defense Advanced Research Projects Agency
ELISA	Enzyme-Linked Immunosorbent Assay
IAEA	International Atomic Energy Agency
IISS	International Institute for Strategic Studies
NAM	Non-Aligned Movement
NGO	Non-Government Organization
NPT	Nuclear Non-Proliferation Treaty
NW	Nuclear Weapons
OMV	Ongoing Monitoring and Verification
OPCW	Organization for the Prohibition of Chemical Weapons
OSI	On-Site Inspection
PCI	Practice Compliance Inspection
R&D	Research and Development
RevCon	Review Conference
SIPRI	Stockholm International Peace Research Institute
UK	United Kingdom
UN	United Nations
UNIDIR	United Nations Institute for Disarmament Research
UNSC	United Nations Security Council
UNSCOM	United Nations Special Commission in Iraq
U.S.	United States
VEE	Venezuelan equine encephalitis
VEREX	Ad Hoc Group of Governmental Experts to Identify and Examine Potential Verification Measures from a Scientific and Technical Standpoint
VFP	Vaccines for Peace
WHO	World Health Organization
WMD	Weapons of Mass Destruction

In researching this paper, the main sources of recent information and debate on issues surrounding BWC verification measures were: public documents from BWC negotiations at the Conference on Disarmament in Geneva, UN publications, articles in various academic and scientific journals, and publications by a number of non-government organizations (NGOs). Although the problems associated with BWC verification are of ongoing concern, for the purposes of uniformity I ceased researching new developments after the end of July 1998. With regard to some records indicating the national policies of BWC member states, for the sake of consistency I examined only ambassadors' public statements delivered prior to and at the BWC Fourth Review Conference (RevCon) of November 1996.

Primary Sources

Ad Hoc Group of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction (Ad Hoc Group). *Trial Inspection of a Biological Production Facility*. Working Paper by Australia, fourth session, Geneva, 18 July 1996. BWC/AD HOC GROUP/WP.77.

———. *Procedural Report*. Seventh session, Geneva, 1 August 1997. BWC/AD HOC GROUP/36.

———. *Procedural Report*. Ninth session, Geneva, 2 February 1998. BWC/AD HOC GROUP/39.

———. *Procedural Report*. Tenth session, Geneva, 17 March 1998. BWC/AD HOC GROUP/40.

———. *Outcome of Discussions by the Friend of the Chair on Measures to Promote Compliance*. Eleventh session, Geneva, 6 July 1998. BWC/AD HOC GROUP/L 17.

———. *Outcome of Discussions by the Friend of the Chair on Confidentiality*. Eleventh session, Geneva, 9 July 1998. BWC/AD HOC GROUP/L 24.

Ad Hoc Group of Governmental Experts to Identify and Examine Potential Verification Measures from a Scientific and Technical Standpoint (VEREX). *Report*. Geneva, 24 September 1993. BWC/CONF.III/VEREX/8.

Australia. Statement by Mr. John Campbell, Ambassador of Australia for Disarmament Matters. Fourth Review Conference of the States Parties to the Biological Weapons Convention. Geneva: BWC 4th Review Conference, November 1996.

Australian Government. *In the National Interest*. Foreign and Trade Policy White Paper. Canberra: Australian Government Publishing Service, 1997.

Canada. Statement by Ambassador Mark Moher. Geneva: BWC 4th Review Conference, November 1996.

China. Statement by Ambassador Sha Zukang, Head of Delegation of the People's Republic of China. Geneva: BWC 4th Review Conference, November 1996.

European Union. Statement by Mr. Mervyn Taylor, Minister for Equality and Law Reform of Ireland on behalf of the European Union. Geneva: BWC 4th Review Conference, November 1996.

Fourth Review Conference of the Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction. *Final Document*. Geneva, 25 November–6 December 1996. BWC/CONF.IV/9.

Fourth Review Conference of the Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction. *List of States Parties to the Biological Weapons Convention* (as of 25 November 1996). 3 December 1996. BWC/CONF.IV/INF.2.

France. Discours de M. Xavier Emmanuelli, sécretaire d'état auprès du premier ministre, chargé de l'action humanitaire d'urgence. Geneva: BWC 4th Review Conference, November 1996.

