Chaillot Paper

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Enforcing non-proliferation

The European Union and the 2006 BTWC Review Conference

Jean Pascal Zanders and Kathryn Nixdorff

Edited by Gustav Lindstrom

Institute for Security Studies
Institut d'études de Sécurité
European Union
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Préface

Nicole Gnesotto

Depuis plusieurs années, la lutte contre la prolifération des armes de destruction massive s'est focalisée en priorité sur l'arme nucléaire. L'Iran et la Corée du Nord monopolisent en effet l'attention et les efforts de l'ensemble de la communauté internationale. Pour autant, le nucléaire est loin d'être le seul élément de ce dossier. La prolifération des armes biologiques représente un autre risque de déstabilisation majeure, qu'elle soit imputable à des Etats constitués ou à d'éventuels groupes terroristes désireux de se doter d'armes de destruction massive.

Pour l'Union européenne, la lutte contre la prolifération ne se divise pas en dossiers « nobles » et dossiers « secondaires ». La stratégie de lutte contre la prolifération est en effet une et indivisible, dans la mesure où elle attache autant d'importance au dossier nucléaire qu'aux autres dossiers. Après s'être mobilisée en 2005 pour la Conférence d'examen du Traité de non-prolifération (TNP), l'Union s'est donc mobilisée en 2006 pour que la sixième Conférence d'examen de la Convention sur les armes biologiques et à toxines (BTWC) soit l'occasion d'un renforcement des régimes multilatéraux de lutte contre la prolifération.

Quel est l'état des consensus internationaux sur l'interdiction des armes biologiques ? Quels sont les risques de prolifération ? Comment distinguer l'interdiction des armes et la légalité de la recherche scientifique et pharmaceutique ? Le risque terroriste est-il avéré ? Quelles sont les propositions de l'Union européenne pour prévenir ce type de prolifération ? Telles sont les questions que l'Institut a voulu explorer dans ce nouveau Cahier de Chaillot, *qui complète avec pertinence la série des publications de l'Institut sur le dossier de la prolifération.*

C'est à Jean Pascal Zanders, directeur du Bio-Weapon Prevention Project (BWPP), que nous avons confié ce dossier. Basé à Genève, le BWPP est une organisation non gouvernementale spécialisée dans la question des armes biologiques et M. Zanders est l'une des figures dominantes sur la liste très restreinte des experts académiques de ce domaine. Grâce également à la contribution de Kathryn Nixdorff, du Department of Microbiology and Genetics à l'Université de Darmstadt, cette étude

représente aujourd'hui l'un des seuls ouvrages de référence sur la BTWC et sur la contribution de l'Union au renforcement de cette Convention.

Redoutable défi d'ailleurs que de vouloir renforcer les instruments multilatéraux de lutte contre la prolifération, alors que le contexte international ne leur est guère favorable : la Corée du Nord a sauté le pas d'un essai nucléaire qui, bien que minime, affaiblit fortement la crédibilité du TNP. Les pressions internationales n'ont pas, à ce jour, eu raison des ambiguïtés nucléaires de l'Iran. Les Etats-Unis ont une attitude plus que réservée sur l'institutionnalisation de la BTWC et la mise en place d'un système contraignant de vérification. Et l'on pourrait multiplier les exemples de ce contexte plutôt défavorable aux instruments multilatéraux de contrôle ou d'interdiction des armements. Pour autant, les Européens ont décidé de ne pas renoncer : parce qu'il n'y a pas d'alternative plus satisfaisante qu'un régime de contrôle, le plus universel possible, de la prolifération des armes de destruction massive.

Paris, novembre 2006

Introduction

Gustav Lindstrom

In its 2003 strategy against the proliferation of weapons of mass destruction, the EU underscores that it is 'committed to the multilateral treaty system' – considering it the legal and normative stepping-stone for all non-proliferation efforts. Among the principal policy objectives outlined in the strategy are to implement and universalise multilateral treaties such as the nuclear Non-Proliferation Treaty (NPT), the Chemical Weapons Convention (CWC), and the Biological and Toxin Weapons Convention (BTWC).

With respect to the BTWC, the EU has increased its efforts to promote the universalisation and implementation of the convention since 2005. In February 2006, it adopted a Joint Action in support of the BTWC. Its two main objectives are to advocate the universalisation of the BTWC by promoting the accession of States not Party to the convention and to push for the implementation of the BTWC by the States Parties.

The EU Joint Action was complemented by an EU Action Plan on biological and toxins weapons to enhance implementation of the BTWC within the EU. Among other things, it encourages EU member states to file confidence-building measures (CBM) returns each year. In the light of the upcoming 2006 BTWC Review Conference (20 November – 8 December 2006), the Council adopted a Common Position in March 2006 outlining its priorities for the conference. Universal accession of all states to the BTWC and full compliance with the obligations under the convention are among the core objectives listed in the text.

This *Chaillot Paper* focuses on international efforts to prevent biological agents and toxins being developed and used as weapons. The analysis is framed around the BTWC and its associated Review Conferences. Besides examining the evolution of international efforts to promote disarmament, the study considers challenges to the convention, such as issues of verification and the impact of advances in the field of science and technology. Weaknesses and limitations in current policymaking are identi-

fied and analysed. It should be noted that the chapters in this study are written to be independent and self-contained, allowing the reader to focus on his or her particular area of interest. To accommodate this structure, there is a limited degree of duplication between some chapters.

In the first chapter, Jean Pascal Zanders gives an overview of international efforts to constrain the use of biological agents – commencing with the 1925 Geneva Protocol. Specific attention is given to the BTWC and related disarmament instruments such as UN Security Council Resolution 1540. The second part of the chapter analyses the challenges facing the BTWC regime as we approach the 6th Review Conference. It looks at how international events, such as the end of the Cold War and the 9/11 terrorist attacks, have affected the convention.

In the second chapter, Jean Pascal Zanders examines the plausibility of an effective verification system for the BTWC. This chapter summarises verification attempts made to date and the reasons why they have failed. The chapter goes on to analyse an alternative form of verification – the confidence-building measures – and their limitations. The chapter ends with a discussion of the verification challenges posed by bio-defence programmes and the lack of an international secretariat in support of the BTWC.

In the third chapter, Kathryn Nixdorff assesses recent advances in science and technology and their impact on the BTWC. Special attention is paid to developments in the fields of genomics, molecular biology, nanotechnology and synthetic biology. Given these developments, the chapter discusses the dual-use risk posed by certain elements such as bioregulators. The second part of the chapter concentrates on targeted delivery systems such as viral vectors and immunotoxins. It also explains how plants can be misused as a delivery system. The chapter ends with a number of recommendations to minimise the possibility of science and technology being used for the production of biological weapons.

The fourth chapter focuses on the EU and the 6th Review Conference. It traces the origins of the EU common policy development on biological warfare. In his analysis, Jean Pascal Zanders provides an extensive overview of EU preparations for the 6th Review Conference, including a summary of the EU working papers released in advance of the conference. The chapter ends

with a discussion of how EU policies can further be developed to maintain longer-term ambitions for the BWTC, focusing on issues of verification and compliance.

This *Chaillot Paper* should be of interest to academics, analysts, and policymakers concerned with disarmament issues relating to biological warfare. It considers the evolution of the BTWC – paying particular attention to the outcomes of the past five review conferences and the challenges posed by scientific developments. Its aim is to contribute to current European thinking in the light of the upcoming 6th BTWC Review Conference.

On the eve of the 6th Review Conference of the Biological and Toxin Weapons Convention

Jean Pascal Zanders

1

Preparing the 6th Review Conference

In 2005 the Biological and Toxin Weapons Convention (BTWC) celebrated the 30th anniversary of its entry into force.[1] The States Parties to the Convention will meet for the 6th Review Conference in late 2006, a three-week event that will take place between 20 November and 8 December. According to Article XII of the BTWC, the goal of such a review conference is to assure 'that the purposes of the preamble and the provisions of the Convention (...) are being realised.' In addition, 'such review shall take into account any new scientific and technological developments relevant to the Convention.' Although the article only mentions a single review conference to be held five years after the entry into force of the BTWC, the States Parties have come together every five years (with one exception) to assess the status of the convention and update the prohibition on biological weapons (BW). Review conferences were held in 1980, 1986, 1991, 1996 and 2001-2002.

The Preparatory Committee for the 6th Review Conference met in Geneva from 26 to 28 April 2006. It agreed on a provisional agenda for the review conference, which is to be held in Geneva from 20 November until 8 December.[2] Among other things, the delegates also considered and agreed upon draft rules of procedure and financial arrangements for the review conference. In addition, they decided on six documents with background information to be prepared in support of the review process. The topics are the history and operation of the confidence-building measures, compliance by States Parties with all their obligations under the BTWC, new scientific and technological developments relevant to the convention, developments since the 5th Review Conference in other international organisations,[3] an overview of additional understandings and agreements reached by previous review conferences, and the status of the universalisation of the BTWC.

1. Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, opened for signature on 10 April 1972 and entered into force on 26 March 1975. Reflections on the 30th anniversary are compiled in Erhard Geissler, Nicholas A. Sims and John Borrie, '30 Years of the BTWC: Looking Back, Looking Forward,' *Occasional Paper* no. 2 (BioWeapons Prevention Project: Geneva, June 2005); available at: http://www.bwpp.org/documents/200506OP002BTWC30th anniversary.pdf.

2. Report of the Preparatory Committee, Preparatory Committee for the Sixth Review 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, Document BWC/CONF.VI/PC/2, 3 May 2006.

3. The original proposal made explicit reference to UN Security Council Resolution 1540 and the revised International Health Regulations of the World Health Organisation (WHO). Their deletion from the Report is not expected to prevent the consideration of these documents in the background information document as both the United Nations and the WHO are international organisations. Graham S. Pearson, 'The Preparatory Committee for the Sixth BWC Review Conference', *CBW Conventions Bulletin*, no. 71, May 2006, p. 14.

Seventy-eight States Parties (out of a total of one hundred and fifty five or 50.3 per cent) participated. In addition, six Signatory States (Egypt, Madagascar, Burma/Myanmar, Nepal, the Syrian Arab Republic and the United Arab Emirates) participated in the discussion without the right to take part in the decision-making processes and one non-Signatory State (Israel) participated as an observer.[4] The countries of the Non-Aligned Movement (NAM) nominated Ambassador Masood Khan from Pakistan as Chairman of the Preparatory Committee, who was subsequently elected by acclamation at the first meeting. He was also nominated to preside over the 6th Review Conference.

In general, participants felt that the outcome of the Preparatory Committee meetings was positive. There had been some apprehension about a repetition of the failure of the 7th Review Conference of the NPT in May 2005, when the States Parties were not able to agree on an agenda until the ninth day.[5] Yet, an undercurrent of tension was discernable, particularly between Iran and the United States. Part of that tension may go back to the abrupt US withdrawal from the Ad Hoc Group negotiations in 2001 and the subsequent failure of the 5th Review Conference; part may be related to the current stand-off over Iran's nuclear programme, which the United States and many European countries believe is for weapons purposes, and geopolitical manoeuvring in the Middle East. The incident between the two countries concerned the mandate of the Ad Hoc Group, which had been decided by the 4th Review Conference and was left unchanged despite the US move to have it terminated at the 5th Review Conference in 2001, and the resumption of the Protocol negotiations. In the end, a compromise formulation over the relevant agenda item was negotiated (which seems to hint at a termination of the Ad Hoc Group mandate in exchange for US endorsement of a work programme between the 6th and 7th Review Conferences wanted by most States Parties). It remains an open question whether the matter (in the broader context of relations between Iran and the West) can be divisive at the end of 2006. Although the final report is a consensus document and a single country can consequently block its adoption, much will depend on whether Iran can mobilise other NAM members to support its position. However, as a NAM representative will be chairing the 6th Review Conference, the regional group will have a great stake in a successful outcome.

4. Report of the Preparatory Committee, op. cit., p. 2.

5. Rebecca Johnson, 'Politics and Protection: Why the 2005 NPT Review Conference Failed', *Disarmament Diplomacy*, no. 80, Autumn 2005; available at: http://www.acronym.org.uk/dd/dd80/80npt.htm.

In the light of the failure to conduct a full review of the articles of the BTWC and an assessment of scientific and technological challenges to the objectives and purpose of the convention in 2001-02, it is of utmost importance that the 6th Review Conference achieves these basic objectives. A full review has not taken place since the 4th Review Conference in 1996. Given the many new commitments and obligations under international law since 1996 and given the changes in the international security environment and importance of biology and biotechnology in the societal, economic and technological development of societies, it will be important for the States Parties to determine their expectations from the BTWC. This will enable them to identify core and peripheral matters of concern and clarify the relationship between the BTWC and other instruments to counter the BW threat (e.g., the WHO, the United Nations, including the responsibilities of the UN Secretary-General to investigate allegations of deliberate use of biological agents and the inspection capacity and expertise of the UN Monitoring, Verification and Inspection Commission, UNMOVIC). The 2002-05 intersessional process emphasised the relevance of national implementation of the Convention in order to address new security challenges and offered useful platforms for exchanges of information on a number of topics. The 6th Review Conference will be the first opportunity to draw conclusions – and possibly define commitments – from these intersessional meetings.

The 6th Review Conference will not be a major stepping stone in the process of regime formation, but it may be able to clear the ground for fresh approaches to strengthening the BTWC. The first step is to conclude the 6th Review Conference successfully, so that there is a reaffirmation of the scope of the core prohibition and obligations of the States Parties under the BTWC as well as decisions adopted at previous review conferences. The second step is to determine an agenda for the period between the 6th and 7th Review Conferences with an aim to improve the effectiveness of existing tools (confidence-building measures or CBMs, national legislation, etc.) and to prepare the ground to formally strengthen the BTWC after 2011, when hopefully the international security context will have become more conducive to multilateral arms control and disarmament.

International constraints on biological warfare

Biological warfare is the intentional application of disease-causing micro-organisms or other entities that can replicate themselves – such as viruses, infectious nucleic acids and prions – against humans, animals or plants for hostile purposes. It may also involve the use of toxins, which are poisonous substances produced by living organisms, including micro-organisms (e.g., botulinum toxin), plants (e.g., ricin derived from castor beans) and animals (e.g., snake venom). Their synthetically manufactured counterparts are also BW if they are used for warfare purposes. During the past few years, concerns have been raised about potential hostile uses of natural mediators of human, animal and plant physiology, like hormones and bioregulators.[6] These so-called mid-spectrum agents – scientists place them midway between traditional chemical and biological warfare agents based on some of their physical characteristics – are highly toxic in low doses and it is known that they have already been investigated as potential biochemical incapacitating agents.

The formal norm against biological warfare is formulated in three international treaties still in force today: the 1925 Geneva Protocol, the BTWC, and (with regard to toxin weapons) the 1993 Chemical Weapons Convention (CWC). It is supplemented by UN resolutions, including those related to the investigative powers of the UN Secretary-General regarding allegations of BW use and UN Security Council Resolution 1540 (2004). Furthermore, the norm is also reflected in several regional security agreements.[7]

The 1925 Geneva Protocol

The Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases, and of Bacteriological Methods of Warfare, was signed in Geneva on 17 June 1925 and entered into force on 8 February 1928. As of 1 August 2006, the Geneva Protocol has 133 contracting parties.

This international agreement is the first document that makes explicit reference to microbial forms of warfare. Earlier formal constraints were impossible because the causes of disease and the methods of its propagation were poorly understood. Nevertheless, legal treatises from the 19th century and earlier indicate that certain types of biological warfare agents were subsumed under

6. For a detailed discussion, see the chapter 'Science and Technology Considerations at the Seventh BTWC Review Conference in 2011' in BioWeapons Prevention Project, *Bioweapons Report 2004* (Geneva: BWPP, December 2004), pp. 103-14.

7. For example, Joint Declaration on the Complete Prohibition of Chemical and Biological Weapons (The Mendoza Accord), signed between Argentine, Brazil and Chile, 5 September 1991 and the Cartagena Declaration on Renunciation of Weapons of Mass Destruction, signed between Bolivia, Colombia, Ecuador, Peru and Venezuela, 4 December 1991.

the term 'poison'. Therefore, early customary prohibitions on the use of poison also applied to certain primitive modes of biological warfare (which mostly consisted of polluting the environment, e.g., by dumping carcasses into wells, or the treatment of kinetic weapons with toxins or concoctions of putrefied organic materials).[8] The Regulations Respecting the Laws and Customs of War on Land annexed to both the 1899 Hague Convention (II) with Respect to the Laws and Customs of War on Land and the 1907 Hague Convention (IV) Respecting the Laws and Customs of War on Land later codified this ban.[9] In its judgment of 30 September 1946, the Nuremberg International Military Tribunal declared that the rules embodied in the 1907 Hague Convention 'were recognised by all civilised nations and were regarded as being declaratory of the laws and customs of war.'[10] As a result, it is possible to convincingly argue that any state is restricted in its options to apply disease and toxins as a means of warfare.

The Geneva Protocol also belongs to the laws of war, which restrict the use in combat of certain types of weapons or modes of warfare that are deemed to be inhumane. The document, however, does not prohibit the preparation for chemical or biological warfare. After its entry into force in 1928, states continued their chemical research and development programmes, stockpiled chemical munitions and trained their military forces in the offensive use of these weapons. Prompted by the growing understanding of disease and its propagation and false allegations of BW programmes and tests, several states – including France, the United Kingdom, Japan and the Soviet Union – also initiated offensive BW research and development programmes in the late 1920s and 1930s. Some of those programmes continued after the Second World War.[11]

Forty-five parties adopted reservations declaring their explicit right to retaliation in kind if an enemy or its allies resort to chemical and biological weapons (CBW) first. Presently many of these states have or are in the process of withdrawing them in order to fully conform their commitment to the Geneva Protocol with their obligations under the BTWC and the CWC.

The 1972 Biological and Toxin Weapons Convention

The BTWC was opened for signature in London, Moscow and Washington on 10 April 1972 and entered into force on 26 March 1975. As of 1 August 2006, there are 155 States Parties and 16 sig-

8. Jean Pascal Zanders, 'International Norms Against Chemical and Biological Warfare: An Ambiguous Legacy', *Journal of Conflict and Security Law*, vol. 8, no. 2, 2003, p. 405.

9. Dietrich Schindler and Jiri Toman (eds.), *The Laws of Armed Conflicts. A Collection of Conventions, Resolutions and Other Documents* (Leiden and Geneva: A. W. Sijthoff and Henry Dunant Institute, 1973), pp. 76-7.

10. The Nuremberg Judgment, as reproduced in Leon Friedman (ed.), *The Law of War: A Documentary History– Volume II* (New York: Random House, 1972), p. 961.

11. The United States started up a major offensive BW programme during the Second World War and expanded it during the 1950s. However, it did not become a party to the Geneva Protocol until 1975, some five years after it had formally announced the unilateral termination of its offensive biological warfare preparations.

natory states to the BTWC. In addition, 24 states have neither signed nor acceded to it (see Annexes). Central to the convention is Article I, which specifies that States Parties cannot acquire or retain BW under any circumstances. The 4th Review Conference (1996) formally expanded the interpretation of this article to cover BW use. The negative security guarantee is reinforced by the requirement in Article II to destroy or divert all BW to peaceful uses and by the non-proliferation provision of Article III. Parties to the BTWC must transpose these prohibitions into their national legal system according to Article IV, so that they become enforceable against any natural or legal person within the borders of the state party or on any territory under its control. This obligation is generally poorly implemented, but the growing concerns of a terrorist attack involving biological agents have pressed states to improve their national legislation and regulations in order to prevent criminals and terrorists from acquiring or using biological materials and to criminalise activities related to the acquisition and use of such agents.