India. Statement by Arundhati Ghose. Geneva: BWC 4th Review Conference, November 1996.

Indonesia. Statement by Ambassador Agus Tarmidzi. Geneva: BWC 4th Review Conference, November 1996.

Oehler, G. C. *The Chemical and Biological Weapons Threat*. Washington DC: Statement for the Record to the Permanent Subcommittee on Investigations of the Senate Committee on Government Affairs, 1 November 1995.

Pakistan. Statement by Ambassador Munir Akram. Geneva: BWC 4th Review Conference, November 1996.

Pharmaceutical Research and Manufacturers Association. *Reducing the Threat of Biological Weapons—A PhRMA Perspective*. Statement to the NGO segment. Geneva: BWC 4th Review Conference, 25 November 1996.

Russia. Statement by Ambassador Grigori Berdennikov. Geneva: BWC 4th Review Conference, November 1996.

South Africa. Statement by Mr. J. S. Selebi. Permanent Representative of the Republic of South Africa. Geneva: BWC 4th Review Conference, November 1996.

Special Conference of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction. *Final Report*. Geneva, 19–30 September 1994. BWC/SPCONF/1.

Text of the Comprehensive Nuclear Test Ban Treaty. Stockholm International Peace Research Institute, *SIPRI Yearbook: Armaments, Disarmament, and International Security*. New York: Oxford University Press, 1997.

Text of the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction (Biological Weapons Convention). *Treaties and Other International Acts*, Series 8062. Washington DC: U.S. Department of State, 1975.

———. *Extract* from Conference on Disarmament Document CD/1170.

Text of the Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare (Geneva Protocol). *League of Nations Treaty Series*, 94 (1929).

United Kingdom. Statement by Mr. David Davis, MP, Minister of State for Foreign and Commonwealth Affairs. Geneva: BWC 4th Review Conference, November 1996.

United States. Remarks of John D. Holum, Director of the U.S. Arms Control and Disarmament Agency. Geneva: BWC 4th Review Conference, November 1996.

Secondary sources

Bailey, Kathleen C. *The UN Inspections in Iraq: Lessons for On-Site Verification*. Boulder: Westview Press, 1995.

———. Review of *Eleventh Plague: the Politics of Chemical and Biological Warfare*, by Leonard A. Cole. *Politics and the Life Sciences* 16, no. 2, September 1997.

"Ban the Bug Bomb" *The Economist* 341, issue 7993, 23 November 1996.

Betts, Richard K. "The New Threat of Mass Destruction." *Foreign Affairs* 77, no. 1 (Jan.–Feb. 1998).

Bond, Michael. "Drug Firms Fight Bio-war Curbs." *New Scientist* 153, 8 March 1997.

Buchanan, H. Lee "Poor Man's A-bomb?" *Proceedings*. April, 1997.

Butler, Declan. "Talks Start on Policing Bio-Weapons Ban." *Nature* 388, no. 6640, 24 July 1997.

———. "U.S.–Cuba Row over Insects Goes to Weapons Meeting." *Nature* 388, 21 August 1997.

Carus, W. S. "The Proliferation of Biological Weapons." B. Roberts, ed. *Biological Weapons: Weapons of the Future?* Washington DC: Center for Strategic and International Studies (CSIS), 1993.

Chevrier, Marie Isabelle. "From Verification to Strengthening Compliance: Prospects and Challenges of the Biological Weapons Convention." *Politics and the Life Sciences* 14, no. 2, 1995.

———. "The Control of Biological Weapons." in Jeffrey A. Larsen and Gregory J. Rattray, eds. *Arms Control Towards the Twenty-First Century*. Boulder: Lynne Rienner, 1996.

Christopher, G. W., T. J. Cieslak, J. A. Pavlin, and E. M. Eitzen. "Biological Warfare: A Historical Perspective," *Journal of the American Medical Association* 278, no. 5 (6 August 1997).

"Council Approves Export/Import Monitoring Mechanism to Ensure Iraq's Weapons Programme Is Not Developed." *UN Chronicle* 33, no. 2, 1996.

Chubin, Shahram. "The South and the New World Order." Brad Roberts, ed. *Weapons Proliferation in the 1990s*. Cambridge, Mass.: Massachusetts Institute of Technology (MIT) Press, 1995.

Dando, Malcolm R. and Graham S. Pearson. "The Fourth Review Conference of the Biological and Toxin Weapons Convention: Issues, Outcomes and Unfinished Business." *Politics and the Life Sciences* 16, no. 1, March 1997.

Danzig, Richard and Pamela B. Berkowsky. "Why Should We Be Concerned About Biological Warfare?" *Journal of the American Medical Association* 278, no. 5 (6 August 1997).

Dashiell, T. "A Review of U.S. Biological Warfare Policies." Brad Roberts, ed. *Biological Weapons: Weapons of the Future?* Washington DC: CSIS, 1993.

"Deadline: 2001." *UN Chronicle* 33, no. 3, 1996.

Duncan, Annabelle. *Views on a Verification Protocol for the Biological Weapons Convention*. Stockholm: Seminar on CBW Verification, 10–11 June 1995.

———. and Robert J. Mathews. "Development of a Verification Protocol for the Biological Weapons Convention: Progress During 1996." *Verification 1997*. London: Verification Technology Centre, 1997.

———. and Susan Hamilton. "Biological Weapons Control." *Australasian Biotechnology* 7, no. 3, June 1997.

Ember, Lois R. "FBI Takes Lead in Developing Counter-terrorism Effort." *Chemical and Engineering News* 4, November 1996.

Ekéus, Rolf. "The UN and Arms Control in Iraq: A New Role?" Interview by Robert C. Loehr and Eric M. Wong. *Journal of International Affairs* 49, no. 1 (Summer 1995).

Falk, Richard. "Strengthening the Biological Weapons Convention of 1972" Erhard Geissler, ed. *Biological and Toxin Weapons Today*. New York: Stockholm International Peace Research Institute (SIPRI), Oxford University Press, 1986.

———. and Susan Wright. "Preventing a Biological Arms Race: New Initiatives." Susan Wright, ed. *Preventing a Biological Arms Race*. Cambridge, Mass.: MIT Press, 1990.

Ferguson, James R. "Biological Weapons and U.S. Law." *Journal of the American Medical Association* 278, no. 5, (6 August 1997).

Flowerree, Charles C. "Verification of Chemical and Biological Weapons: Lessons Learned." John G. Tower, James Brown, and William K. Cheek, eds. *Verification: The Key to Arms Control in the Late 1990s*. Washington, DC: Brassey's, 1992.

Forsberg, Randall, William Driscoll, Gregory Webb, and Jonathan Dean. *Nonproliferation Primer: Preventing the Spread of Nuclear, Chemical and Biological Weapons*. Cambridge, Mass.: Institute for Defense and Disarmament Studies, 1995.

Gee, John. "A Strengthened Biological Weapons Convention: Lessons to Be Learned from the Chemical Weapons Convention." *UNIDIR Newsletter*, no. 33, 1996.

Geissler, Erhard. "Vaccines for Peace: A Response to Commentaries." *Politics and the Life Sciences* 12, no. 1, February 1993.

Hammer, B. *Arms Control and Disarmament*. Lecture to Joint Services Staff College, 1 August 1994.

Heylin, Michael. "If There Is a Fetish, It Is for Technology, Not for Treaties." *Chemical and Engineering News* 74, no. 2, 8 January 1996.

Holloway, Harry C., Ann E. Norwood, Carol S. Fullerton, Charles C. Engel, and Robert J. Ursano. "The Threat of Biological Weapons: Prophylaxis and Mitigation of Psychological and Social Consequences." *Journal of the American Medical Association* 278, no. 5 (6 August 1997).

Human Rights Watch. "Human Rights Watch Arms Project—Chemical and Biological Weapons Program." *Politics and the Life Sciences* 15, no. 1, March 1996.

Huxsoll, D. L. "The U.S. Biological Defense Research Program." Brad Roberts, ed. *Biological Weapons: Weapons of the Future?* Washington DC: CSIS, 1993.