The BTWC contains some tools to deal with compliance concerns. Under Article V parties may consult and cooperate with each other to resolve an issue or may undertake to resolve the concern through appropriate international procedures within the framework of the United Nations and in accordance with its Charter. The 3rd Review Conference (1991) adopted a procedure to strengthen Article V, whereby bilateral or other consultations among the states involved in a dispute must precede the formal consultative meeting. The depositaries of the BTWC must convene such a formal consultative meeting within 60 days following the receipt of the request to hold such a meeting.[12] Any compliance concerns that cannot be resolved through consultation and cooperation may be referred to the UN Security Council, in accordance with the provisions of Article VI. In such a case, the BTWC parties are enjoined to cooperate with the Security Council during its investigation. The results of the investigation are to be conveyed to all BTWC parties. No party has ever lodged a complaint of a suspected violation of the BTWC with the UN Security Council.

Another cornerstone of the BTWC is Article X, which gives the parties the right to participate in the fullest possible exchange of equipment, materials, and scientific and technological information of relevance to the convention for peaceful purposes and encourages the parties to facilitate such exchanges. The article also orders States Parties to implement the BTWC in such a way

12. Final Document of the Third 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, Part II, Final Declaration, BTWC Third Review Conference document BWC/CONF.III/22, 27 September 1991, Article V. In 1997 Cuba invoked this mechanism following a claim that the United States had released an insect pest from a plane. The matter was closed following the presentation of the conclusions of the consultative meeting in December 1997, although it did not confirm Cuba's claim or fully exonerate the United States. Jean Pascal Zanders and John Hart, 'Chemical and biological weapon developments and arms control', *SIPRI Yearbook 1998: Armament, Disarmament and International Security* (Oxford: Oxford University Press, 1998), pp. 479-80; and Jean Pascal Zanders, Elisabeth M. French and Natalie Pauwels, 'Chemical and biological weapon developments and arms control', *SIPRI Yearbook 1999: Armament, Disarmament and International Security* (Oxford: Oxford University Press, 1999), p. 586.

that it avoids hampering the economic or technological development of other States Parties. The implementation of Article X has become more contentious as biotechnology plays an increasingly prominent role in economic and societal development but may also make it easier for a state to acquire an offensive biological warfare capability (e.g., in terms of a surge production capability for BW) or to engineer novel types of agents. The export controls imposed by a number of industrialised states to prevent BW proliferation are viewed by some developing countries as discriminatory and a violation of the obligation not to hamper their economic or technological development.

The 1993 Chemical Weapons Convention

The Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction opened for signature on 10-13 January 1993 and entered into force on 29 April 1997. The CWC established an international body, the Organisation for the Prohibition of Chemical Weapons (OPCW) in The Hague, to oversee treaty implementation. As of 20 October 2006, there are 180 States Parties and eight signatory states to the CWC. An additional nine states have neither signed nor ratified the convention.[13]

The CWC bans the acquisition, possession and use of toxins as well as mid-spectrum agents such as bioregulators and peptides for hostile purposes. The so-called 'general purpose criterion' (GPC) governs the core prohibition of the CWC, which means that all application of technologies that might contribute to the development and production of chemical weapons (CW) is banned unless it is for purposes not prohibited by the convention. The GPC thus covers any present or future toxin irrespective of the production method. One advantage of presently treating toxins under the CWC is the possibility of applying the convention's verification and compliance regime to cases of suspected or actual violations of the prohibition as well as allegations of use. However, this attraction to the intrinsic strengths of the CWC may harm the comprehensiveness of the BTWC. One non-prohibited purpose accepted under the CWC is 'law enforcement including domestic riot control purposes.'[14] A riot control agent is specified as being 'any chemical not listed in a Schedule, which can produce rapidly in humans sensory irritation or disabling physical effects which

13. On 28 June 2006 the UN General Assembly admitted Montenegro as a new member. The membership of the State Union Serbia and Montenegro in the United Nations, including all organs and organisations of the United Nations system, is continued by the Republic of Serbia on the basis of Article 60 of the Constitutional Charter of Serbia and Montenegro, activated by the Declaration of Independence adopted by the National Assembly of Montenegro on 3 June 2006. As a consequence, Montenegro has become an additional non-state party to both the BTWC and CWC.

14. Chemical Weapons Convention, Article II, para. 9 (d).

disappear within a short time following termination of exposure.'[15] The BTWC, in contrast, does not recognise law enforcement and riot control as legitimate purposes for agent development or production.[16]

It is likely that before long nanotechnology products will constitute another area of overlap for the biological and chemical weapons conventions, as the distinction between chemistry and biology becomes meaningless once one manipulates molecules or individual atoms in the development and manufacture of biochemically active agents. Its impact on both conventions will have to be carefully assessed.

Status of the norm against biological weapons

Status of the BTWC

The Geneva Protocol remains a principal source of the prohibition of BW use in armed conflicts, as the BTWC contains no explicit language to that effect. At the 4th Review Conference in 1996 the States Parties reaffirmed that 'the use by the States Parties, in any way and under any circumstances, of microbial or other biological agents or toxins, that is not consistent with prophylactic, protective or other peaceful purposes, is effectively a violation of Article I of the convention.'[17] Iran, whose attempt to have the title and Article I of the BTWC amended to reflect the language of the CWC led to the inclusion of the cited paragraph in the final document of the review conference, nevertheless remains unconvinced. Having experienced the lack of international condemnation of Iraq's initiation of chemical warfare in violation of its obligations under the Geneva Protocol, Iran maintains that the ban on use should be an integral part of the treaty text rather than a mere expansion of the understanding of the scope of Article I.[18]

The BTWC, like the CWC, achieves the comprehensiveness of its core prohibition by means of the GPC in Article I: no biological agent or toxin, irrespective of its production method, is to be acquired or retained unless justified for prophylactic, protective or other peaceful purposes. The positive formulation of 'other peaceful purposes' in the BTWC is open-ended and therefore difficult to apply objectively.[19] Through interpretation at review conferences, the international community agrees that the formula-

15. Chemical Weapons Convention, Article II, para. 7. The CWC categorises chemical compounds of particular concern in 3 schedules depending on their relative importance for the production of chemical warfare agents or for legitimate civilian manufacturing processes.

16. For example, on 26 October 2002 Russian elite forces preluded their storming of a Moscow theatre in which around 40 Chechen hostage takers had been holding some 700 people for three days with the introduction of a large volume of the opioid fentanyl or one of its derivatives, like carfentanyl. The subsequent discussion of the legality of the operation was mostly conducted with reference to the CWC. However, as a plant toxin, fentanyl also falls under the BTWC. Similarly, the legality of the widespread use of pepper spray by law enforcement forces across the world should be clarified under the BTWC.

17. 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, Document BWC/CONF.IV/9, Part II Final Declaration, p. 15.

18. See, for instance, Statement by H. E. Ali-Asghar Soltanieh, Ambassador of the Islamic Republic of Iran, at the Opening Plenary of the Fifth Review Conference of the Biological Weapons Convention, Geneva, 19 November 2001, p. 5. Document available at : http://www.opbw.org/rev_cons/5rc/docs/statements/5RC-OS-IRAN.pdf.

19. The phrase 'other peaceful purposes' is broad and potentially ambiguous. Particularly in the context of bio-defence programmes, certain activities – such as the open-air aerosolisation of pathogens to study their dissemination patterns in order to improve detectors, or research into modified microbial agents in order to test the adequacy of existing medicines against them or to develop new ones – test the limits of what is considered legitimate under the BTWC. The results can easily contribute to the preparations for offensive biological warfare. See chapter two, pp. 54-8.

tion does not include deterrence or defence with BW. Nevertheless, the GPC affords two major advantages. First, it enables the BTWC to deal with future discoveries and technological developments, as new potential warfare agents will be automatically banned if they have no justifiable non-military purpose. Thus the treaty covers not only existing, but also new or genetically-modified biological agents. Second, the GPC allows the international community to deal with dual-use commodities. Pathogens and toxins occur naturally and are therefore impossible to ban as such. Because the GPC makes it possible to distinguish between permitted and banned activities, it is not necessary to determine the intrinsic threat posed by a pathogen.[20]

The BTWC also exerts strong pressure on non-States Parties, as is evidenced by the lack of public admissions to BW holdings. The prohibitions also apply to legal and natural persons. Since States Parties must ensure that no prohibited activities take place on their territory, they are required to promulgate national legislation. In particular, criminal and penal law based on the Convention can be important tools to prevent and punish biological terrorism and the involvement of companies and individuals in the BW programmes of other states. Strong internal and external transfer controls will restrict access to relevant technologies to legitimate people, research institutes and companies only.[21] Despite its significance for the strength of the treaty regime, national implementation remains an undervalued tool in the efforts to counter the use of disease for hostile purposes.

Despite its all-encompassing scope, the BTWC is in urgent need of a verification and compliance regime: there have been some grave violations of the treaty (notably by the Soviet Union) and serious concerns have been voiced about the true purpose of certain types of research and development activities carried out under the banner of biodefence preparedness (such as the genetic manipulation of pathogens in order to assess future threats). A process to equip the BTWC with a legally binding protocol started in the early 1990s. The negotiations by an Ad Hoc Group of States Parties ended in failure in 2001, which, five years later, is still a source of considerable frustration and tension.[22]

The BTWC also requires sufficient flexibility to face the challenges of scientific and technological development and changes in the international security environment. The five-yearly review conferences are the principal instrument to update the conven-

20. In practice, the GPC poses a number of difficulties to implement, which leads to the adoption of lists (e.g., for export controls) of pathogens, as well as other types of equipment that might be used for weapon development. Such lists are based on an assessment of the risk that the technology poses to the objectives of the Convention.

21. A proposal based on the implementation of the GPC is formulated in Jean-Pascal Zanders, 'A Verification and Transparency Concept for Technology Transfers under the BTWC', Paper no. 26 (WMD Commission, Stockholm, 17 December 2004), 43p. Available at: http://www.wmdcommission.org/files/No26.pdf.

22. See chapter two, pp. 42-4.

tion. However, the failure of the 5th Review Conference in 2001-02 means that the scope of the prohibition has not been updated since the 4th Review Conference in 1996.[23] In order not to close the door completely on the BTWC, the States Parties agreed in 2002 on a series of annual meetings focussing on a limited number of specific topics until the 6th Review Conference in 2006.[24] While these meetings contributed little in terms of state party commitments or formal treaty development, they nonetheless drew attention to the individual obligations of States Parties (e.g., with regard to national implementation legislation) and the responsibilities of scientists and professionals regarding the prevention of the weaponisation of disease. At the time of writing the prospect of States Parties resuming negotiation of an instrument to strengthen the BTWC is poor, and it is not certain whether the 6th Review Conference will lead to a fresh series of annual meetings until the 7th Review Conference in 2011.

The investigative powers of the UN Secretary-General

Procedures to investigate compliance concerns – elementary as they might appear today – had been proposed during the negotiation of the BTWC. The UK working paper on microbiological warfare of 6 August 1968 considered the possibility of creating a competent body of experts, established under the auspices of the United Nations, to investigate allegations by a party to the Convention that another party had acted in violation of its obligations. All States Parties would have had to cooperate fully with any investigation, and failure to do so would have been reported to the UN Security Council.[25] The revised UK draft convention of 18 August 1970 identified the UN Secretary-General and his authorised representatives as the competent body to carry out investigations. A separate UN Security Council resolution would have described the Secretary-General's competences and the Security Council's responsibilities if the Secretary-General's report concludes that a complaint is well-founded.[26]

The proposal to have a separate resolution is noteworthy: while under the terms of Article III of the draft convention only parties to the convention could lodge a complaint with the UN Secretary-General, the resolution would have required the cooperation of all UN Members and specialised agencies. In contrast, the draft conventions submitted by the Socialist countries in October 1970 and

23. Some people argue that the norm has not been updated since the 3rd Review Conference in 1991, because of the preoccupation with the Ad Hoc Group in 1996.

24. The inter-sessional meetings consisted of a meeting of experts halfway through the year and a meeting of the States Parties at the end of the year. The agreed topics were: (i) national measures to implement the prohibitions in the Convention, including penal legislation (2003); (ii) national mechanisms to establish and maintain the security and oversight of pathogenic microorganisms and toxins (2003); (iii) enhancing international capabilities to respond to, investigate and mitigate the effects of alleged use or suspicious outbreaks (2004); (iv) strengthening efforts for the surveillance, detection, diagnosis and combatting of infectious disease (2004); and (v) content, promulgation, and adoption of codes of conduct for scientists (2005). UN Department of Disarmament Affairs, Draft Decision of the Fifth Review Conference of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) Weapons and on Their Destruction, BWC/CONF. V/CRP.3, 6 November 2002.

25. The UK working paper is reproduced in Stockholm International Peace Research Institute, *The Problem of Chemical and Biological Warfare, Volume IV: CB Disarmament Negotiations 1920-1970* (Stockholm: Almqvist & Wiksell, 1971), pp. 255-57.

26. Revised UK draft convention for the prohibition of biological methods of warfare and accompanying draft Security Council resolution, Disarmament Conference document CCD/225/Rev. 2, 18 August 1970, as reproduced in *The Problem of Chemical and Biological Warfare, Volume IV*, op. cit., pp. 322-25.

April 1971 identified the Security Council as the competent body to receive complaints and carry out investigations.[27] This procedure is the one ultimately retained in Article VI of the BTWC. It has three characteristics: (1) the formulation preserves the right of the Permanent Members of the Security Council to veto an investigation request; (2) it does not differentiate between between allegations of use and complaints about other types of treaty violation; and (3) both the complaints procedure and obligation to cooperate with the subsequent investigation is limited to BTWC States Parties only.

In 1980 the United States began to launch a series of serious allegations of Soviet violations of the BTWC, which included the operation of an illicit offensive BW programme following a major anthrax outbreak near Sverdlovsk (now Ekaterinburg) in 1979, use of chemical and biological agents in Afghanistan, and the transfer of trichothecene mycotoxins to Vietnam, which was accused of using them against the Hmong tribes in Laos (the so-called Yellow Rain allegations). The inability of the BTWC to enforce compliance and deal with (allegations of) serious breaches had thus been demonstrated by the time of the 1st Review Conference.

Under Article 99 of the UN Charter the Secretary-General has the authority to 'bring to the attention of the Security Council any matter which in his opinion may threaten the maintenance of international peace and security'.[28] To this end, he can investigate the causes of this concern. The US allegations against the Soviet Union in 1980 and Iraq's use of chemical weapons in the 1980-88 war with Iran prompted the development of the fact-finding mechanism. A first General Assembly resolution in December 1980 requested the Secretary-General to conduct a fact-finding mission in Afghanistan and Southeast Asia.[29] A similar resolution adopted two years later instructed the Secretary-General to investigate violations of the Geneva Protocol and relevant customary law and report the results of any such investigation to all UN members and the General Assembly. It also called on the Secretary-General to set up and maintain a list of qualified experts who could participate in such investigations.[30] A Group of Consultant Experts subsequently drafted criteria to launch an investigation and detailed procedures to carry it out. In 1984, 1986 and 1988 three such missions were undertaken in response to allegations of Iraq's CW use against Iran. The General Assembly, followed by the

27. Revised draft convention on the prohibition of the development, production and stockpiling of chemical and bacteriological (biological) weapons and on the destruction of such weapons, submitted by Bulgaria, Byelorussian SSR, Czechoslovakia, Hungary, Mongolia, Poland, Romania, Ukrainian SSR and the USSR, UN document A/8136, 23 October 1970; and Draft convention on the prohibition of the development, production and stockpiling of bacteriological (biological) weapons and toxins and on their destruction, submitted by Bulgaria, Byelorussian SSR, Czechoslovakia, Hungary, Mongolia, Poland, Romania, Ukrainian SSR, and the USSR, Disarmament Conference document CCD/325/Rev. 1, 15 April 1971. Documents reproduced in *The Problem of Chemical and Biological Warfare, Volume IV*, op. cit., pp. 326-30 and 331-5.

28. Charter of the United Nations, Chapter XV, Article 99.

29. UN General Assembly Resolution 35/144 C, 12 December 1980.

30. UN General Assembly Resolution 37/98 D, 13 December 1982.

Security Council, next authorised the Secretary-General to launch an investigation at his own initiative. Previously he had to wait for a request from a UN member.[31] After 1988 only a few more such investigations were conducted, and none have been undertaken since 1992, the year in which the negotiation of the CWC was finalised.

The mechanism and the procedures to investigate allegations of chemical and biological use are presently far more elaborate that the British proposals of 1968 and 1970. Nevertheless the outcomes of the investigations have not been fully satisfactory. In several cases, the results were inconclusive.[32] In other cases, too much time had lapsed before the investigation could be executed resulting in the inability to collect samples of chemical or biological warfare agents. Finally, investigator access to the scene of chemical or biological warfare depended on the authorisation from the government on whose territory the attack had taken place. This prevented, for example, the investigation of the CW attacks in Halabja, which, although under Iranian control at the time, remained Iraqi territory. It was similarly impossible to investigate the chemical attacks against Kurds inside Iraq during the summer of 1988. With regard to CW, the Secretary-General's mechanism has meanwhile been overtaken by the CWC provisions on the investigations of alleged use. Nevertheless, it retains residual relevance for cases involving states not party to the CWC.

As Article VI of the BTWC proved unsatisfactory to address allegations of BW use an attempt was made during the late 1990s to develop investigative tools similar to the ones in the CWC. However, in 2001 the Ad Hoc Group failed in its mission to conclude a legally binding protocol to the BTWC, which left the UN Secretary-General's mechanism as the only available investigative tool. Some ideas to bring it under Article VI of the BTWC were later floated. However, States Parties to the BTWC were reluctant to take them up because of the different conditions and considerations to initiate an investigation under the BTWC and the UN Secretary-General's mandate as well as the broader scope of the latter instrument as determined by both the UN General Assembly and Security Council.

One final tool to investigate BW allegations is UNMOVIC.[33] It replaced the UN Special Commission (UNSCOM), which had been created in 1991 to oversee among other things the destruction of Iraq's CBW holdings and termination of its CBW pro-

31. UN General Assembly Resolution 42/37 C, 30 November 1987 and UN Security Council Resolution 620 (1988), 26 August 1988.

32. Similar frustration exists with regard to the application of Article V of the BTWC. See footnote 12.

33. UN Security Council Resolution 1284 (1999), 17 December 1999.

grammes. Although its inspectors no longer have access to Iraqi territory after the US invasion of Iraq in 2003, it continues with the mandate to verify Iraq's compliance with its disarmament obligations and operate a system of ongoing monitoring and verification. UNMOVIC's future is uncertain. Despite the limited number of field operations conducted by this ad hoc body between the end of 2002 and early 2003, the assimilation of the UNSCOM experience, the preparations for its tasks and its pool of national experts appear to make it a robust asset to investigate violations of the norm against BW. UNMOVIC's mandate covers onsite inspections, destruction of proscribed weapons, and the monitoring of so-called dual-use activities, including investigations of procurement of dual-use goods and the running of an export-import control mechanism in support of the sanctions against Iraq.[34] Although this mandate is much broader than the UN Secretary-General's authority to investigate allegations of CBW use, its application is limited to a single country. Once more, no obvious way exists to integrate it with other existing tools in support of the norm against BW in general and the BTWC goals in particular.