———. "On-site Inspection Measures and Interviews." *Politics and the Life Sciences* vol. 14, no. 2, August 1995.

"In Praise of Weapons Controls." *The Economist* 343, issue 8016, 10 May 1997.

International Institute for Strategic Studies (IISS). "Biological Weapons: New Threats or Old News." *Strategic Survey 1996/97*. London: Oxford University Press, 1997.

Ivker, R. "Stricter Surveillance of Biological Weapons Urged," *The Lancet* 348, issue 9042, 14 December 1996.

Johnson–Winegar, Anna. "The Role of Declarations in UNSCOM's Program in Iraq." *Politics and the Life Sciences* 14, no. 2, August 1995.

Joseph, Robert G. and John F. Reichart. "Deterrence and Defense in a Nuclear, Biological, and Chemical Environment." *Comparative Strategy* 15, April–June 1996.

Kadlec, Robert P., Allan P. Zelicoff, and Ann M. Vrtis. "Biological Weapons Control: Prospects and Implications for the Future." *Journal of the American Medical Association* 278, no. 5 (6 August 1997).

Kaplan, David E. "Terrorism's Next Wave." *U.S. News and World Report* 123, no. 19, 17 November 1997.

Karkoszka, A. "The Convention on Biological Weapons." Serge Sur, ed. *Verification of Current Disarmament and Arms Limitation Agreements: Ways, Means and Practices*. Aldershot: United Nations Institute for Disarmament Research (UNIDIR), 1991.

Kay, David A. "Denial and Deception Practices of WMD Proliferators: Iraq and Beyond." Brad Roberts, ed. *Weapons Proliferation in the 1990s*. Cambridge, Mass.: MIT Press, 1995.

Kellman, B., D. S. Gualtieri, and E. A. Tanzman. "Disarmament and Disclosure: How Arms Control Verification Can Proceed Without Threatening Confidential Business Information." *Harvard International Law Journal* 36, no. 1 (1995).

King, Jonathan and Harlee Strauss. "The Hazards of Defensive Biological Warfare Programs." Susan Wright,. ed. *Preventing a Biological Arms Race*. Cambridge, Mass.: MIT Press, 1990.

Kleiner, Kurt. "U.S. Bioterror Alert Prompts Tighter Rules." *New Scientist* 150, 22 June 1996.

———. "Pentagon Anthrax Plan 'Sends the Wrong Message.'" *New Scientist* 152, 12 October 1996.

Kupperman, Robert H. and David M Smith. "Coping with biological terrorism." Brad Roberts, ed. *Biological Weapons: Weapons of the Future?* Washington, DC: CSIS, 1993.

Latter, Richard. *An End to Chemical and Biological Weapons?* Paper 63. London: Wilton Park, 1992.

———. *Biological Weapons: The Growing Threat*. Paper 124. London: Wilton Park, 1997.

Lederberg, Joshua. "Infectious Disease and Biological Weapons: Prophylaxis and Mitigation" (editorial). *Journal of the American Medical Association* 278, no. 5 (6 August 1997).

Lowenthal, Mark H. "The Politics of Verification: What's New, What's Not." John. G. Tower, James Brown, and William K. Cheek, eds. *Verification: The Key to Arms Control in the Late 1990s*. Washington, DC: Brassey's, 1992.

Lundin, S. Johan Ed. *Views on Possible Verification Measures for the Biological Weapons Convention*, SIPRI. New York: Oxford University Press, 1991.

MacKenzie, D. "Biowar Checks Hang in the Balance." *New Scientist*, issue 2057 (23 November 1996).

Mann, Paul. "Mass Weapons Threat Deepens Worldwide." *Aviation Week and Space Technology* 144, 17 June 1996.

———. "Detection Sensors Crucial, but Technically Exacting," *Aviation Week and Space Technology* 144, 17 June 1996.

Marshall, Eliot. "Too Radical for NIH? Try DARPA." *Science* 275, 7 February 1997.

Mohr, Alan J. "Biological Sampling and Analysis Procedures for the United Nations Special Commission (UNSCOM) in Iraq." *Politics and the Life Sciences* 14, no. 2, August 1995.

Monastersky, R. "Policing the Peace." *Science News* 149, issue 19, 11 May 1996.

Moodie, Michael. "Arms Control Programs and Biological Weapons." B. Roberts, ed. *Biological Weapons: Weapons of the Future?* Washington DC: CSIS, 1993.

———. "The Chemical and Biological Arms Control Institute" (CBACI). *Politics and the Life Sciences* 15, no. 1, March 1996.

———. "Facing Up to Chemical and Biological Weapons." Review of *the Eleventh Plague: The Politics of Biological and Chemical Warfare*, by Leonard A. Cole. *Chemical and Engineering News* 75, no. 8, 24 February 1997.

Müller, Harald "Specific Approaches: Nuclear, Chemical and Biological Proliferation." S. Sur, ed. *Disarmament and Arms Limitation Obligations: Problems of Compliance and Enforcement*. Aldershot: UNIDIR, 1994.

Pearson, Graham S. "Biological Weapons: the British View," B. Roberts, ed. *Biological Weapons: Weapons of the Future?* Washington DC: CSIS, 1993.

———. "Vaccines for Peace: An Incentive for Developing Countries." *Politics and the Life Sciences* 12, no. 1, February 1993.

———. "A Strengthened Biological Weapons Convention is Essential, Feasible and Achievable." *UNIDIR Newsletter*, no. 33, 1996.

———. *Strengthening the Biological Weapons Convention: The Importance of On-Site Investigations*. Briefing Paper No. 1. Bradford: Department of Peace Studies, University of Bradford, July 1997.

———. "The Complementary Role of Environmental and Security Biological Control Regimes in the 21st Century," *Journal of the American Medical Association* 278, no. 5 (6 August 1997).

———. *The Necessity for Non-Challenge Visits*. Briefing Paper No. 2. Bradford: Department of Peace Studies, University of Bradford, September 1997.

———. *Discriminating Triggers for Mandatory Declarations*. Briefing Paper No. 3. Bradford: Department of Peace Studies, University of Bradford, September 1997.

———. "Non-challenge visits." 8th Workshop of the Pugwash Study Group on the Implementation of the Chemical and Biological Weapons Conventions: Strengthening the Biological Weapons Convention. Geneva, 20–21 September 1997.

Pilat, Joseph F. "Arms Control, Verification, and Transparency." Jeffrey A. Larsen and Gregory J. Rattray, eds. *Arms Control Towards the Twenty-First Century*. Boulder: Lynne Rienner, 1996.

Preston, Richard. "The Bioweaponeers." *New Yorker* 74, no. 3, 9 March 1998.

Roberts, Brad. "New Challenges and New Policy Priorities for the 1990s." B. Roberts, ed. *Biological Weapons: Weapons of the Future?* Washington DC: CSIS, 1993.

———. Review of *Chemical and Biological Weapons: A Study of Proliferation*, by Edward M. Spiers. *Politics and the Life Sciences* 16, no. 1, March 1997.

———. "Evaluating Global Non-proliferation Instruments." Ramesh Thakur, ed. *Keeping Proliferation at Bay: Papers From the ARF Track Two Seminar.* Jakarta, December 1996. Jakarta: CSIS, (forthcoming).

Robinson, J. P. "Controlling Dual-Use Biotechnology: The Crucial Role of National Measures." 8th Workshop of the Pugwash Study Group on the Implementation of the Chemical and Biological Weapons Conventions: Strengthening the Biological Weapons Convention. Geneva, 20–21 September 1997.

Rosenberg, Barbara Hatch "North Versus South: Politics and the Biological Weapons Convention." *Politics and the Life Sciences* 12, no. 1, February 1993.

———. and L. C. Klotz. *Confidentiality Can be Protected During Sampling and Analysis in a BWC Compliance Regime.* Pugwash Workshop on Strengthening the BWC. September, 1997.

Rueckert, G. L. "Managing On-Site Inspections: Initial Experiences and Future Challenges." John G. Tower, James Brown, and William K. Cheek, eds. *Verification: The Key to Arms Control in the Late 1990s*. Washington, DC: Brassey's, 1992.