UN Security Council Resolution 1540

On 28 April 2004 the UN Security Council adopted Resolution 1540 under Chapter VII of the UN Charter, which aims to prevent non-state actors from acquiring unconventional weapons, related materials and means of delivery.[35] To this end, all UN member states are required to adopt and enforce laws as well as other measures of domestic control. The resolution has its origins in the declaration issued by the UN Security Council meeting at the level of Heads of State on 31 January 1992, which declared in the wake of the first Gulf War that 'the proliferation of all weapons of mass destruction constitutes a threat to international peace and security'.[36] Resolution 1540 also forms part of a series of resolutions on terrorism adopted by the UN Security Council after the terrorist attacks against the United States in 2001.

With regard to biological weapons, UNSC Resolution 1540 basically follows the obligation of Article IV of the BTWC (although the actual language used refers to all categories of non-conventional weapons).[37] It should be noted that through the reference to 'any recipient whatsoever' in Article III, the BTWC

34. Barbara H. Rosenberg, 'Enforcing WMD treaties: Consolidating a UN role', *Disarmament Diplomacy*, no. 75, January/February 2004; available at: http://www.acronym.org.uk/dd/dd75/75bhr.htm.

35. UN Security Council Resolution 1540 (2004), 28 April 2004.

36. Note by the President of the Security Council, UN Security Council Document S/23500, 31 January 1992.

37. In addition, none of the obligations in the resolution can be interpreted in such a way that they conflict with or alter the rights and obligations of State Parties to the Nuclear Non-Proliferation Treaty, CWC and BTWC or alter the responsibilities of the International Atomic Energy Agency or the OPCW. UN Security Council Resolution 1540 (2004), para. 5.

already addressed the threat of non-states actors acquiring BW. The resolution, however, moves beyond the 'weapon' (biological agent and delivery means) and also covers the dual-use technologies required for weapon development and production. Moreover, it requires states to develop and maintain appropriate effective physical protection measures and a range of laws, regulations and other measures to effectively control international and domestic transfers of BW and related materials. UN Members must report the status of their laws and regulations to the 1540 Committee, which was established under the terms of the resolution, and can also submit requests for assistance in order to meet their obligations.[38]

As a security tool, Resolution 1540 has come in for a degree of criticism, not least because many of the paragraphs are open to interpretation and the text does not offer any standards for measuring effectiveness of the laws and regulations.[39] Notwithstanding, it reinforces a trend after the 2001 terrorist attacks where the strength of international norms depends not just on the number of states adhering to a treaty, but also on them actively applying and enforcing the treaty obligations. The state of national implementation of the BTWC has always been poor. The first meetings of experts and the States Parties after the failed 5th Review conference in 2003 dealt extensively with this question. Viewed from the BTWC, Resolution 1540 is an important promotional tool: given its mandatory nature, no State Party to the BTWC can any longer make excuses for the lack of national implementation legislation. With regard to the norm against the weaponisation of disease, Resolution 1540 extends the core prohibitions in Articles I to III of the BTWC to all members of the United nations, irrespective of whether they are party to the convention or not.

Challenges to the regime

Despite the strength of the norm, the BTWC remains an intrinsically weak legal instrument. It lacks substantive mechanisms to monitor and enforce compliance. Moreover, the absence of an institutional setup to oversee the treaty's implementation denies the States Parties an important tool to generate transparency and acquire confidence in the compliance with the treaty's provisions by other States Parties. It is also responsible for the poor level of

38. In April 2006, the two-year mandate of the 1540 Committee was extended until 2008 in order to achieve the original goals set forth in Resolution 1540. UN Security Council Resolution 1673 (2006), 17 April 2006.

39. For an overview of the different types of criticism, see Ben Steyn, 'Understanding the implications of UN Security Council Resolution 1540', *African Security Review*, vol. 14, no. 1, 2005, pp. 85-91; available at: http://www.iss.co.za/pubs/ASR/14No1/steyn.pdf.

national implementation, the low annual CBM returns,[40] and the lack of a coordinated programme to meet the obligations and expectations under Article X. This deficiency also impacts on the degree of universality. The CWC has attracted 180 States Parties over nine years, whereas only 155 states became party to the BTWC since its entry into force in 1975. The lack of institutionally organised outreach activities explains the low awareness of the treaty and its opportunities among non-States Parties (many states had not yet achieved independence in the mid-1970s, which contributes to their ignorance about the convention).

The international community has always been conscious of the BTWC's shortcomings. The first successful experiments with recombinant DNA coincided with the opening for signature of the BTWC in 1972 and raised immediate concerns that the new technology might lead to novel, militarily more useful pathogens. By the 1st Review Conference in 1980 the anthrax outbreak near Sverdlovsk and the allegations of biological warfare in Afghanistan and Southeast Asia demonstrated the terrible inadequacy of the treaty's verification, conflict resolution and compliance enforcement provisions. By turning the review into a quinquennial event, the States Parties have been able, besides appraising the convention's status and implementation over the previous five years, to develop a clear forward-looking dimension that aims to keep the treaty relevant in the light of political and scientific developments, on the one hand, and to incrementally address its intrinsic weaknesses, on the other hand. The latter group of activities have brought forth enhanced consultation procedures, the CBMs, concrete ideas for verification, and even the negotiation of a full supplementary protocol that would have upgraded the BTWC to CWC standards.

However, a disarmament treaty does not operate in a vacuum. In its lifetime the BTWC witnessed the end of the Cold War; the redistribution of global power with the United States becoming the dominant political, economic and military actor and the rise of the relevance of regional security interactions; the emergence of new transnational security actors such as terrorists and criminals; the rise of biotechnology as a major engine of economic and social development; and so on. Each of these changes in the international system have had a profound impact on the perception of the utility of the BTWC as a security instrument and, as a consequence, of the best way to amend its shortcomings.

40. See chapter two, pp. 44-50.

These different – and perhaps widening – perceptions and expectations impacted on the efforts to strengthen the BTWC. Following the conclusion of the negotiation of the CWC in 1992, there was a rapid succession of activities that led to the identification of possible verification measures by a gathering of governmental experts (VEREX) and the creation of the Ad Hoc Group to further explore these proposals and then to negotiate a legally binding document to supplement the treaty. The hopes for a reinforced treaty regime were dashed spectacularly in the summer of 2001 after the US declaration that it could not accept the draft protocol text and its effort to terminate the Ad Hoc Group mandate in the final hours of the 5th Review Conference in December (leading to an adjournment of the meeting for one year).

While several NAM members were equally responsible for procrastination in the Ad Hoc Group, the administration of the newly elected US president, George W. Bush, approached the BTWC as well as other bilateral and multilateral security treaties with profound ideological scepticism regarding their utility to US security. The members of the Bush Administration saw their world outlook confirmed by Russia's admission to a major illegal BW programme in the early 1990s, the embarrassing outcome of the Trilateral process between the Russian Federation, the United States and the United Kingdom,[41] and the inability of UNSCOM to close the file on Iraq's BW programme despite the inspectors' unprecedented access to installations in the country. The world view was further reinforced by the terrorist strikes against New York and Washington on 11 September 2001 and the deliberate release of (what was then described as) high-quality anthrax spores via the US postal system,[42] which killed five people and infected another seventeen. These events reinforced the conviction that the United States could only rely on itself for its security interests and further reduced any interest in cooperative security. Among other things, the United States set up the huge Homeland Defence project and undertook several measures to protect itself against biological attack, including the establishment of large stockpiles of drugs and vaccines against threat agents.[43] The fear of the US pharmaceutical and biotechnology industries that the proposed protocol as formulated during the late 1990s would expose them to the risk of loss of confidential business and propriety information further underpinned the Bush administration's opposition to the draft document. After the terrorist

41. Following Russia's admission to the covert Soviet BW programme, the Trilateral process involving onsite visits by experts was set up to lift the secrecy surrounding Soviet activities. As part of the political deal, the Russians were also authorised to visit installations in the United Kingdom and the United States. Not finding any evidence of a BW programme during a visit to the US, the Russians demanded and eventually received access to a commercial pharmaceutical plant, but upon their return to Moscow they claimed that they had found evidence that the plant was engaged in illicit BW activities. The incident greatly influenced industry positions with regard to a BTWC inspection regime. David C. Kelly, 'The Trilateral Agreement: lessons for biological weapons verification', in Trevor Findlay and Oliver Meier (eds.), *Verification Yearbook 2002* (London: VERTIC, 2002), pp. 92-109.

42. In August 2006 an article by a senior FBI scientist discounted earlier claims by US government officials and scientists that the anthrax spores had been specially treated to maximise their dispersion potential. Douglas J. Beecher, 'Forensic application of microbial culture analysis to identify mail intentionally contaminated with *Bacillus anthracis* spores', *Applied and Environmental Microbiology*, vol. 72, no. 8, August 2006, pp. 5304-10. There is a possibility that later in 2006 a Congressional Committee will investigate why US officials did not revoke the earlier claim of sophisticated preparation any earlier.

43. The total federal funding of BW prevention and defence has risen from US$ 1.624 billion in Fiscal Year 2001 to a requested US$ 8.017 billion in Fiscal Year 2007. 'Federal Funding for Biological Weapons Prevention and Defense', Fiscal Years 2001 to 2007', report released by the Center for Arms Control and Non-proliferation, Biological and Chemical Weapons Control Program, Washington D.C., August 2006, p. 2.

attacks, pharmaceutical and biotechnology companies became a major strategic asset in the biodefence programmes, which strengthened the resistance to international verification even further.

Certain components of the US response to the new threat environment have proved very contentious. The invasion of Iraq based on false assumptions of the presence of an unconventional weapons capability and linkages between the Ba'ath regime and the Al Qaeda attacks on the USA has become the cause of troubled relations between Washington and many of its traditional allies, notably in Europe. As part of preparedness programmes against BW, the USA has also expanded its biodefence programmes. Certain programme components are fully classified, and not even reported under the relevant CBM. It has also placed emphasis on the so-called 'science-based threat assessment', which involves the study and laboratory development of offensive biological agents (including genetically-engineered ones) in order to develop detection technology, new medication and prophylaxis, and risks further blurring the distinction between biodefence programmes permitted under the BTWC and prohibited offensive BW activities.[44] Even if those activities are fully legitimate under the BTWC, the lack of transparency and communication about purpose might convince other states of their malicious intent, and lead them to set up similar quasi-offensive programmes, justifying their activities with reference to the US precedent.[45]

The connection between disarmament and development is another source of tension permanently present in the efforts to strengthen the BTWC. During the 1970s and the 1980s the issue remained suppressed, but in the 1990s it caused increasing polarisation between the developed and developing world. With regard to BW there was a marked shift from disarmament to non-proliferation. The origin of the shift was the large-scale CW use in the Iraq-Iran war and the foreign involvement in Iraq's weapon development. With the negotiations of the CWC still a long way from being concluded, the Western industrialised powers set up the Australia Group in an effort to prevent chemical precursors from reaching Iraq and Iran.[46] The chemical control list gradually expanded, and after the war new control lists for biological agents and equipment were adopted. To the industrialised states the shift was uncontroversial, perhaps even natural: since there are no BW to destroy, security policies should aim to

44. Details of several so-called black programmes that lack any Congressional oversight were revealed in September 2001. See Judith Miller, Stephen Engelberg and William Broad, *Germs: Biological Weapons and America's Secret War* (New York: Simon & Schuster, 2001), pp. 287-89. In July 2006, details of a major highly classified biodefence research facility planned at Fort Detrick in Maryland that will run black programmes were revealed. Joby Warrick, 'The Secretive Fight Against Bioterror', *Washington Post*, 30 July 2006, p. A01.

45. See chapter two.

46. For more information on the structure and policies of the Australia Group, see: http://www.australiagroup.net.

prevent technologies that may contribute to BW development and production fall in the hands of certain state and non-state actors.

Non-proliferation policies are a requirement under Article III of the BTWC; legislative or regulatory measures to implement these policies are required under Article IV. The concrete measures, however, are not developed within the treaty framework. The Australia Group is an informal coalition of select states that coordinate technology export control measures and standards among themselves. It is exclusive, as new members have to be invited in.[47] This opaque decision-making and exclusivity generate suspicion about the true intentions among the non-participants, who are often developing countries. Developing countries have viewed the emphasis on export controls as yet another attempt by the industrialised world to preserve their economic dominance and technological edge at their expense. The globalising economy, and the growing importance of biology and biotechnology for economic and societal development, have reinforced their demands for access to technology.

The introduction of a development dimension into arms control and disarmament treaties goes back to the 1960s. As more peoples acquired their independence, developing countries became an increasingly powerful caucus in disarmament negotiations, and in multilateral UN forums in general. This empowered them to adopt positions independent from the interests of either the Soviet Union or the United States and their respective allies. They linked arms control and disarmament to development, an issue that acquired prominence during the negotiation and early implementation of the 1968 Nuclear Non-Proliferation Treaty (NPT). The linkage was accommodated in Article X of the BTWC, but it was initially not developed much further. Besides superpower priorities during the Cold War, the long intervals between BTWC review conferences caused a significant lag between the formulation of concrete ideas (for instance, arising from the concept of the New International Economic Order)[48] and their emergence at the next review conference.[49]

The tension over the implementation of Articles III and X intensified during the early 1990s. The end of the Cold War and expectations of a large peace dividend resulting from the reduced need for costly weapon systems opened prospects for greater multilateral cooperation and development assistance. The creation of

47. Similar export control coalitions exist for other types of weaponry too, such as the Nuclear Suppliers Group, the Missile Technology Control Regime and the Wassenaar Arrangement (for conventional weaponry).

48. The UN General Assembly adopted the 'Declaration of Principles' and the 'Programme of Action' in support of the NIEO on 2 May 1974.

49. Nicholas A. Sims, *The Evolution of Biological Disarmament*, SIPRI Chemical & Biological Warfare Studies no. 19 (Oxford: Oxford University Press, 2001), pp. 120-4.

the Preparatory Commission on national preparedness (including biodefence programmes) may thus perpetuate some of the divisions and suspicions among the global community. The creation of the Preparatory Commission (PrepCom) of the OPCW with the opening for signature of the CWC in January 1993 and the increasingly frequent meetings of the States Parties to the BTWC (VEREX, Ad Hoc group) gave permanency to the debate. In addition, the discussions on Article XI of the CWC (which has similar objectives to Article X of the BTWC) in The Hague reverberated in Geneva, and vice versa. The net outcome was a growing polarisation between Western states and NAM members over the role and impact of export controls, and in particular of the Australia Group.[50] In the Ad Hoc Group, NAM countries in general wanted to have transfers regulated by the proposed OPBW. China refused any transfer restrictions for peaceful purposes among States Parties. In its view, the Protocol ought to be the sole legal foundation for transfer controls, and it proposed that following the protocol's entry into force a licensing system could be developed, which would then be implemented nationally. The Western states did not wish to discuss existing export control mechanisms or their phasing out. Towards the end of the Ad Hoc Group negotiations some progress was being made with regard to possible areas of technical cooperation for peaceful purposes. The Western states, which viewed the BTWC as a security treaty, had limited interest in Article X until September 1998, when they accepted the importance of all aspects of the BTWC. In January 1999 the NAM states proposed the establishment of a Cooperation Committee to oversee implementation of Article X of the BTWC.[51] It would take a full year before the Western states were able to agree to a concept for this body, but their initial opposition to the idea gradually waned so that the issue of technical cooperation disappeared as a point of contention.[52]

As a consequence of the failure of the Ad Hoc group negotiations, the idea of a Cooperation Committee has all but disappeared. Meanwhile, during the 2003-05 intersessional process, areas for concrete elaboration of cooperation under Article X were identified (notably, in the fields of disease surveillance and detection, bio-security and safety, and so on), so that it is possible that specific programmes implementing the article will be initiated after the 6th Review Conference.

50. Jean Pascal Zanders, 'Technology Transfers and Export Controls Under the CWC', OPCW Synthesis (April 2001), pp. 16-17, available at: http://www.opcw.org/synthesis/html/s5/zanderspg16_17finalprt.html.

51. Working paper submitted by the Group of NAM and Other Countries – Establishment of a Cooperation Committee, BWC/AD HOC GROUP/WP.349

52. Areas for scientific and technological exchange for peaceful purposes and technical cooperation that were explored during the Ad Hoc Group negotiations included the publication, exchange and dissemination of information on conferences, training programmes, research and development relating to biotechnology, and Good Laboratory Practice and Good Manufacturing Practice. Transparency would also have been promoted with regard to the work of certain laboratories (e.g., those working on disease prevention and surveillance). Finally, States Parties to the protocol could assist other parties with the improvement of their laboratory capabilities.

Conclusion

Despite the statement of the formal goal in Article XII of the BTWC, the review conference process represents much more than a periodic check on the health of the convention or an assessment of scientific and technological challenges to the norm against the weaponisation of disease. Taken together, the review conferences have been a laboratory for experimentation in methods to build trust, generate transparency, and, ultimately, offer security to States Parties. The States Parties devised CBMs to promote transparency regarding certain treaty-relevant activities, and they are trying to expand their scope and relevance. At review conferences they also laid the foundations to investigate and negotiate options for a comprehensive compliance and verification regime, but these efforts failed in 2001. A new process of annual expert and state party meetings was subsequently adopted to overcome the acrimony and bitterness, which ultimately proved a useful exercise focussing on the responsibilities of individual States Parties and their citizens to prevent the hostile application of disease. The 6th Review Conference will ultimately judge the political value of this new process, decide on the integration of its outcomes into the BTWC regime, and determine the value of continuing to meet annually to improve the implementation mechanisms of the convention.

While these activities demonstrate that the BTWC is an active treaty and the central norm retains its validity, the limited progress on strengthening the convention over more than three decades also allowed a lot of frustration and animosity to build up. The long gap between review conferences means that there will always be significant time lapses between the emergence of new ideas and the time by which the States Parties can take them up. The diplomatic process is invariably slower than the issues they need to address. Even if there is quasi-permanent diplomatic activity, the meetings can only deal with limited, pre-agreed topics.

The creation of a fully-fledged international organisation to support the implementation of all aspects of the BTWC offers the best prospect of keeping pace with scientific and technological progress, changing patterns in the global economy, development and trade, and shifts in threat perceptions and distribution of power. Such a goal, however, is not on the agenda of the 6th Review

Conference. The 6th Review Conference will be judged a success if the States Parties are able to preserve the relevance of the core norm against the weaponisation of disease despite a rapidly changing economic and security context and adopt a work agenda that will lay the foundation for substantive progress at the 7th Review Conference in 2011.

Verification of the BTWC: Seeking the impossible or impossible to seek?

Jean Pascal Zanders

2

Introduction

The League of Nations met between 4 May and 17 June 1925 to discuss the supervision of the arms trade. During the meeting the United States suggested a prohibition on the transfer of chemical weapons, which eventually lead to the adaption of the 1925 Geneva Protocol for the Prohibition of Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare.[1] During the discussions of the initial US proposal the delegates came across some of the core issues with regard to chemical agents that today still challenge the feasibility of a verification regime for the non-development and production of biological weapons (BW): the dual-use characteristics of the agents, confidence in the ability to detect violations and the right to protect oneself in case of a threat or an attack.

The requirement 'to define, if possible, the characteristics of gases and chemicals which cannot be utilised in war, or of those which can be utilised both for warlike and non-warlike purposes' was identified immediately.[2] The issue was investigated in detail, but it proved impossible to overcome the problems posed by dual-use technologies. As expressed by the French military representative, 'all products used in chemical warfare were merely part of the economic necessities of a country.'[3] Today, biology and biotechnology support societal development very much in the same way chemistry did in the 1920s.

Biological weapons are unique in the sense that the key ingredient required for the weapon (i.e., the pathogen) is identical to the one used to research and develop the medical protection and defence against its effects. In 1925, the delegates faced a similar dilemma. The Hungarian representative proposed as a practical and effective step to render chemical weapons ineffective to make public:

1. Jean Pascal Zanders, 'The CWC in the context of the 1925 Geneva debates', *Nonproliferation Review*, vol. 3, no. 3, Spring/Summer 1996, pp. 38-45.

2. Proceedings of the Conference for the Supervision of the International Trade in Arms and Ammunition and in Implements of War, held at Geneva, 4 May to 17 June, 1925, League of Nations, Document A. 13. 1925. IX, September 1925, p. 156.

3. Ibid., p. 540.

> all discoveries concerning the methods of defence against this warfare and of making these methods accessible to everyone, even non-combatants in all countries of the world. No one would continue to use a weapon against which his adversary possessed effective means of defending himself. The real danger for a nation was to go to sleep peacefully trusting to an international undertaking and to awake finding itself defenceless.[4]

He furthermore clarified that his proposal only concerned means of personal defence, like gas masks, and not the defensive use of gas. (He was to withdraw his proposal in the face of the argument that the regulation of the methods of defence might be construed as admitting to the possibility of chemical warfare, which, in turn, would undermine the moral and effective scope of the prohibition under consideration.) The question of transparency of chemical weapon defence programmes would not be resolved until the conclusion of the negotiation of the 1993 Chemical Weapons Convention. In the field of BW the issue was encountered during the negotiation of the 1972 Biological and Toxin Weapons Convention (BTWC). States Parties have tried to clarify the meaning of a defensive programme at review conferences, but with the exception of a confidence-building measure (CBM) there is no need to report on BW defence activities and there is no international organisation to oversee whether all such activities are fully consistent with the prohibitions in the BTWC. Particularly with the rise of the fear of terrorist attacks using biological agents there has been a tendency to increase the scope and intensity of biodefence programmes and to shroud them in more layers of secrecy. Suspicion about the true purpose of such activities could seriously erode the BTWC.

Because of the ever-increasing relevance of biology and biotechnology to societal and economic development, the growing fears of biological attacks as well as of emerging and reemerging diseases, and the difficulties in distinguishing legitimate from illicit research and development activities, the need for a transparency-enhancing regime for the BTWC is more than ever necessary. However, while the technical challenges to set up such a regime are formidable, there is still a lot of political resistance to its desirability in general and to certain specific tools in particular.

This chapter first outlines the attempts to make the BTWC verifiable and the reasons why they failed. An alternative in the form

4. Ibid., p. 530.

of CBMs was adopted, but, as discussed in the second section, their scope and the level of participation is so limited that there are serious doubts about their relevance. The third section analyses the impact of the absence of an international organisation on the development of the BTWC, while the fourth looks into the challenge to the convention posed by biodefence programmes. The final section discusses those issues in the light of the 6th Review Conference.

On the origin of a lasting frustration

Ever since governments began considering a formal ban on BW development and possession, verification was seen as an almost insurmountable obstacle. The BTWC's conceptual roots have been traced back to the Modified Brussels Treaty of 1954, which invited Germany to join the Western European Union on the condition that it would not acquire atomic, biological or chemical weapons.[5] An Agency for the Control of Armaments (ACA) was established, whose task it was (among other things) to ensure Germany's compliance. To this end, its inspectors were authorised to carry out 'test checks, visits and inspections at production plants, depots and forces (other than depots or forces under NATO authority).'[6] The ACA was to focus its attention 'to the production of end-items and components (...) and not to processes'. Furthermore, it was to 'ensure that materials and products destined for civilian use are excluded from its operations'.[7] However, with respect to BW, it was noted 13 years later that the provisions had not been activated because the Council of the Western European Union had thus far not been able to reach agreement on detailed regulations for their control.[8] The dual-use characteristics of the technologies that need to be controlled under a BW ban also affected early British thinking on an international treaty. In 1964 the United Kingdom recognised that effective verification might possibly be an unachievable goal as a consequence of the application of chemical and biological agents in medicine, veterinary medicine and agriculture. This was initially not viewed as an obstacle to the goal of a disarmament treaty.[9]

In 1968 the international community began to consider a global ban on the acquisition and possession of BW in earnest. Biological weapons had not been used as a regular instrument, but

5. Declaration Inviting Italy and the Federal Republic of Germany to Accede to the Brussels Treaty, 23 October 1954; and Protocol No. III on the Control of Armaments, 23 October 1954 (including annexes). Documents available from the West European Union at: http://www.weu.int.

6. Protocol No. IV on the Agency of Western European Union for the Control of Armaments, 23 October 1954, Article 7. Document available from the West European Union at: http://www.weu.int.

7. Protocol No. IV on the Agency of Western European Union for the Control of Armaments, 23 October 1954, Article 10. Document available from the West European Union at: http://www.weu.int.

8. Confidential communication, E. J. W. Barnes to Lord Hood, 'Western European Union: Control of Biological Weapons,' 23 November 1967, as cited in Marie-Isabelle Chevrier, 'The politics of biological disarmament', in Mark Wheelis, Lajos Rózsa and Malcolm Dando (eds.), *Deadly Cultures. Biological Weapons Since 1945* (Cambridge, MA: Harvard University Press, 2006), p. 307.

9. Ibid, p. 308.

preparations for biological warfare and the acquisition and possession of BW were not proscribed under international law. In a working paper submitted to the Eighteen-Nation Disarmament Committee (ENDC) the United Kingdom therefore argued that research work that might be used toward the production of microbial agents for weapons purposes should be 'open to international investigation and, if so required, should also be open to public scrutiny to the maximum extent compatible with national security and the protection of industrial and commercial processes'.[10] With regard to verification, the document stated:

> In the knowledge that strict processes of verification are not possible, it is suggested that consideration might be given *inter alia* to the possibility that a competent body of experts, established under the auspices of the United Nations, might investigate allegations made by a party to the Convention which appeared to establish a *prima facie* case that another party had acted in breach of the obligations established in the Convention. The Convention would contain a provision by which parties would undertake to co-operate fully in any investigation and any failure to comply with this or any of the other obligations imposed by the Convention would be reported to the Security Council.[11]

Reactions to the UK proposal were varied, primarily because some states feared an undermining of the Geneva Protocol. Sweden shared the UK's view that perfect control over the production and possession of CBW was impossible. It nevertheless suggested a range of possible measures that included *inter alia* a system of periodic reporting, the gradual adoption of 'verification-by-challenge' and a system of onsite inspections that could serve as a departure point for further investigations by inspectors.[12]

On 10 July 1969 the UK submitted a draft convention banning BW. Article III dealt with two aspects of a verification regime. If a state party were to believe it was the victim of biological warfare, it would have had the right to lodge a complaint with the UN Secretary-General, submitting all evidence at its disposal, and to request that the complaint be investigated and a report on the result of the investigation be submitted to the Security Council. In the case where a state party were to believe that another state party has acted in breach of its treaty obligations, then it would have had the right to lodge a complaint with the Security Council and

10. UK Working Paper on Microbiological Warfare, Disarmament Conference document ENDC/231 (6 August 1968), para. 7.

11. Ibid., para. 8.

12. Stockholm International Peace Research Institute (SIPRI), *The Problem of Chemical and Biological Warfare, Vol. 4: CB Disarmament Negotiations 1920-1970* (Stockholm: Almqvist & Wiksell, 1971), pp. 259-60.

request that the complaint be investigated. The wording reflected the vision that there was a need for a deterrent against violations of the treaty provisions and that then existing methods of verification in arms control were of little value with regard to BW. The ensuing discussion about verification and enforcement was influenced by several contextual factors, such as the ideological differences of the Cold War era, the limitations of existing verification technologies (e.g., satellite surveillance and remote sensing) to verify a BW ban, and the fact that most states were not yet ready to accept foreign inspectors in their laboratories, factories or military installations. These opinions, however, do not appear to have been rooted in a belief that a convention banning the acquisition and possession of BW is inherently unverifiable.

Despite widespread scepticism, the British draft convention led to the tentative formulation of several ideas dealing with aspects of a possible verification regime.[13] In the spring of 1971 the Soviet Union and the United States reached consensus on a draft convention, which enabled the speedy conclusion of the negotiation. However, they had dropped the verification proposals.

The issue of verification before the 3rd Review Conference

At the conclusion of the negotiation of the BTWC, a number of states criticised the dropping of mechanisms to control treaty compliance. For a few states like France or Sweden this disappointment was such that they considerably delayed the signing of ratification of the BTWC. The issue was not to go away. Persistent allegations about illicit BW programmes and the use of biological agents in conflicts in Asia during the late 1970s and throughout the 1980s pushed compliance verification and enforcement to the top of the agenda of the States Parties. In 1991 – the year of the 3rd Review Conference – no state doubted the value of a verification system for the BTWC.

By that time, however, the debate had shifted to whether verification in the biological area was at all technically feasible. Almost all the countries whose representatives spoke during the opening plenary session of the 3rd Review Conference demanded concrete measures to strengthen the treaty and verification measures in particular. At the same time, almost all of the states also described verification of the BTWC as difficult or even impossible. Views on

13. An extensive summary of the ideas and reactions is available in ibid., pp. 293-310. The debate was further complicated by the insistence by many states on framing the ban on chemical and biological weapons in a single treaty. In particular, the verification of the ban on CW raised some challenging technical questions that the international community would only be able to resolve satisfactorily some two decades later. The dynamic of the discussions changed dramatically on 30 March 1971 when the Soviet Union and its allies accepted the separation of the negotiation on biological and chemical weapons and submitted a draft BW convention two weeks later. Draft Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (biological) Weapons and Toxins and on their Destruction, submitted by Bulgaria, Byelorussian SSR, Czechoslovakia, Hungary, Mongolia, Poland, Romania, Ukrainian SSR, and the USSR, Disarmament Conference document CCD/325/Rev. 1., 15 April 1971.

how to proceed thus differed widely. The United States basically maintained the position it had adopted some 20 years earlier that great technical and practical barriers to verification exist:[14]

> These difficulties are inherent in the methods of producing microorganisms and toxins. (...) An ineffective verification regime force fed into the BW Convention could ultimately make cheating easier and more rewarding by creating a false sense of confidence. Since the practical problems of differentiating between legitimate and illicit activities would remain, it would have no value in detecting noncompliance and no deterrent value. (...) Although we have not found any such measures, the United States is prepared to explore the feasibility of effective verification of the BW Convention. Therefore, we would be willing to consider a move by the Review Conference to establish a multilateral effort to give the issue careful study.[15]

Other states were of the view that, despite the difficulties, verification was possible and necessary and several representatives argued that the difficulties inherent in designing a verification regime could not be invoked to undertake nothing. The European Community[16] and Norway[17] both suggested in their opening statements creating an ad hoc group of experts to study verification options. Views of non-Western states are documented in only a few instances. China and India noted the wishes of Western states and agreed to examine verification possibilities.[18] India concurred, but suggested linkage with the equitable implementation of other provisions of the BTWC, notably Article X.[19] Iran did not mention verification at all in its opening statement. The Soviet Union appreciated the complexities of developing a verification system:

> It is undoubtful that due to a number of objective factors the elaboration of a reliable verification system in the area of biological weapons is a highly complicated task, and we cannot boast that we have a detailed diagram of a verification mechanism. (...) The Soviet delegation urges States Parties to get down to work with the view to develop a verification mechanism.[20]

One important aspect was that during the 3rd Review Conference no state spoke against examining possibilities of verification

14. For the US position on verification during the negotiation of the BTWC, see SIPRI, *The Problem of Chemical and Biological Warfare*, op. cit., p. 302.

15. 'Biological and Toxin Weapons Convention, Third Review Conference', Statement by Ambassador Ronald F. Lehman, II, Head of United States Delegation, 10 September 1991.

16. For instance: 'It is generally accepted that verifying the BTWC will be a difficult but desirable goal, which deserves serious consideration. ... [T]he Review Conference should establish an ad hoc group of governmental experts to examine the question of the technical feasibility and the scope of a verification regime for the Convention.' Common Statement on Behalf of the European Community and its Member States at the Third 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 by Ambassador Hendrik Wagenmakers of the Kingdom of the Netherlands, 10 September 1991, p. 2.

17. For instance: 'The existing [verification and complaint] provisions are in our opinion inadequate. ... At this stage the Review Conference should consider appointing a group of experts to discuss the technicalities of a verification regime, including the limitations involved in verifying the BW Convention.' Statement by Ambassador Svein Sæther, Special Adviser on Disarmament, at the Third Review Conference of the Parties to the Biological Weapons Convention, 11 September 1991, p. 5.

18. Statement by Ambassador Hou Zhitong, Head of the Delegation of the People's Republic of China, at the Third Review Conference of the Parties to the Biological Weapons Convention, 12 September 1991 (Translation), p. 3.

19. Statement by Ambassador Prakash Shah (India) at the Third 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, 11 September 1991, pp. 2 and 4.

in more detail. In their statements during the final plenary session, states expressed their satisfaction with the fact that all countries agreed on the necessity of such an exercise. The European Community told the conference:

> The Twelve consider the great interest in verification, expressed by a considerable number of delegations present at this Conference, highly encouraging.[21]

This consensus led to the creation of the Ad Hoc Group of Governmental Experts to Identify and Examine Potential Verification Measures from a Scientific and Technical Standpoint (VEREX). It was tasked with identifying and examining potential verification measures. The group met four times between March 1992 and September 1993.

VEREX: Identification and examination of potential verification measures[22]

VEREX was limited by its mandate to look at measures able to determine compliance with Article I of the BTWC. During the first session, states started by grouping possible verification measures according to the three prohibitions in Article I of the BTWC, namely (i) development, (ii) production and acquisition, and (iii) stockpiling and retention. Measures identified by states were compiled in three lists accordingly. The Chairman then integrated the three lists into one 'Compiled List of Potential Verification Measures'. By amalgamating the original three lists into a single one, the differentiation between the prohibitions in Article I of the BTWC disappeared.

This development went against the tide of expert opinion established between the 1970s and early 1990s.[23] The differentiation between types of verification measures was never taken up seriously again.

20. Statement by Ambassador Serguei B. Batsanov, Head of the USSR Delegation to the Third Review Conference of the Biological Weapons Convention, 12 September 1991 (Unofficial translation), pp. 2-3.

21. Common Statement on Behalf of the European Community and its Member States at the Plenary of the Third 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 by Ambassador Hendrik Wagenmakers of the Kingdom of the Netherlands, 27 September 1991, p. 3.

22. The VEREX and the Ad Hoc Group overviews draw on background research prepared for the BioWeapons Prevention Project by Dr. Iris Hunger, Hamburg Centre for Biological Arms Control.

23. SIPRI, *The Problem of Chemical and Biological Warfare, Vol. 5: A Study of the Historical, Technical, Military, Legal and Political Aspects of CBW, and Possible Disarmament Measures* (Almqvist & Wiksell: Stockholm, 1971), pp. 141-44; Raymond A. Zilinskas, 'Verification of the Biological Weapons Convention', in: Erhard Geissler (ed.), *Biological and Toxin Weapons Today* (Oxford: Oxford University Press, 1986), pp. 82-107; David Huxsoll, Testimony, Global Spread of Chemical and Biological Weapons Hearings, Committee on Governmental Affairs, US Senate, 101st Congress, 1st Session, May 1989, pp. 199-203; and Nicholas A. Sims, 'Achievements and Failures at the Third Review Conference', *Chemical Weapons Convention Bulletin*, no. 14 , December 1991, p. 3.

Table 1: Potential BTWC verification measures

Off-site measures	On-site measures
Information monitoring • Surveillance of publications • Surveillance of legislation • Data on transfers and transfer requests and on production • Multilateral information sharing • Exchange visits	***Exchange visits*** • International arrangements
Data exchange • Declarations (including notifications, data on transfers and transfer requests and on production)	***Inspections*** • Interviewing • Visual inspections (including observation and surveillance by aircraft) • Identification of key equipment • Auditing • Sampling and identification • Medical examination
Remote sensing • Surveillance by satellite • Surveillance by aircraft • Ground-based surveillance	***Continuous monitoring*** • By instruments (including ground based surveillance) • By personnel
Inspections • Sampling and identification • Observation • Auditing	

However, the amalgamation may well help to explain why the final version of the draft protocol to strengthen the BTWC contained numerous detailed proposals for the overseeing of civilian research and development, but hardly any provisions for particularly relevant activities such as work on aerosols, open air testing, weaponisation or stockpiling. Although the amalgamation appears to have been uncontroversial in 1992, its ongoing acceptance today as well as the deviation from disarmament to non-proliferation during the negotiation of the draft protocol may still hamper progress on efforts to develop a BTWC verification regime.

The VEREX Group identified and examined 21 potential verification measures, 12 off-site measures and 9 on-site measures (see table above).[24] For each of the 21 measures an evaluation report was agreed by consensus.[25] The experts identified 14 measures as useful to varying degrees and seven as being of rather limited use.[26]

24. Summary of the work of the Ad Hoc Group for the period 23 November to 4 December 1992, Ad Hoc Group of Governmental Experts to Identify and Examine Potential Verification Measures from a Scientific and Technical Standpoint, document BWC/CONF.III/VEREX/4, 8 December 1992, pp. 87-8; and Report, Ad Hoc Group of Governmental Experts to Identify and Examine Potential Verification Measures from a Scientific and Technical Standpoint, BWC/CONF.III/VEREX/9, 1993, pp. 132-33.

25. Summary of the work of the Ad Hoc Group for the period 24 May to 4 June 1993, Ad Hoc Group of Governmental Experts to Identify and Examine Potential Verification Measures from a Scientific and Technical Standpoint, document BWC/CONF.III/VEREX/6, 8 June 1993, pp. 5-110.

26. The seven measures with limited use were: Exchange visits – international arrangements; Exchange visits (off-site); Ground-based surveillance (off-site); Observation (off-site); Sampling and identification (off-site); Surveillance by aircraft; and Surveillance by satellite.

In general, they considered onsite measures to be of higher verification value than off-site measures. In addition, most evaluation reports stated that the measures would be more effective if used in combination.

The final report, which was agreed at the last VEREX session in September 2003, offered a more hopeful prospect for verification than generally expected.[27] The document nevertheless hid deep-reaching disagreements about the interpretation of the term 'verification' and the evaluation of the effectiveness of possible verification measures. They were to emerge at the Special Conference of the States Parties to consider the VEREX report in September 1994.

Views on verification after VEREX

All plenary statements made during the opening session of the Special Conference in 1994 dealt with the technical feasibility of a verification regime for the BTWC. Twenty of the twenty five statements argued that VEREX had proven the feasibility of verification. The European Union needed no further convincing.[28] Even the United States recognised the value of a legally binding protocol to the BTWC, although its resistance to the term 'verification' was already apparent.[29] Terminology issues would soon occupy a more central position. Conference working papers frequently referred to 'verification'. The European Union, for instance suggested a 'Mandate for an Ad-Hoc Working Group on Verification' on the second day.[30] Two days later the USA formally opposed the liberal use of the term, explaining their understanding of 'effective verification'. They also reminded the participating States Parties that VEREX had had difficulties in differentiating between peaceful and hostile activities, and concluded that the aim of further efforts should not be verification but 'strengthening the Biological Weapons Convention' and 'compliance enhancement'.[31] By the end of the 1990s Western diplomats had begun to refer jokingly to the 'V-word' in conversations, in effect confirming the taboo status the term 'verification' had acquired.