Sen, Samir K. "Controlling Non-Nuclear Weapons of Mass Destruction: Problems and Prospects in a Changing World." *Comparative Strategy* 15 (April–June 1996).

Sidel, Victor W. "The History of Biological Warfare and Research." Gary McCuen, ed.; *Poison in the Wind: The Spread of Chemical and Biological Weapons*. Hudson: Gary E. McCuen Publications Inc., 1992.

Simon, Jeffrey D. "Biological Terrorism: Preparing to Meet the Threat." *Journal of the American Medical Association* 278, no. 5 (6 August 1997).

Sims, Nicholas A. "Organizational Aspects with Regard to Possible Verification Tasks under the Biological Weapons Convention." S. Johan Lundin, ed. *Views on Possible Verification Measures for the Biological Weapons Convention*. New York: SIPRI, Oxford University Press, 1991.

Spiers, Edward M. *Chemical and Biological Weapons: A Study of Proliferation*. London: Macmillan, 1994.

St. Onge, Allen A. "United Nations Biological Warfare Inspectors in Iraq: Implications for Biological Arms Control." *Politics and the Life Sciences* 14, no. 2, August 1995.

Stephenson, Joan. "Pentagon-Funded Research Takes Aim at Agents of Biological Warfare." *Journal of the American Medical Association* 278, no. 5 (6 August 1997).

Stockholm International Peace Research Institute. *SIPRI Yearbook 1997: Armaments, Disarmament and International Security*. New York: Oxford University Press, 1997.

Sur, Serge "General Considerations on Verification." S. Sur, ed. *Verification of Current Disarmament and Arms Limitation Agreements: Ways, Means and Practices.* Aldershot: UNIDIR, 1991.

Taylor, Robert. "All Fall Down." *New Scientist* 150, 11 May 1996.

Thränert, Oliver. "The 'Vaccines for Peace' Program: Does It Really Help to Strengthen the Biological Weapons Convention?" *Politics and the Life Sciences* 12, no. 1, February 1993.

Trapp, R. "Applicable Verification Lessons From the Negotiations on the Chemical Weapons Convention." S. Johan Lundin, ed. *Views on Possible Verification Measures for the Biological Weapons Convention*. New York: SIPRI, Oxford University Press, 1991.

Tucker, Jonathan B. "The Biological Weapons Threat." *Current History* (April 1997).

———. "National Health and Medical Services Response to Incidents of Chemical and Biological Terrorism." *Journal of the American Medical Association* 278, no. 5 (6 August 1997).

———. "Putting Teeth in the Biological Weapons Ban." *Technology Review* 100, no. 9, January–February 1998.

Utgoff, V. A. "The Biotechnology Revolution and Its Potential Military Implications." B. Roberts, ed. *Biological Weapons: Weapons of the Future?* Washington DC: CSIS, 1993.

Walker, J. R. "Update: Verification of the Biological and Toxin Weapons Convention and the UK's Practice Compliance Inspection Programme." J. B. Poole and R. Guthrie, eds. *Verification 1995*. Boulder: Westview Press, 1995.

Weston, Michael. "Giving Teeth to the Biological Weapons Convention." *NATO Review* 45, no. 3, May–June 1997.

"The Whore of Babylon and the Horseman of Plague." *The Economist* 343, issue 8012, 12 April 1997.

Woodall, Jack. "An Exceptional Window of Opportunity: Comments on 'Vaccines for Peace.'" *Politics and the Life Sciences* 12, no. 1, February 1993.

Wright, Susan. "Cuba Case Tests Treaty." *Bulletin of the Atomic Scientists* 53, no. 6, Nov.–Dec. 1997.

Zilinskas, Raymond A. "UNSCOM and the UNSCOM Experience in Iraq." *Politics and the Life Sciences* 14, no. 2, August 1995.

———. "Detecting and Deterring Biological Weapons in Iraq: The Role of Aerial Surveillance." *Politics and the Life Sciences* 14, no. 2, August 1995.

———. "Iraq's Biological Weapons: The Past as Future?" *Journal of the American Medical Association* 278, no. 5 (6 August 1997).