Dissatisfaction with the outcomes of the VEREX meetings was greatest among members of the Non-Aligned Movement. In particular China, India, Indonesia and Iran expressed doubts to varying degrees and bluntly referred to the inadequacies of the technical means of verification and the fundamental problems in the

27. Report, Ad Hoc Group of Governmental Experts to Identify and Examine Potential Verification Measures from a Scientific and Technical Standpoint, op.cit; and Barbara Hatch Rosenberg, 'A Regime to Monitor Compliance with the Biological Weapons Convention Moves Closer', in John B. Poole And Richard Guthrie (eds.), *Verification 1994. Arms Control, Peacekeeping and the Environment* (London and New York: Brassey's, 1994), p. 129.

28. Summary Record of the 2nd Meeting held at the Palais des Nations, Geneva, on Monday, 19 September 1994, at 3 p.m., 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, document BWC/SP-CONF/SR.2, 13 October 1994, p. 3.

29. Plenary Statement of the United States Representative to the 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, 19 September 1994.

30. Federal Republic of Germany on behalf of the European Union, 'Proposal for a Mandate for an Ad-Hoc Working Group on Verification', 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, document BWC/SP-CONF/WP.1, 20 September1994, p. 1.

31. Statement of US Representative Donald A. Mahley to the Committee of the Whole, September 22, 1994, 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, document BWC/SPCONF/WP.16, 23 September 1994.

strengthening of the convention that still require further examination.[32]

The Special Conference created the Ad Hoc Group (AHG) to further consider the VEREX proposals. When the 4th Review Conference (November-December 1996) assessed the work by the AHG, it seemed that the differences in view on the verifiability of the BTWC had diminished. The European Union statement in the General Debate, for instance, was optimistic:

> The effective verification of the BTWC, once considered too complex and impractical, is now regarded as achievable. The work of VEREX and the Ad Hoc Group has constructed a broad consensus, both technical and political, on the outlines of a workable regime.[33]

The NAM was once again more guarded. In the words of Pakistan:

> The verification of the BWC has long been regarded as a difficult and complex issue. Verification provisions could not be agreed earlier because of objections based on arguments advanced by some important countries. Their political views have evolved since then. However, the complexity and difficulty of the measures envisaged for verification of the BWC have not changed.[34]

One of those 'important countries' was likely the United States. Although shunning the term 'verification, the US statement expressed the belief that 'the Ad Hoc Group ... can bring the Convention into the 1990s, through a legally binding compliance protocol that provides for new off-site and on-site activities'.[35]

Towards the end of the 4th Review Conference, the complexities involved in the strengthening of the BTWC were clearly appreciated, but the goal of supplementing the BTWC with a legally binding instrument was seen to be achievable. Whereas the 1994 Special Conference tasked the AHG with further exploring the VEREX proposals, the Review Conference mandated the AHG to negotiate a supplementary protocol.

The proposed protocol to the BTWC

Building on the work of VEREX, the compliance regime in the draft protocol would have been built around declarations, visits and

32. Summary Record of the 3rd Meeting held at the Palais des Nations, Geneva, on Tuesday, 20 September 1994, at 10 a.m., 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, document BWC/SP-CONF/SR.3, 26 September 1994, pp. 8 and 14.

33. Statement by Mr Mervyn Taylor, Minister for Equality and Law Reform of Ireland, on Behalf of the European Union, 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, 25 November 1996.

34. Statement by Ambassador Munir Akram at the 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, 26 November 1996.

35. Remarks of the Hon. John D. Holum, Director, United States Arms Control and Disarmament Agency, to the Fourth Review Conference of the Biological Weapons Convention, 26 November 1996.

investigations. Parties to the protocol would have been required to submit an initial declaration on past offensive and defensive biological warfare programmes. Thereafter, they would have had to make annual declarations on matters such as national biological defence programmes or other activities against BW, certain maximum containment facilities for handling pathogens, other high-containment facilities that work with human and plant pathogens listed in the protocol, and certain production installations. The declarations were structured so as to ascertain capabilities of a state party rather than to focus on quantitative reporting thresholds because of the small initial amounts of pathogen required to grow biological agents.

Inspections were labelled visits and, in the case of suspected non-compliance, investigations in the draft protocol. The purpose of the visits to protocol-relevant installations and sites was to generate confidence in compliance by States Parties by ascertaining the correctness and completeness of the declarations. Three types of visits were envisaged, namely randomly-selected transparency visits, voluntary assistance visits and declaration clarification procedures. The inspectors would have been staff members of an organisation for the prohibition of BW (OPBW). They would have conducted a maximum of 120 randomly-selected transparency visits per year with a maximum of seven such visits per country. Field and facility investigations were being proposed to deal with cases of suspected BW use and other treaty violations. By the time of the collapse of the negotiations, the AHG had not been able to resolve the procedures to authorise investigations nor the modalities of their execution.

As a consequence of the differences in views on the concept of verification that emerged at the 1994 Special Conference, the draft protocol envisaged a confidence-building regime with strong emphasis on the enhancement of transparency rather than the verification protocol (modelled after the Chemical Weapons Convention) many States Parties had in mind. Between January 1995 and August 2001 the AHG met 24 times in regular session and elaborated a text of eventually more than 200 pages. Among the arguments against a BTWC verification regime advanced during the AHG negotiations were growing doubts that any single on-site inspection could demonstrate compliance, the dual-use characteristics of treaty-relevant technologies and their potential application for peaceful and non-peaceful purposes, and the fear of loss

of confidential business information. In addition, fundamental ideological differences on key aspects of the projected BTWC regime emerged among groups of countries, while individual States Parties held onto strong views on certain elements of the transparency mechanisms, which, taken together, left little room for compromise in order to conclude the negotiation in the summer of 2001. The negotiation collapsed in July after the United States declared that the proposed measures were too weak and not in the interest of US security.

Confidence-building measures

In the light of the failure of the protocol negotiations, confidence-building measures (CBMs) are presently the only formal transparency-generating tool available to the BTWC States Parties.[36] Each CBM is centred around a specific issue and their principal purpose is to reduce the ambiguity surrounding different types of activity that because of their nature might easily be construed as being in violation of the BTWC and to promote international cooperation with regard to legitimate activities.[37] However, their combined scope is limited and only a minority of states participate in them regularly. In the current state of international security interactions in general and attitudes towards the BTWC in particular, increased emphasis on CBM implementation and gradual expansion of their scope appear to be the only viable option that may lead to more formal cooperative measures in the future.

Development of CBMs for the BTWC

The first CBMs were devised at the 2nd Review Conference in 1986 in order to compensate for the lack of a meaningful verification regime. A second set of CBMs were agreed at the 3rd Review Conference in 1991. The current CBMs are:

- CBM A
  - Part 1: Exchange of data on research centres and laboratories.
  - Part 2: Exchange of information on national biological defence research and development programmes.
- CBM B: Exchange of information on outbreaks of infectious diseases and similar occurrences caused by toxins.

36. The extensive information exchanges at the expert meetings of the intersessional process between 2002 and 2005 greatly contributed to transparency with regard to the selected topics. Should the States Parties decide on the continuation of the annual meetings at the 6th Review Conference, an embryonic institutionalisation of the process may take shape. However, to equal the purpose of the CBMs, there would be a need to formally require all States Parties to submit reports on the selected annual topics. Such formalisation of the information exchanges is fraught with dangers. Submissions might become the subject of accusations of incompleteness or falsity, while states might decide not to participate in the meetings in order to avoid international public scrutiny of their commitment to the treaty obligations. In addition, the submissions would be a one-off statement whose validity could be questioned with the passing of time, unless the States Parties also agree on a process of periodically updating the information (which would amount to agreeing to new CBMs).

37. See, for instance, Marie-Isabelle Chevrier, and Iris Hunger, 'Confidence-Building Measures for the BTWC: Performance and Potential', *Nonproliferation Review*, Fall/Winter 2000, p. 25; Holly Higgins, 'Applying Confidence-Building Measures in a Regional Context', in Holly Higgins (ed.), *Building Nuclear Confidence on the Korean Peninsula: Proceedings of the July 23-24, 2001 Workshop* (Washington, D.C.: Institute for Science and International Security, 2001), p. 109; and Michelle Maiese, 'Confidence-Building Measures', in Guy Burgess and Heidi Burgess (eds.), *Beyond Intractability* (Conflict Research Consortium, University of Colorado: Boulder, CO., September 2003), available at http://www.beyondintractability.org/m/confidence_building_measures.jsp; and Steve Tulliu and Thomas Schmalberger, *Coming to Terms with Security: Lexicon for Arms Control, Disarmament and Confidence-Building* (Geneva: UNIDIR, 2004), p. 136.

- CBM C: Encouragement of publication of results and promotion of use of knowledge.
- CBM D: Active promotion of contacts.
- CBM E: Declaration of legislation, regulations and other measures.
- CBM F: Declaration of past activities in offensive and/or defensive biological research and development programmes.
- CBM G: Declaration of vaccine production facilities.

Since 1991 no further CBMs have been added to the set. The 1996 Review Conference mandated the Ad Hoc Group to negotiate the supplementary protocol, which was expected to turn the politically binding CBMs into formal treaty obligations and expand the scope of reporting requirements. Following the termination of the protocol negotiation, the 5th Review Conference in 2001 considered the expansion of the scope of some CBMs and the addition of at least one new one (on the declaration of production facilities for biocontrol agents and plant inoculants). Given the failure of that review conference and the adoption by the States Parties of a new work programme based on annual meetings of experts and the States Parties at the resumed session of the 5th Review Conference in 2002, there exists no formal record of these proposals.[38]

Participation in the CBMs.

Participation in the CBMs is an obligation for the States Parties.[39] Annual submissions are due with the UN Department for Disarmament Affairs by 15 April and the information in the reports should cover the previous year.

Despite the formal obligation, state party involvement in the CBM process has always been unsatisfactory. This seriously undermines the value of the exercise and fuels the perception that the effort does not contribute to any greater transparency or generate confidence in compliance. Most years less than one-third of all States Parties submit the reports. 1996 was a peak year when 53 out of 138 States Parties sent in their declarations (38.5%). By 2003 the number had dropped to 33 out of 152 (21.7%).[40] Furthermore, between 1999 and 2003 only 22 States Parties had submitted their declarations each year, and between 1987 – the year of the first submissions – and 2003 a mere 87 States Parties had sent in their dec-

38. The draft Final Declaration of the 5th Review Conference included language stating that 'the Conference takes note of proposals to expand the scope of existing confidence-building measures, to improve existing measures and to create new measures, in order to provide a broader range of relevant information, consistent with the approach agreed upon in 1991. Therefore, the Conference takes note that the next meeting of States Parties [i.e., the 6th Review Conference in 2006 – author's note] shall take up CBMs to discuss possible modifications.' Chairman of the Drafting Committee, Draft Final Declaration, Article V, para. 9 (7 December 2001), p. 7.

39. Second 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 Declaration, Article V, document BWC/CONF.II/13/II (26 September 1991), p. 6. The obligation was repeated in subsequent final declarations of review conferences.

40. *BioWeapons Report 2004* (Geneva: BioWeapons Prevention project, 1004), pp. 26-27.

larations at least once (57% of the number of States Parties in 2003). Since then the negative trend appears to have been reversed. 42 out of 154 (27.3%) and 45 out of 155 (29%) States Parties submitted their CBM declarations in 2004 and 2005 respectively.[41] In summary, fewer than one third of all States Parties meet their CBM obligations.

Causes of the poor CBM implementation

It is probably fair to postulate that between 1996 and 2001 interest in the CBMs waned in anticipation of the adoption of the Protocol, which, as already noted, would have had extensive declaration requirements. The terrorist attacks of 11 September 2001 'individualised' threat perceptions and the resulting trend towards 're-nationalisation' of security challenged multilateralism and the principles of collective security in their foundations. This process is likely to have had a detrimental effect on the perceived utility of the BTWC as a security instrument. In view of the failure of both the Ad Hoc Group negotiations and the 5th Review Conference many States Parties may consequently have accorded lower priority to the BTWC as an instrument to enhance their national security, despite the fact that the consequences of an attack with especially highly infectious agents might have important transnational consequences.[42]

The true effect of the BTWC CBMs is difficult to gauge. The widespread perception of limited utility among state representatives, academics and outside observers is almost wholly based on the quantitative analysis of the annual submissions. The content of those CBM reports is confidential and, as a consequence, there have been few substantive studies.[43] The lack of public debate also means that few proposals for new ideas or substantive and procedural improvements are being formulated. Nevertheless, there appears to be a revival of interest in the CBMs, and in an effort to increase their relevancy some States Parties have begun to publish their submission to the Internet.[44] As a result, there is great likelihood that the States Parties will take up the issue of CBMs at the 6th review Conference and try to ameliorate the process or devise a new one for issues that have grown in relevance since 1991.

Deeper analysis reveals some additional patterns, an understanding of which may be relevant for the future development of the regime against BW. First, analysis of the annual submissions

41. François Rivasseau, 'Confidence-building measures: Annual information exchange of States Parties (Reports 2000-2005)', presentation to the conference 'Future Measures for Strengthening the BWC Regime', Tokyo, 14-15 February 2006.

42. Jean Pascal Zanders, 'Chemical and Biological Threats: Some Comments', presentation to the conference *Exploring Functional Security: National Responses and Prospects for Nordic and European Collaboration*, Swedish Institute of International Affairs, Stockholm, 24-25 October 2002, available at: http://projects.sipri.se/cbw/research/cb_threats2_comments.pdf.

43. The Hamburg Centre for Biological Arms Control runs a CBM analysis programme. See, for instance, Iris Hunger, *Confidence Building Needs Transparency: A Summary of Data Submitted Under the Bioweapons Convention's Confidence Building Measures 1987-2003* (Sunshine Project: Hamburg, September 2005), 51p., document available at: http://www.biological-arms-control.org/download/hunger_CBM.pdf; and Nicolas Isla, 'Transparency in Past Offensive Biological Weapons Programmes: An Analysis of Confidence Building Measure Form F 1992-2003', *Occasional Paper* no. 1, Hamburg Centre for Biological Arms Control (June 2006), 43p., document available at: http://www.biological-arms-control.org/download/FormF_1992-2003.pdf.

44. Australia (2001, 2003 and 2004), the United Kingdom (2003, 2004 and 2005) and the USA (2003) published their CBM submissions for certain years on the Internet. The documents are available at: http://www.opbw.org, 'Strengthening the Convention'. Several other, principally Western, countries are considering publication of their CBM reports, but explain the delays by referring to existing confidentiality agreements with the industry and research institutions about the information they supply in preparation of the CBM reports.

reveals the uneven regional distribution of participation in the CBMs. The highest concentration is among the countries that were at the heart of the Cold War rivalry (NATO and former Warsaw Treaty members in particular). On average, over 65% of the states belonging to the Western Group participate in the annual CBM exercise. Only in 2003 the figure dropped to 50% and rose again to 65.2% and 71.9% in 2004 and 2005, implying that the rise of the number of annual returns for the last two years is primarily due to members of this group. The Eastern Group averages around 54%.[45] These participation rates may be due to the fact that the CBMs evolved from the Confidence and Security-Building Measures agreed as part of the 1975 Final Act of the Conference on Security and Co-operation in Europe (CSCE)[46] and that the participating states acquired sufficient expertise and confidence in the relevance of the exercise.

The level of economic development also appears to be an important factor as participation rates are much higher among industrialised countries (as defined by membership of the Organisation for Economic Cooperation and Development, which besides the European Union members and some candidate member states also includes Australia, Canada, Iceland, Japan, Korea, Mexico, New Zealand, Norway, Turkey and the United States) than many developing countries. Barely one third of the countries belonging to the Non-Aligned Movement (NAM) have submitted CBM reports at least once since 1987.[47] Between 2000 and 2005 fewer than 10 NAM states (out of 98) participated in the CBMs; 82 never submitted a CBM declaration during this period.[48] This suggests that the BTWC, and the CBMs in particular, are of little relevance to their security.[49]

A second factor, which may also help to explain the discrepancy between developed and developing societies, is the lack of necessary resources by government administrations to collect and process the required information. The draft Final Report of the 5th Review Conference stated that 'the Conference also recognises the technical difficulties experienced by some States Parties with respect to preparing CBM responses'.[50] The BioWeapons Prevention Project (BWPP) encountered similar issues at its seminars in South Africa, when government officials responsible for BTWC matters repeatedly expressed their frustration that they do not have a full picture of the relevant activities, companies and institutions on their territory.[51] Such lack of governmental resources

45. Rivasseau, op. cit..

46. Final Act of the Conference on Security and Co-operation in Europe, signed in Helsinki on 1 August 1975. Document available at: http://www.osce.org/documents/mcs/1975/08/4044_en.pdf.

47. *BioWeapons Report 2004* (Geneva: BioWeapons Prevention Project, 2004), pp. 26-27.

48. Rivasseau, op. cit. NAM states make up about two thirds of the parties to the BTWC.

49. Research into the slow rate of accession of non-states parties to the BTWC points to the strong security interests among those states that were formerly at the heart of the Cold War (and who therefore emphasise the disarmament dimension of the treaty). In contrast, the principal advantage for developing countries to join the convention is the promise of scientific, technological and economic benefit offered under Article X, but its limited effectuation and lack of promotion by an organisation dedicated to the implementation of the BTWC sustains their perception of the convention's irrelevance. A similar perception among the developing countries that have become a party to the BTWC may be at the root of their lack of interest in the CBMs.

50. Chairman of the Drafting Committee, op. cit., Article V, para. 7, p. 7.

51. See, for instance, BioWeapons Prevention Project, 'International Networking to Prevent the Misuse of Biology for Hostile Purposes-Part 2', Report from the BWPP workshop, Johannesburg (South Africa), 14 July 2004, *BWPP Event Report*, no. 3 (2004), p. 4, document available at: http://www.bwpp.org/documents/200410BWPPSAseminar.pdf.; and BioWeapons Prevention Project, 'International Networking to Prevent the Misuse of Biology for Hostile Purposes – Part 3', report from the BWPP workshop, Cape Town (South Africa), 12 October 2004, *BWPP Event Report*, no. 5 (2004), p. 3, document available at: http://www.bwpp.org/documents/200410BWPPSAseminar.pdf.

also affects the ability to analyse the submitted data. States Parties are not required to submit the CBM forms in more than one of the six official UN languages and the UN Department for Disarmament Affairs cannot offer translation services or any other assistance with the CBM process beyond the collation and distribution of the annual returns. Only the richest States Parties with large government bureaucracies are consequently in a position to have the documents systematically translated and analysed.

A third possible factor touches upon the core purpose of the CBMs: they do not affect threat perceptions. The collection, processing and reporting of data is a resource-intensive, onerous task. If the process affects threat perceptions or confidence in compliance only marginally or not at all, then the utility of submitting the CBMs diminishes. Each state maintains assumptions and makes judgements about the behaviour of other states based on the observation of past actions. Prior estimation of a country's compliance and the quality of the information determines whether confidence will be increased or not.[52] Research suggests that accurate and complete submissions by countries in poor standing will be considered unconvincing and misleading and that these countries will continue to be viewed as non-compliant. Only a fundamental change in a country's behaviour over a broad range of activities is likely to remove the distrust. Similarly, a country in good standing is likely to be judged favourably, even if its submissions are not entirely accurate or incomplete (although questions about its commitment to its obligations may be raised). However, for countries that fall in between those two extremes, CBM submissions – if not seen to be fully accurate or complete – can easily confirm or increase suspicion of non-compliance and illegal activities. It takes a sustained effort of reporting consistent with compliance before the assessment of a state's behaviour will improve.[53] The absence of an international organisation means that there can be no independent confirmation of the accuracy of the submissions.

State practice has actually compounded the problem of relevance of the CBM returns to national security. There have been manifestly wrong submissions, such as the declarations of purely defensive BW activities by the Soviet Union and Russia, or incomplete ones like South Africa's with regard to the secret Project Coast. These have not been formally challenged by other States Parties or become the subject of clarification requests, nor does the BTWC

52. Chevrier and Hunger, op. cit., p. 27.

53. Ibid., pp. 27-29.

provide for any penalties for misleading or false submissions. Consequently, not only can some States Parties come to believe that they can lie or be economical with the truth with impunity with regard to BTWC-relevant activities, other States Parties can become distrustful of or indifferent to the CBM returns.[54]

A fourth possible explanation of the low rates of annual returns is that the CBM submissions of a distant state are of limited relevance. Most of the CBM-based security arrangements are either regional or bilateral.[55] Besides the BTWC CBMs, the only other global mechanisms is the UN Register of Conventional Arms (UNROCA). Although participation in the UNROCA is much higher than in the BTWC CBMs (121 countries reported data in 2004), the arms register too suffers from limited reliability of the data. For instance, 80 per cent of the data related to transactions reported by both exporters and importers do not match. In addition, the interest of arms importers in submitting data is low. In general, it is easy to draw wrong conclusions from the UNROCA data.[56]

The relatively higher success of regional and bilateral arrangements may be attributed to the immediate security interests that the parties involved have in their timely implementation and communication of relevant information. The analysis of the patterns of ratification of global treaties like the BTWC and the CWC indicates that regional and local security calculations play a significant role in the decisions to ratify or accede to the agreements. During the negotiation of the CWC there have been shifts between the global (Conference on Disarmament), regional (e.g., the debates on chemical weapon free zones) and bilateral levels (USA-USSR). Especially those states belonging to a regional security complex – a geographical area in which states have particularly strong security interactions – preceded their decision to join the CWC with regional accords.[57] The local and regional articulation of interest in the BTWC did not occur with regard to the BTWC. It was also absent from the protocol negotiation, which may be one of less appreciated reasons for its failure.[58] This absence of local and regional articulation of interests in the BTWC, combined with the lack of any discourse on the relevance to regional security of the CBMs, may be an important factor contributing to the low response rates.

A final reason for the poor participation rates may be the format of the CBM forms. They allow States Parties to submit their

54. Russia admitted to past offensive BW activities in the early 1990s and in April 1992 President Boris Yeltsin issued a decree banning all activities contravening the convention. Nevertheless, at the 4th Review Conference in 1996 Russia's representative categorically denied having had any offensive BW programme. See Jean Pascal Zanders, Susanna Eckstein and John Hart, 'Chemical and biological weapon developments and arms control', *SIPRI Yearbook 1997: Armaments, Disarmament and International Security* (Oxford: Oxford University Press, 1997), p. 465. In 1995 the United Kingdom and the United States undertook a demarche to South Africa to seek clarifications about Project Coast and strongly urged the South African government to submit a credible CBM statement on its past offensive BW activities. Private communication by Chandré Gould, former researcher with the Truth and Reconciliation Committee and author of a book and several articles on Project Coast, June 2004. South Africa's last known CBM submission on past offensive BW programmes dates from 1994 and does not acknowledge Project Coast. On the contrary, it explicitly states that no offensive BW efforts were undertaken. See Nicolas Isla, op. cit., pp. 18-19.

55. For an overview, see Tulliu and Schmalzerger, op. cit., pp. 137-57.

56. Siemon T. Wezeman and Mark Bromley, 'International arms transfers', *SIPRI Yearbook 2005: Armaments, Disarmament and International Security* (Oxford: Oxford University Press, 2005), pp. 443-44.

57. Jean Pascal Zanders and Elisabeth M. French, 'Article XI of the Chemical Weapons Convention: Between Irrelevance and Indispensability', *Contemporary Security Policy*, vol. 20, no. 1, April 1999, pp. 69-77.

58. Jean Pascal Zanders, 'Challenges to Disarmament Regimes: The Case of the Biological and Toxin Weapons Convention', *Global Society*, vol. 15; no. 4, October 2001, pp. 376-381.

information in an unstructured manner. As a consequence, the person compiling the data experiences a considerable degree of uncertainty about which information to supply. This complicates efforts at comparative analysis. Some of the information requests are also confusing. For example, Form A, part 2 (iii) on national biological defence research and development programmes requests the total number of personnel for each facility, but later asks for the number of contractor staff working in the facility. States submitting information under this CBM have interpreted the question whether contractor staff should be included in the total number of staff differently.[59] Consequently, a considerable degree of uncertainty regarding the extent of the biological defence programmes for all states persists. A similar problem exists with regard to the Declaration Form on nothing to declare or nothing new to declare for use in the information exchange. States may, for example, have reported a biodefence programme in the past, but by subsequently filling in the so-called null-form they may fail to report the termination of the programme or any other relevant changes. In this way the null-form, which was designed to simplify the CBM submission procedure, may be the source of ambiguity and uncertainty.

Institutional support for the implementation of the BTWC

Having negotiated the BTWC during a thaw in the Cold War, the two superpowers were nonetheless not yet ready to accept an elaborate verification regime that would have intruded on their sovereignty. One of the consequences was the lack of emergence of any need for an institutional setup. Only the three depositary countries-the Russian Federation (as successor to the Soviet Union), the United Kingdom and the United States – have limited formal responsibilities. Not being an UN treaty, the United Nations does not have formal commitments, except for those administrative and logistical tasks explicitly requested by the States Parties. These include support for the review conferences and other meetings decided by the States Parties (including expert meetings) and the collection and distribution of the annual CBMs. Between any of these meetings there is no formal organ that oversees or assists with the implementation of the BTWC, nor are there standing committees, advisory panels, lists of experts to be called up in the case of

59. Nicolas Isla and Iris Hunger, 'BWC 2006: Building transparency through confidence-building measures', *Arms Control Today*, vol. 36, no. 6, July/August 2006, article available at: http://www.armscontrol.org/act/2006_07-08/BWC2006.asp.

allegations of use or other contingencies, or a minimal permanent secretariat (within or without the UN). Each time the States Parties wish to meet, a UN General Assembly resolution requesting the UN Secretary-General to render the necessary assistance to the depositary governments of the BTWC is adopted.[60] This results in the provision of meeting rooms in the UN premises in Geneva, conference services and the creation of a temporary BWC Meetings Secretariat within the Geneva branch of the UN Department of Disarmament Affairs (UNDDA) to assist with the preparations and support the meetings.

The lack of an institutional setup to oversee the BTWC's implementation denies the States Parties an important tool to generate transparency and acquire confidence in the compliance with the treaty's provisions by other States Parties. If the OPCW can be taken as a standard, then the BTWC's institutional deficit also helps to explain the relatively low number of States Parties (155 States Parties in 31 years compared to 180 for the CWC in 9 years), the poor level of national implementation of the BTWC, the low annual reporting under the CBMs, and the absence of a coordinated programme to meet the obligations and expectations under Article X. As noted earlier, the AHG envisaged an OPBW, but the failure of the protocol negotiation also ended the conceptual development of the proposed international organisation.

Nevertheless, the succession of state party activity during the 1990s to strengthen the BTWC (review and special conferences, VEREX and the AHG meetings, as well as a set of meetings to resolve the Cuban allegation of US biological warfare) and the annual expert and state party meetings between 2003 and 2005 has created a sense of informal institutional permanency. The high level of activity over those 15 years has led many diplomats and outside observers to believe that the BWC Meetings Secretariat is a permanent part of the UNDDA. This impression forms the basis of some proposals to assign certain tasks (particularly with regard to CBMs and other information collection, processing and dissemination activities) to the UNDDA, whereby a couple of additional staff members could be hired. However, the BWC Meetings Secretariat and its two staff members do not figure in UN organisational charts and their temporary contracts are paid for outside the UN budget. Changing this chart is a complex undertaking, and currently unlikely given the state of UN finances and nature of the debates on UN reform.

60. The final report of a meeting of the States Parties to the BTWC will usually indicate the dates of the next meeting, if such a meeting is already anticipated, and call on the three depositary states to undertake the necessary preparations.

Presently, some states strongly oppose institutionalisation processes and the further development of international organisations, as is evidenced by the career policy limitations and budget restrictions of the OPCW.[61] Some of the concerns are legitimate. Processes of institutionalisation and bureaucratisation tend to bloat international bodies and make them less responsive to changing needs. However, some other arguments are high in ideological content. They reflect a low esteem for the role multilateral arms control and disarmament can play in international security and tendencies towards (re-)nationalisation of security. As some BTWC States Parties – particularly the United States and some other industrialised countries-are known to resist any suggestion of a large bureaucracy, many ideas by diplomats or proposals by academics or researchers in non-governmental organisations tend to depart from a minimalist staffing complement – (usually less than five people).[62] Often the possible tasks of the institution are then determined in function of the number of staff. This mode of thinking inspired by the wish to preempt the criticism concerning large international bureaucracies and make the proposals palatable to certain States Parties has become quite entrenched in Geneva. For example, a government official coming from the capital of an EU Member State stunned the audience at a seminar in preparation of the 6th Review Conference organised by the Geneva Forum in March 2006 by outlining a proposal for a small institutional support unit comprising about 25 people. This figure is low if compared to most other international organisations serving global arms control and disarmament treaties. The incident serves to highlight that numbers are only relevant if the tasks of the supporting institution have been identified.

Nicholas Sims elaborated on the potential tasks of an institutional support unit immediately after the failure of the AHG negotiations and identified eight functions:

- To follow up the final declaration and decisions of the review conferences;
- To exercise a general oversight over the effective application of the provisions of, and the balanced operation of, the BTWC;
- To assist States Parties in fulfilling their obligations under the convention and their politically binding commitments, including the CBMs;

61. Second Special Session of the Conference of the States parties, 'Decision: Tenure policy of the OPCW', OPCW document C-SS-2/Dec. 1 (30 April 2003); Kerry Boyd, 'OPCW fails to agree on budget, Russian request for extension', *Arms Control Today*, no. 10, October 2002, document available at: http://www.armscontrol.org/act/2002_10/opcwoct02.asp.

62. See, for example, Statement to the Meeting of the States Parties to the BTWC by Ambassador Paul Meyer, Permanent Representative of Canada to the Conference on Disarmament, Geneva, 5 December 2005. Canada subsequently submitted a discussion paper, which took into account solicited views and comments on an earlier non-paper, to the Preparatory Committee for the 6th Review Conference. This document no longer mentions size nor involvement of UNDDA. 'Towards the Sixth BTWC Review Conference: An Accountability Framework', Preparatory Committee for the Sixth Review 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, document BWC/CONF.VI/PC/INF.1, 10 April 2006, p. 2. In 2001 Nicholas Sims drafted a mandate for 'Interim Supportive Institutions' for inclusion in the Final Declaration of the 5th Review Conference. The idea for a small staff was inspired by a conviction that the AHG had suffered a temporary setback in 2001 and that there was a need to steer the evolution of the BTWC until the 6th Review Conference, which might reactivate the negotiation of the protocol, or the 7th Review Conference in 2011, which was the earliest time the OPBW might have been expected to become operational. Nicholas A. Sims, 'Nurturing the BWC: Agenda for the Fifth Review Conference and Beyond', *Chemical and Biological Weapons Conventions Bulletin*, no. 53, September 2001, pp. 3-5. See also, Nicholas A. Sims, *Remedies for the Institutional Deficit of the BTWC: Proposals for the Sixth Review Conference*, Review Conference Paper no. 12, Department of Peace Studies, University of Bradford, March 2005.

- To promote universal adherence to the BTWC, encourage signatories to accede to the Convention and encourage wider membership from non-signatory states;
- To represent States Parties in relations with the United Nations and with other international organisations;
- To establish, as necessary, subsidiary bodies (such as a legal advisory panel or scientific advisory panel);
- To establish, in conjunction with the UN Secretary-General, a small secretariat dedicated to the service of the BTWC; and
- To recommend to future review conferences if its mandate should be extended.[63]

The Verification Research, Training and Information Centre (VERTIC) proposed a modular approach to strengthening the BTWC, which has the advantage of allowing the secretariat to grow or evolve organically as States Parties assign it new functionalities.[64] It identified four main task groups for the secretariat.

First, it should undertake the mundane and operational functions of a treaty secretariat. Many of these functions are already undertaken by the UNDDA and the BWC Meetings Secretariat. They can be fulfilled with minimal expansion of the current financial and logistical arrangements. Second, VERTIC suggests the creation of a dedicated CBM unit to enhance the CBM process, encourage higher levels of participation and improve the value of the annual reports. In particular, the unit could analyse reports and engage states in dialogue over any gaps or lack of clarity, assist states in gathering information and presenting it in the correct format, liaise with states over procedural aspects of reporting, and provide and facilitate technical assistance. A third major area of activities would be to provide legal assistance to BTWC States Parties with regard to the translation of their international obligations into domestic measures, the review of existing implementation measures and the enactment of measures to prevent non-state actors acquiring or using biological and toxin weapons. Finally, the VERTIC proposal recognises the importance of the functional division of treaty implementation activities between an international organisation and nation governments by suggesting the establishment of national contact points similar to the 'national authority' under the CWC. Besides liaising with the international secretariat, the contact points could form a network

63. Sims (2001), op. cit..

64. Trevor Findlay and Angela Woodward, *Enhancing BWC Implementation: A Modular Approach*, Report no. 23 (Stockholm: Weapons of Mass Destruction Commission), October 2004, available at: http://www.vertic.org/assets/No23.pdf.

in support of cooperation and generation of transparency among States Parties.

The proposals elucidate some of the core functions the international body ought to undertake in order to improve the relevance and implementation of the BTWC. However, they are built on the assumption that at some not too distant point the States Parties will agree on an OPBW and that in the meantime an expanded BTWC secretariat within the UNDDA could assume those responsibilities. There is a certain danger with both assumptions. Following the failure of the AHG negotiations, it is unlikely that a major international organisation along the lines of the OPBW will be established in the foreseeable future. The 6th Review Conference may decide on a new annual work programme until 2011, but the price of consensus could well be the termination of the AHG mandate and thus of any form of protocol negotiations. As noted above, the integration of the functions of an international body with the UNDDA may not be as straightforward as often supposed in discussions. The creation of an independent unit might meet with more resistance, unless a state party is willing to host the initiative or an opportunity exists to latch it onto an existing national or international organisation. This model exists with the Implementation Support Unit for the Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on Their Destruction, which by decision of the States Parties has been attached to the Geneva International Centre for Humanitarian Demining.[65] The States Parties make voluntary contributions into a fund set up to support the activities of the Implementation Support Unit.

The question of biological defence programmes under the BTWC

Under Article I of the BTWC States Parties are authorised to acquire and manipulate pathogens for protective, prophylactic and other peaceful purposes. Such activities include biological defence programmes. These programmes have become increasingly controversial during the 1990s as a consequence of the forced vaccinations and other prophylactic measures administered to US troops that were deployed to the Gulf in 1990 and 1991. There are many reports suggesting that these may have contributed to the

65. For background information on the Implementation Support Unit and its relation with the Geneva International Centre for Humanitarian Demining, see: http://www.gichd.ch/219.0.html.

Gulf War Illnesses.[66] After the terrorist attacks by Aum Shinrikyo in the 1990s and the strikes against the United States in September 2001 there has been a major expansion of BW defence programmes in the United States and other countries. The perceived increase of the BW threat has prompted states to undertake a number of emergency measures ranging from the creation of strategic stockpiles of certain types of medication and vaccines to the reorientation of emergency response services towards mass casualty events involving biological, chemical or radiological substances. Other activities try to assess the risk from advances in biology and biotechnology, and the likelihood that states or terrorist entities might apply the new science and technology for hostile purposes. The absence of a verification regime, the limited utility of the current CBM process, and the reluctance to communicate about the substance of the biodefence activities, fuel concerns that these biodefence programmes may hide illicit weapon programmes.

Biodefence programmes were already a sensitive issue when the BTWC was being negotiated. During the process of strengthening the BTWC some fundamental questions were repeatedly raised as to what are legitimate biodefence activities under Article I of the BTWC and how the legitimacy of such activities should and could be communicated to other States Parties. After 30 years of treaty implementation a resolution of those issues does not appear any closer.

The BTWC and BW defence

The question of the biodefence programmes is governed by the general purpose criterion in Article I of the BTWC. However, there is an inherent ambiguity and judgment of compliance with the BTWC depends largely on the judgement of intent (in which enemy images inevitably play a significant role). Furthermore, the BTWC does not specify any quantitative or qualitative limitations for the biological agents that are used in the non-prohibited activities. One of the few instruments to clarify biodefence programmes is CBM A, parts 1 and, particularly, 2. States are requested, among other things, to submit information on relevant national defence research and development programmes and on research centres and laboratories that specialise in permitted biological activities of direct relevance to the BTWC. However, as noted in the CBM section, annual responses have generally been poor.

66. Eamonn Ferguson and Helen Cassaday, 'Theoretical Accounts of Gulf War Syndrome: From Environmental Toxins to Psychoneuroimmunology and Neurodegeneration', *Behavioural Neurology*, vol. 13, nos. 3-4, 2002, pp. 133-147.

However, the omission of information on certain types of activity may equally fuel suspicions of malicious intent. For instance, the United States has consistently made rather detailed declarations of its BW defence activities. Yet the various programmes that were revealed in the second half of 2001 were never declared, nor was the Nevada test site.[67] The surprise and the concern about these programmes is less about the fact that the United States conducts a wide variety of BW defence projects in order to deal with its perceived security threats than about the intent that motivates and justifies their secrecy and non-disclosure. As two experts in BW disarmament wrote, CBMs are 'an assortment of activities that states engage in with the primary aim to become more sure that each understands the actions and/or intentions of the others'.[68] These doubts about intent in turn have led to serious questions about the permissibility of these activities under the BTWC among members of the arms control community and foreign governments.

Attempts at common understandings under the BTWC

The BTWC is unclear about when a particular activity should be considered defensive or offensive, and the determination of 'purpose' comes down to a judgment of intent. Nevertheless, based on analyses of past programmes and proliferation of allegations, certain activities have become widely accepted as pointers to an offensive programme: certain kinds of vaccine research (especially if the disease is not indigenous), large-scale vaccinations of troops against certain agents, the creation of non-naturally occurring disease strains (especially those with heightened pathogenicity), the development of agent delivery systems, agent production installations, open-air release of pathogens, the presence of an explosive chamber inside a research establishment, and so on.

In 1972 the United States clarified some key terms of Article I as follows:

> The word *prophylactic* refers to activities related to the protection of the human body from the effects of organisms or substances to which an individual might be directly exposed. It encompasses medical activities such as diagnosis, therapy and immunization, and related research.
>
> The term *protective* applies to the development of such equipment as decontamination systems, protective masks and clothing,

67. See Judith Miller, Stephen Engelberg and William Broad, *Germs: Biological Weapons and America's Secret War* (New York: Simon & Schuster, 2001) for detailed descriptions of previously unknown US biological defence programmes. 'Verification Watch', *Trust & Verify*, September/October 2001, available at: http:www.vertic.org/tnv/septoct01/watch.html.

68. Chevrier and Hunger, op. cit., p. 25.

air and water filtration systems, and detection and warning devices.

Laboratory quantities of certain agents and toxins might well be required for research and testing in these areas.

In order to avoid any ambiguity, it was made clear during the negotiation of this Convention that the terms *prophylactic* and *protective* are not intended to convey any broader meaning which would in any way permit possession of biological agents or toxins for weapons purposes on the theory that such weapons were for 'defensive' warfare, retaliation or deterrence.[69]

The concern about drawing the borderline between legitimate activities and activities that lead to the creation of BW surfaced at the 3rd Review Conference in 1991. The States Parties noted 'that experimentation involving open-air release of pathogens or toxins harmful to man, animals or plants that has no justification for prophylactic, protective or other peaceful purposes is inconsistent with the undertakings contained in Article I'.[70]

There were, however, some farther-reaching proposals for clarification, which the Conference did not include in the final report. Chile, Panama, Peru and Venezuela requested that the 'Review Conference should reaffirm that the creation, by any means, of biological agents or toxins with altered properties that might increase their usefulness as weapons is not justified under the BWC for any military purpose'.[71] Although the Final Document included the above-mentioned reference to open-air release of biological or toxin agents, Australian and Finish suggestions to include a prohibition on trials involving explosive aerosolisation of agents or to require prior notification, approval and provision for the presence of representatives of an international body of oversight with regard to trials involving large-scale aerosolisation were equally rejected.[72]

Biodefence at the 5th Review Conference

The 5th Review Conference took place in the immediate wake of the September terrorist attacks, the mail-delivered anthrax spores and the revelations about the secret US biodefence research projects. Consequently, the States Parties considered the issue of biodefence activities in some detail. The draft final report proposed the following language under Article I of the BTWC:

69. William P. Rogers, Secretary of State, Report on the Biological Weapons Convention, submitted to President Nixon on 21 June 1972, US Arms Control and Disarmament Agency, *Documents on Disarmament 1972*, pp. 380-86, as cited in Nicholas A. Sims, *The Diplomacy of Biological Disarmament. Vicissitudes of a Treaty in Force, 1975-85* (London: Macmillan Press, 1988), p. 298.

70. Third 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 Declaration, Article I, document BWC/CONF. III/23/ (26 September 1991), p. 6.

71. Third 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, 'Proposals for Action by the Third Review Conference of the Biological Weapons Convention', Working Paper submitted by Chile, Panama, Peru and Venezuela, document BWC/CONF.III/COW/WP.2 (16 September 1991), p. 2.

72. S.J. Lundin, Thomas Stock and Erhard Geissler, 'Chemical and biological warfare and arms control developments in 1991', *SIPRI Yearbook 1992: World Armaments and Disarmament* (Oxford: Oxford University Press, 1992), p. 177.

> 7. The Conference notes that experimentation involving open-air release of pathogens or toxins harmful to humans is inconsistent with the undertakings contained in Article I; experimentation involving open-air release of pathogens or toxins harmful to animals or plants that has no justification for prophylactic, protective or other peaceful purposes is inconsistent with the undertakings contained in Article I.[73]

The draft text contained a sharp distinction between pathogens and toxins harmful to humans, which could under no circumstances be justified under the GPC, and pathogens and toxins harmful to animals and plants, whose release might have justification for prophylactic, protective or other peaceful purposes. This wording was significantly stronger than that of the Final Document of the 4th Review Conference, which also allowed the open-air release of human pathogens and toxins for permitted purposes:

> 7. The Conference notes that experimentation involving open-air release of pathogens or toxins harmful to man, animals or plants that have no justification for prophylactic, protective or other peaceful purposes is inconsistent with the undertakings contained in Article I.[74]

The final document of the 5th Review Conference, as considered in 2001, was not accepted by the United States.

US officials have justified the nature of the US projects on the grounds that the activities, installations and equipment are part of a defensive programme. They have also argued that the secrecy surrounding them is necessary in order not to provide potential adversaries with information about US weaknesses in BW defence. In doing so, they not only acknowledge that a wide range of activities that could contribute directly to an offensive programme fall outside the core prohibitions of the BTWC, but they may also undermine the non-proliferation norms they seek to establish by enabling countries of proliferation concern to plausibly deny that certain suspicious activities are connected to an offensive BW programme.

What is clear is that in the United States the understanding of the scope of Article I with regard to biodefence programmes has changed significantly between 1971 and the early 21st century.

73. Draft Final Declaration, op. cit., Article 1, para. 7, p. 3.

74. Final Declaration of the 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, Geneva, 25 November-13 December 1996, document BWC/CONF.IV/9, Part II, 13 December 1996, Article I, para. 7, p. 16.

Towards the 6th Review Conference

A comprehensive verification system for the BTWC will not happen any time soon. Nonetheless, the need to increase the transparency with regard to activities that are relevant to the norm against the weaponisation of disease is clear to all. States Parties to the BTWC are therefore likely to remain seized by the issue, but may have to rely on a host of already existing, but fractional measures to carve out a transparency and confidence regime. As discussed in the first chapter, some of the possible measures – the UN Secretary-General's investigative mechanism and the UNMOVIC expertise – reside outside the BTWC. Other ones are already part of the BTWC regime, but offer limited opportunities.

Although the CBM process is the only transparency-enhancing tool currently available, BTWC States Parties do not perceive it as an effective activity and consequently accord it low priority. This creates a vicious circle as the low priority confirms the limited utility of the exercise. Nonetheless, during the second half of 2005 there has been a resurgent interest in CBMs. Yet, optimising the existing CBMs and possibly considering new ones are viewed as one route to revitalise the convention.

One possible starting point would be the draft Final Report of the 5th Review Conference (2001), which suggested the expansion of the scope of some CBMs and the addition of new ones at the next meeting of the States Parties. There was widespread agreement among States Parties about these proposals, and virtual unanimity on the proposed language.

A second option is to encourage States Parties to publish their CBM submissions. Presently the information is only available to States Parties. The ability of academics or other interested parties to study the submissions for individual countries and to prepare comparative analyses of the substance of the submissions would greatly enhance the utility of the CBMs and their contribution to transparency. In that sense, the 6th Review Conference could launch a call to expand the practice of publishing the annual CBM submissions to the Internet (as has been done by Australia, the United Kingdom and the United States) or make them available upon request in any other way.

A third option is to focus on the simplification of the CBM forms. While it may not be possible to undertake this task at the 6th Review Conference, a commitment should nonetheless be for-

mulated that the exercise be undertaken in preparation for the 7th Review Conference in 2011.

An alternative approach could be the establishment of a panel of government experts. Among the tasks to be given to such a panel could be the analysis of the CBM submissions. While its members could not realistically be expected to undertake substantive verification of the accuracy of each individual declaration, they would nonetheless be able to report to the 7th Review Conference on the value of the CBM exercise and recommend changes to the process, including the relevance of certain types of CBM declarations, the submission forms and the need to modify or add new types of CBMs. Several ideas about a scientific advisory board or a panel of government experts are already in circulation in the context of efforts to regularly update States Parties on the impact of scientific and technological developments on the BTWC.

There is also a growing appreciation among States Parties of the need for some form of institutional support for the convention. However, they still need to clarify its tasks and determine the optimal number of staff in function of those tasks. While the 6th Review Conference may not yet be in a position to decide on the creation of an international body, some unit may evolve naturally from the work plan adopted for the 2007-2010 period. While such an evolution would signify a major improvement compared to the administration of the BTWC over the past three decades, it would still leave open many questions about the future direction of the convention.

Without any doubt, the establishment of some form of institutional support would instantaneously benefit the CBM process. If CBMs are considered relevant transparency-enhancing tools, then there is a clear requirement for the 6th Review Conference to look into the mechanics of information collection, processing and distribution. This institution would also be in a position to organise or facilitate assistance with the completion of the CBM returns, which may be a prerequisite to significantly increase the quality and quantity of the annual submissions. It should be noted that the idea for institutional support for the CBM process is not new: already at the 3rd Review Conference there had been an attempt to create a small 'secretariat unit' to assist governments with their CBM reporting.[75]

Finally, transparency about biodefence programmes is a clear requirement if States Parties are to retain any confidence in the

75. Nicholas A. Sims, 'The case for a BWC committee of oversight: Draft mandate and commentary', *Disarmament Diplomacy*, no. 60, September 2001, available at: http://www.acronym.org.uk/dd/dd60/60op3.htm.

compliance with the BTWC. At the same time, the verification of such activities is close to improbable in the current international political climate. In particular, it is highly unlikely that the United States will accept a final declaration of the 6th Review Conference that limits the scope of its biodefence preparedness activities. Nonetheless, it is important that the issue be raised during the deliberations so that international concern about biodefence activities, and their lack of transparency in particular, is registered. It should be noted that biodefence programmes will be a major issue in any proposal related to the development of verification or transparency – enhancing mechanisms. It should be equally noted that the issue pertains not just to the United States, but to any other country that conducts programmes under Article I of the BTWC.

Some concrete proposals for modest progress at generating transparency or clarifying the scope of what is permitted under the GPC include the adoption of language on open-air experiments similar to that proposed in the draft final document under discussion in December 2001. If that proves impossible, then the phrasing contained in the Final Document of the 4th Review Conference should be reiterated. Other possible initiatives would fit into efforts to make the CBMs more meaningful. Thus States Parties could emphasise the need for fully comprehensive declarations under CBM A, parts 1 and 2, and add that no biodefence-related activities can be exempted from this obligation. They could furthermore investigate whether certain types of biodefence activity can be made declarable under the heading of biosecurity and safety, and adapt the CBM declaration requirement to reflect this. Finally, the CBM proposals that circulated during the first session of the 5th Review Conference could be expanded in order to increase the types of declarable facilities and activities.

Scientific and Technological Challenges to the BTWC

Kathryn Nixdorff

3

Introduction

Characteristic of the technologies connected with modern forms of research in the life sciences is the explosive rapidity with which new developments occur. Over the past three decades biotechnology has been revolutionised by molecular biology, genetics, genomics and proteomics. In the biomedical sciences these developments are essential for research designed to unravel the mechanisms of disease-causing processes, including the pathogenic mechanisms micro-organisms use to cause infectious diseases. Knowledge gained by this research allows a much improved approach for the development of more effective diagnostic and therapeutic procedures aimed at countering diseases and improving health in general. However, the same techniques used to improve health and protect against infections can of course be misused to produce new and more effective biological weapons (BW).

We need to be concerned not only about the deliberate misuse of science and technology for the production of biological weapons but also about the inadvertent creation of micro-organisms and bioregulators that have enhanced potential for causing disease. There have been several examples of such work reported in the scientific literature over the past few years, the most prominent example being the mousepox experiment,[1] which highlights the fact that this is a phenomenon that gives equally great cause for concern.

The biotechnology revolution is continuing on into the pharmacological revolution with its emphasis on drug discovery,[2] in which bioregulators will be gaining more and more relevance for biochemical weapons control.[3] In this regard, there is clear evidence of a shift in focus away from the possiblity of using micro-organisms malignly to cause infectious diseases to the possibility of using bioregulators (biochemical agents) as weapons to disrupt the operation of interacting biological systems.[4] An example is the balance provided by interactions of the neuroendocrine and the

1. R.J. Jackson, A.J. Ramsay, C. Christensen, S. Beaton, D.F.R. Hall and I.A. Ramshaw, 'Expression of mouse interleukin-4 by a recombinant ectromelia virus suppresses cytolytic lymphocyte responses and overcomes genetic resistance to mousepox', *Journal of Virology*, vol. 75, 2001, pp. 1205-10.

2. M. Wheelis, 'Biotechnology and biochemical weapons', *The Nonproliferation Review*, Spring 2002, pp.48-53.

3. M. Dando, 'Genomics, bioregulators, cell receptors and potential biological weapons,' *Defense Analysis*, vol. 17, 2001, pp. 239-258.

4. A. Kelle, K. Nixdorff and M.R. Dando, *Controlling Biochemical Weapons. Adapting Multilateral Arms Control for the 21st Century* (Basingstoke: Palgrave Macmillan, 2006).

immune systems, with the double vulnerability of these systems to modulation. Manipulation of one system with bioregulators will cause profound effects on the other. In the light of this shift, dealing with advances in the life sciences becomes enormously more complex.

Advances in Science and Technology

The following is a brief review of some scientific and technological developments that could pose a challenge to the Biological and Toxin Weapons Convention (BTWC).

Genomics

Genome analyses are concerned with the determination of the nucleotide base sequence of the genomic (chromosomal) deoxyribonucleic acid (DNA) of organisms. In its widest application, genomics includes efforts to determine the functions of the genes delineated through the sequence analyses.

Genome analyses of micro-organisms

The complete sequencing of the genomes of over 100 prokaryotic micro-organisms and many viruses has been achieved, and many others are currently being sequenced.[5] Recently, considerable progress has been made in the area of high-throughput automated DNA sequencing in connection with many genome sequencing projects that will ensure an even more rapid pace of data gathering in the future. These methods are being intensively applied to the sequencing of the genomes of pathogenic micro-organisms, with the aim of discovering and identifying new virulence determinants. It is hoped that targets for the development of diagnostic and chemotherapeutic reagents as well as vaccines can be defined in the course of these investigations.[6] Indeed, the 'need for newer and safer antimicrobial drugs continues unabated' and the impact of genomics on anti-infectives drug discovery has been and still is enormous.[7] Naturally, genomic sequencing has dual-use relevance for the BTWC.[8] In this regard, the discovery and genetic definition of virulence factors contributing to the pathogenicity of a micro-organism could at the same time facilitate the manipulation of

5. For a current overview of genome sequences, see: http://www.ncbi.nlm.nih.gov:80/PMGifs/Genomes/micr.html.

6. P.J. Jenks, 'Sequencing microbial genomes – what will it do for microbiology?', *Journal of Medical Microbiology*, vol. 47, 1998, pp. 375-82.

7. T. Parkinson, 'The impact of genomics on anti-infective drug discovery and development', *Trends in Microbiology*, Supplement, vol. 10, 2002, pp. S22-S26.

8. C.M. Fraser and M.R. Dando, 'Genomics and future biological weapons: the need for preventive action by the biomedical community', *Nature Genetics*, vol. 29, 2001, pp. 253-56.

those properties to enhance their effects or to transfer these properties to other micro-organisms that do not already possess them.

At the same time, genomics can play a very positive role for verification of compliance to the BTWC. The need for effective methods of identifying micro-organisms with increased virulence or transmissibility as well as antibiotic-resistant strains has prompted a novel approach to molecular typing[9] primarily designed for global epidemiology. This approach is called multilocus sequence typing (MLST),[10] which involves using the polymerase chain reaction (PCR) to amplify DNA fragments of a limited set (for example seven) of designated genes of a particular bacterium and then sequencing the PCR products either manually or by using an automated sequencer. For each gene, deviating sequences in different isolates of the bacterium are designated as alleles of that gene and the alleles of the seven loci provide an allelic profile, which unambiguously defines the sequence type of each isolate. The accumulation of nucleotide changes (mutations) in what is known as conserved genes is relatively slow, and the allelic profile based on such slowly evolving genes is stable enough over time for the method to be well suited for global epidemiology. Genes that change more rapidly may be useful for short-term, local epidemiology to determine, for example, if different isolates from a localised outbreak of disease are the same or different strains.

The technique has been successful in identifying antibiotic resistant clones of *Streptococcus pneumoniae* isolated from an outbreak in Taiwan, and in tracing the origin of these clones.[11] In these studies, some isolates were identified as members of a multiply-antibiotic-resistant clone originating from Spain, while others were of Far Eastern origin. Further successful applications have been made, such as in the case of *Neisseria meningitidis* strains,[12] as well as with many other micro-organisms.[13]

A similar approach was used to study genetic relationships within *Bacillus anthracis*.[14] Even though this bacterium is one of the most genetically homogeneous pathogens known, the authors of the study were able to determine genomic regions containing enough variability to allow discrimination among different *Bacillus anthracis* isolates. The sequences used for profiling were those found in DNA areas known as variable number tandem repeat (VNTR) sequences, whose function is essentially unknown.

These studies have been extended in a comparison of whole-genome sequences that identify further markers that can be used to

9. Molecular typing refers to identification of micro-organisms using methods in molecular biology, in this case identifying particular DNA sequences characteristic for a micro-organism.

10. R. Urwin, and M.C.J. Maiden, 'Multi-locus sequence typing: a tool for global epidemiology', *Trends in Microbiology*, vol. 11, 2003, pp. 479-87.

11. M.C. Enright and B.G. Spratt, 'Multilocus sequence typing', *Trends in Microbiology*, vol. 7, 1999, pp. 482-87.

12. M.C.J. Maiden, J.A. Bygraves, E. Feil, G. Morelli, J.E. Russell, R. Urwin, Q. Zhang, J. Zhou, K. Zurth, D.A. Caugant, I.M. Feavers, M. Achtman, and B.G. Spratt, 'Multilocus sequence typing: a portable approach to the identification of clones within populations of pathogenic microorganisms', *Proceedings of the National Academy of Sciences USA*, vol. 95, 1998, pp. 3140-45.

13. R. Urwin and M.C.J. Maiden (2003), op. cit.

14. P. Keim, L.B. Price, A.M. Klevytska, A.L. Smith, J.M. Schupp, R. Okinaka, P.J. Jackson, and M.E. Hugh-Jones, 'Multiple-locus variable-number tandem repeat analysis reveals genetic relationships within *Bacillus anthracis*', *Journal of Bacteriology*, vol. 182, 2000, pp. 2928-36.

distinguish among *Bacillus anthracis* strains.[15] Paticularly useful markers in addition to VNTRs were single nucleotide polymorphisms[16] (SNPs) and inserted or deleted sequences (indels). For example, the investigators observed two SNPs and two indels that differed between *Bacillus anthracis* isolated from the anthrax letter attack that occurred in Florida in 2001 and the Ames strain from Porton Down, which lacks both virulence plasmids. In another example, the authors found that two other *Bacillus anthracis* strains, each of which carried one of the two virulence plasmids lacking in the Porton Down stain, differed from the Florida strain by 38 SNPs, three indels and eight VNTRs. The researchers hypothesise that polymorphisms can appear after relatively few generations of the bacteria. Their work shows in any case that genome-based analyses can indeed be useful in determining the origin of *B. anthracis* strains.

Genome-based analysis of microbial pathogens will certainly provide a powerful new tool for investigation of infectious disease outbreaks.[17] As such it could contribute decisively to promoting transparency and building confidence in a BTWC compliance regime, which is a strong criterion for preventive arms control.[18]

Human genome analyses

The sequencing of the entire human genome was carried out with the expressed aim of gaining insight into the organisation and function of genetic material, providing a solid, molecular base for physiology and medicine, while at the same time obtaining knowledge about inherited genetic disorders as well as the development of cancer.[19] Notwithstanding the potential benefits that this could render to the fields of biology and medicine, critics have expressed the fear that the information gained from this project may be used to create genetic or 'ethnic' biological weapons, that is, weapons that can be used to attack a particular racial or ethnic group.

At present, this seems unlikely for several reasons. For example, it has been pointed out in several reports[20] that races do not exist from a genetic perspective, but are rather social categories reflecting slightly different genetic constitutions that have arisen partly due to local adaptations in populations living under different environmental conditions. These differences reflect, however, only gradients of change in the frequencies of allelic (alternative) forms of genes in particular populations. This is illustrated by the inheritance of the ABO blood group substances: the frequencies of cer-

15. T.D. Read, S.L. Salzberg, M. Pop, M. Shumway, L. Umayam, L. Jiang, E. Holtzapple, J.D. Busch, K.L. Smith, J.M. Schupp, D. Solomon, P. Keim and C.M. Fraser, 'Comparative genome sequencing for discovery of novel polymorphisms in *Bacillus anthracis*', *Science*, vol. 296, 2002, pp. 2028-33.

16. Polymorphism (genetic) refers to the simultaneous occurrence in the population of genomes showing variations at a given position in the DNA molecule, none of which is predominant in the population.

17. Ibid.

18. K. Nixdorff, M. Hotz, D. Schilling and M. Dando, *Biotechnology and the Biological Weapons Convention*. (Münster: Agenda, 2003).

19. T. Bartfai, S. J. Lundin and B. Rybeck, 'Benefits and threats of developments in biotechnology and genetic engineering', Appendix 7A. *SIPRI Yearbook 1993: World Armaments and Disarmament* (New York: Oxford University Press, 1993), pp. 293-305.

20. Ibid.; M.R. Dando, V. Nathanson and M. Darvell, 'Genetic Weapons', Chapter 4 in *Biotechnology, Weapons and Humanity* (London: Harwood Academic Publishers, 1999), pp. 129-36; R.A. Brown and G.J. Armelagos, 'Apportionment of Racial Diversity: a Review', *Evolutionary Anthropoplogy*, vol. 10, 2001, pp. 34-40.

tain ABO blood types may vary considerably in different populations. In this regard, approximately 41 percent of individuals in the US have blood group A, whereas 10 percent have group B.[21] In other populations these frequencies may be different; however, the full complement of ABO blood types would be found in all populations in varying frequencies.

It has been suggested that single nucleotide polymorphisms or SNPs are the most frequent form of variation in the human genome (see also the discussion above about using SNPs to type *Bacillus anthracis* strains genetically) and that, in isolated populations, certain SNPs may be more frequently expressed than usual. However, in studies that have purposely tested isolated populations for a possible increased frequency in the incidence of particular polymorphisms, none have been found that can absolutely define ethnic or racial groups.[22] Population geneticists can, however, assign individuals to a particular continent based on their genetic makeup, but to do this they have to use several genetic markers, and in approximately 30 percent of the cases the placement is wrong. It is even more difficult to assign individuals to a subcontinental area.[23] There are, nonetheless, genetic markers that are specific for particular populations or ethnic groups, but these markers are usually present in less than 25 percent of that population. This is especially true for markers that could conceivably be used as a target.[24]

While this small percentage of selectivity might be enough to cause disruption in targeted populations, the technical difficulty of delivery limits the feasibility of use even more. There are numerous problems involved with being able to deliver a sufficient amount of a desired substance to the correct target cells. Nevertheless, active research is being carried out with the aim of improvement of targeted delivery systems for gene and cancer therapy, so advances in this area can be expected in the future (see below).

Even though the creation of ethnic biological weapons that can be feasibly deployed seems unlikely at the present time, several reports caution that it cannot be ruled out and suggest that this work continue to be carefully monitored: '...there is a need to keep careful watch on research in this area and to give attention to means by which malign developments can be thwarted. Whilst we should hope that genetic weapons are never developed, it would be a great mistake to assume that they never can be, and therefore that we can safely afford to ignore them as a future possibility'.[25]

21. W.C. Boyd, *Fundamentals of Immunology*, Fourth edition (New York: John Wiley and Sons, 1966).

22. C. Romualdi, D. Balding, I.S. Nasidze, G. Rish, M. Robichaux, S.T. Sherry, M. Stoneking,, M.A. Batzer and G. Barbujani,, 'Patterns of human diversity, within and among continents, inferred from biallelic DNA polymorphisms', *Genome Research*, vol. 12, 2002, pp. 602-12; C.M. Fraser and M.R. Dando (2001), op. cit.

23. R.A. Brown and G.J. Armelagos, (2001), op. cit.

24. Ibid.; and Romualdi et al. (2001), op. cit.

25. M.R. Dando, V. Nathanson and M. Darvell (1999), op. cit.

Additional concerns lie in the possibility of creating genetic markers in a particular population, for example, by immunisation or targeted delivery of new genes to cells using a gene vector. Such marked populations may then be vulnerable to genetic weapons.[26]

It should be remembered that biological warfare may be directed against plants and animals as well as humans. It has rightly been pointed out that while ethnic weapons targeting specific groups of humans are at present not a very realistic prospect, equivalent weapons designed to target specific varieties of plants and animals are a real possibility. For example, agriculture, particularly in many developed countries, employs monocropping of large acreages with genetically identical cultivars, which would be highly vunerable to genotype-specific weapons.[27]

Creating and manipulating micro-organisms

Viruses

Of particular concern is the use of modern techniques of molecular biology and information technology to create viruses, a phenomenon that has been the subject of recent reports. Headlines in the *New Scientist* from 11 July 2002 made the sensational announcement that 'Scientists build polio virus from scratch'.[28] This referred to the work of a research group at the State University of New York at Stony Brook[29] in which the authors reported that they built the virus that causes polio from the genomic sequence information contained in public databases and readily available technology. There were decidedly mixed feelings about the report. Some scientists were not surprised at the breakthrough because much of the technology has been around for more than a decade and so the experiment was expected to be successful. In fact, the same researchers showed previously that poliovirus cDNA (complementary DNA, a complementary copy of RNA) contained in a plasmid vector[30] could be transcribed to produce highly infectious viral RNA.[31] In addition, they have also reported on the de novo synthesis of poliovirus from transcript viral RNA in a cell-free extract of uninfected HeLa cells.[32] What was different about the work reported in *Science* was that the viral cDNA was made by chemical synthesis of several segments of DNA corresponding to the polio virus genome (RNA) and combining these segments together into a plasmid vector. While the poliovirus itself has little relevance as a

26. K. Nixdorff, 'Assault on the immune system', *Disarmament Forum*, vol. 1, 2005, pp. 25-35

27. M. Wheelis, 'Agricultural biowarfare and bioterrorism: an analytical framework and recommendations for the fifth BTWC review conference', Paper presented at the 14th Workshop of the Pugwash Study Group on the Implementation of the Chemical and Biological Weapons Conventions: Key Issues for the Fifth BWC Review Conference 2001, Geneva, Switzerland, 18-19 November.

28. R. Orwant, 'Scientists build polio virus from scratch', *New Scientist*.com news service, 11 July 2002.

29. J. Cello, A.V. Paul and E. Wimmer, 'Chemical synthesis of poliovirus cDNA: generation of infectious virus in the absence of natural template', *Science*, vol. 297, 2002, pp. 1016-18.

30. Plasmid refers to a small molecule of DNA that can reproduce itself inside a cell separately from the chromosome. A plasmid vector (vehicle) is a plasmid that is used to transmit or transfer genetic material to a cell or organism.

31. S. van der Werf, J. Bradley, E. Wimmer, F.W. Studier and J.J. Dunn , 'Synthesis of infectious poliovirus RNA by purified T7 RNA polymerase.',*Proceedings of the National Academy of Sciences USA*, Vol. 82, 1986, pp. 2330-34.

32. A. Molla, A. Paul and E. Wimmer, 'Cell-free de novo synthesis of poliovirus', *Science*, vol. 254, 1991, pp. 1647-51.

biological weapon this work nevertheless has major implications for biosecurity. The study has been supported by the US Department of Defense for the past three years and was reportedly undertaken to emphasise the need for awareness of the possibility of creating a virus from sequence information.[33] In the same vein, another scientific report described the generation of a bacterial virus within two weeks using synthetic segments of DNA.[34]

Many experts are quick to point out that the poliovirus and the bacterial virus have a fairly simple composition, so that this feat could not be readily repeated, at least at the present time, in the case of more complex viruses such as the causative agent of smallpox. Nevertheless, with the pace of advancement in biotechnology that has been experienced over the last ten years, awareness of the possibility of creating viruses using genetic information is crucial and work in this area should be carefully monitored. The recent reconstruction of a virus containing all eight coding sequences of the 1918 Spanish flu virus[35] is a case in point. In this regard, it should be noted that productivity improvements in DNA synthesis and sequencing, which could greatly aid in construction of synthetic micro-organisms, are increasing at enormous rates.[36]

Of further concern is the fact that in some respects similar research is actively being carried out on viruses of biological weapons relevance that have genomes that are less complex than those of pox viruses. In this case, researchers have been working on the development of artificial replication systems for both Ebola and Marburg viruses,[37] which cause a severe type of hemorrhagic fever. This work is centered around the creation of an infectious virus from DNA clones. It is hoped that methodologies might be developed which would allow specific engineering of filoviruses (a virus group to which Ebola and Marburg belong). The development of such methodologies would provide a powerful research tool to study replication of the virus, dissect the mechanisms of pathogenicity and further vaccine development. However, 'concerns over the potential dangers and possible misuse of such systems have led to recommendations (and in some cases regulations) limiting the availability of the components, even to reputable institutions in which research is guided by the oversight of a biosafety committee'.[38]

There is a great deal of interest in finding ways to more easily manipulate pox virus genomes *in vitro* for research and therapeutic purposes. Poxviruses have genomes that are composed of linear

33. R. Orwant (2002), op. cit.

34. H.O. Smith, C.A. Hutchison III, C. Pfannkoch and J.C. Venter, 'Generating a synthetic genome by whole genome assembly: fX174 bacteriophage from synthetic oligonucleotides', *Proceedings of the National Academy of Sciences USA*, vol. 100, 2003, pp. 15440-45.

35. T.M. Tumpey, C.F. Basler, P.V. Aguilar, H. Zeng, A. Solorzano, D.E. Swayne, N.J. Cox et al, 'Characterisation of the reconstructed 1918 Spanish influenza pandemic virus', *Science*, vol. 310, 2005, pp. 77-80.

36. R. Carlson, 'The pace and proliferation of biological technologies', *Biosecurity and Bioterrorism: Biodefense Strategy, Practice and Science*, vol. 1, 2003, pp. 1-12.

37. E. Mühlberger, M. Weik, V.E. Volchkov, H.D. Klenk and S. Becker, 'Comparison of the transcription and replication strategies of Marburg virus and Ebola virus by using artificial replication systems', *Journal of Virology*, vol. 73, pp. 2333-42.

38. A. Sanchez, A.S. Kahn, S.R. Zaki, G.J. Nabel and T.G. Ksiazek, 'Filoviridae: Marburg and Ebola viruses', Chapter 40 in: D.M. Knipe and P.M. Howley (eds.), *Fields Virology*, vol. 1, Fourth edition (Philadelphia: Lippincott Williams & Wilkins, 2001), pp. 1279-1304.

double-stranded DNA molecules that are resolved from transient head-to-head or tail-to-tail structures called concatemers during replication. The introduction of new genes into the vaccinia virus genome is usually carried out by homologous recombination in mammalian cells, which is rather inefficient. Also, time-consuming selection procedures are required. Now, a way to facilitate manipulation of this complex genome has been reported.[39] The method involves cloning the entire genome of vaccinia virus (VAC) as a continuous molecule in a plasmid (circular DNA molecule that can be replicated in bacteria), which takes on the form of a bacterial artificial chromosome (BAC). This VAC-BAC could thus be stably propagated in the bacterium *Escherichia coli* and subsequently converted into an infectious virus in mammalian cells. This system can greatly facilitate genetic studies on pox viruses, but at the same time it is decidedly dual-use.

Synthetic biology

Another emerging technology that is 'on the threshold of synthesising new life forms'[40] is that of synthetic biology, which is the design and assemblage of interacting genes into circuits in order to direct cells to perform new tasks. As an example, the bacterium *Escherichia coli* was refitted with a gene circuitry that enabled it to synthesise a precursor to the antimalarial drug artemisinin.[41] In a further example, researchers have built a population control circuit that autonomously regulates the density of a population of bacterial cells. It incorporates a mechanism for programmed cell death in response to changes in the environment.[42] According to the authors of the study, this work 'lays the foundation for using cell-cell communication to programme interactions among bacterial communities, allowing the concept of communications-regulated growth and death to be extended to engineering synthetic ecosystems.'

This technology is one of the most difficult to master and requires concerted effort from different disciplines such as engineering, computer science and biology.[43] Efforts are being made, however, to make biological engineering simple, primarily through standardisation, decoupling and abstraction.[44] Standardisation envisions devising and promulgating a set of 'standard, interchangeable biological parts',[45] a catalogue of 'BioBricks' that can be built together and placed into living cells, where they can impart

39. A. Domi and B. Moss, 'Cloning the vaccinia virus genome as a bacterial artificial chromosome in *Escherichia coli* and recovery of infectious virus in mammalian cells', *Proceedings of the National Academy of Sciences USA*, vol. 99, 2002, pp. 12415-20.

40. P. Ball, 'Starting from scratch', *Nature*, vol. 431, 2004, pp. 624-26.

41. V.J.J. Martin, D.J. Pitera, S.T. Withers, J.D. Newman and J.D. Keasling, 'Engineering a mevalonate pathway in Escherichia coli for production of terpenoids', *Nature Biotechnology*, vol. 21, 2003, pp. 796-802.

42. L. You, R. S. Cox III, R. Weiss and F.H. Arnold, 'Programmed population control by cell-cell communication and regulated killing', *Nature*, vol. 428, pp. 868-71.

43. E. Check, 'Designs on life', *Nature*, vol. 438, 2005, pp 417-18.

44. D. Endy, 'Foundations for engineering biology', *Nature*, vol. 438, 2005, pp. 449-53.

45. MIT hosted Registry of Standard Biological Parts, available at http://parts.mit.edu.

new functions to those cells. Decoupling of design and fabrication is seen as a further step towards simplification. Abstraction would allow individuals to work at one level of complexity without having to know any details of the work going on at another level. These principles have been tested in international intercollegiate Genetically Engineered Machine (iGEM) competitions at Massachusetts Institute of Technology (MIT) in which students, some of whom have little background in biology, design and build new genetic circuits that can function in living cells.[46] Synthetic biology has 'opened up extraordinary possibilities for biomedical discovery and environmental engineering', but at the same time the 'scope for abuse or inadvertent disaster could be huge'.[47]

Vulnerability of the immune system to attack

A great deal of focus has been placed on the immune system and its vulnerability to manipulation. The immune system plays a crucial role in protecting the organism against infectious diseases. This is clearly demonstrated in the case of individuals with genetic defects in certain immune mechanisms, which frequently result in a devastating infectious disease state and eventual death, despite the use of antibiotics or other chemotherapeutic agents. Indeed, the pathogenicity of a micro-organism can only rightly be defined within the scope of its interaction with the immune system. To be a successful pathogen, a micro-organism must possess strategies that enable it to evade immune defence mechanisms. Immune responses are regulated to a great extent through the production of cytokines, which are bioregulators synthesised mainly by cells of the immune system, that can exert both positive and negative effects depending upon the amounts produced. The immune system is thus very vulnerable to both immune evasion strategies and immune bioregulators, a situation that can be easily exploited for either good or malign purposes. The central dual-use role that the immune system plays in the context of life sciences research can be seen in the examples of research activities that have been frequently quoted in recent years as being potentially extremely dangerous. Most of these examples, including the mousepox experiment[48] and the potentiation of a virulence factor of vaccinia virus,[49] involve the exploitation of immune evasion strategies.

Another classical example of an immune evasion strategy is antigenic variation, which involves the mutation of surface compo-

46. E. Check, (2005), op. cit.

47. P. Ball (2004), op. cit.

48. R.J. Jackson, A.J. Ramsay, C. Christensen, S. Beaton, D.F.R. Hall and I.A. Ramshaw (2001), op. cit.

49. A.M. Rosengard, Y. Liu, Z. Nie and R. Jimenez, 'Variola virus immune evasion design: expression of a highly efficient inhibitor of human complement', *Proceedings of the National Academy of Sciences USA*, vol. 99, 2002, pp. 8808-13.

nents of the micro-organism so that the immune system can no longer recognise and respond to that pathogen.[50] Viruses that use this strategy with extraordinary frequency are the influenza virus and the human immunodeficiency virus (HIV), better known as the AIDS virus. It has become evident, however, that there are many other immune-evasion strategies that pathogens might use. Some of these include the negative regulation of complement (a group of serum components essential for innate immunity) activity through the production of proteins that mimic inhibitors of complement components,[51] the induction of the production of cytokine homologues by certain viruses so that the immune response is re-directed in ways that suppress antiviral activity,[52] or the induction of the production of a variety of viral inhibitors of apoptosis, or programmed cell death. In doing the latter, viruses protect the cells they invade from dying, so that these cells will continue to produce new viral particles. Other viruses can suppress the activity of so-called natural killer lymphocytes that are normally an important component of innate immunity.[53]

There are two types of immunity, innate and adaptive. The innate system has a relatively low specificity for micro-organisms in that the cells of this system (e.g. macrophages and dendritic cells) recognise what have been termed pathogen-associated molecular patterns (PAMPs), which are mainly components of many different micro-organisms. The adaptive immune system has a high specificity and recognises specific antigens on single micro-organisms. Innate immune system components are ready to work immediately (within minutes or hours) upon encounter with micro-organisms without requiring much induction, but this immunity is of relatively short duration. The adaptive immune system cells (B and T lymphocytes) must be induced by antigens to go through phases of activation, proliferation and differentiation before they can function fully. This takes several days to weeks, but once induced, these adaptive responses work longer than innate immune responses. Nevertheless, the innate immune system represents the all-important first line of defence against pathogens and is absolutely essential for keeping an infection in check before adaptive immunity can be induced. If innate immunity is malignly attacked, the battle against infections is lost from the start.[54]

Innate immunity is one area of immunology that has gained enormous importance and developed most rapidly since the middle of the 1990s. With the discovery of the mammalian Toll-like

50. S. Gupta, N. Ferguson and R. Anderson, 'Chaos, persistence, and evolution of strain structure in antigenically diverse infectious agents', *Science*, vol. 280, 1998, pp. 912-15.

51. A. Alcami and U.H. Koszinowski, 'Viral mechanisms of immune evasion', *Trends in Microbiology*, vol. 8, 2000, pp. 410-18.

52. Ibid.

53. L.N. Carayannopoulos and W. M.Yokoyama, 'Recognition of infected cells by natural killer cells', *Current Opinion in Immunology*, vol. 16, 2004, pp. 26-33.

54. K. Nixdorff (2005), op. cit.

receptors (TLRs)[55] and other similar receptors of the NOD (nucleotide-binding oligomerisation domain) family, their importance in governing the recognition of and response to different classes of micro-organisms by macrophages (phagocytes)[56] of the innate immune system has been revealed. Indeed, research activity in this area of immunology has reached whirlwind proportions in the past few years.

In innate immunity, macrophages are activated most prominently through engagement of TLRs on the cell surface (or in membrane compartments inside the cell) by the PAMPs of micro-organisms. There are several different TLRs and each is activated by a different set of PAMPs. The PAMPs are generic in the sense that each is found on a variety of micro-organisms. For example, lipopolysaccharide, which activates macrophages through TLR4, is found in a large number of different bacteria. Activation of macrophages over TLRs leads to an intracellular signalling cascade that ends in the activation of genes that control, among other things, the production of cytokines.[57] Type I interferons (a and b) are cytokines produced by activated macrophages that are essential for a successful defence against many viral infections. These phagocytes are also potent producers of inflammatory cytokines including interleukin 1 beta (IL-1b), IL-6 and tumour necrosis factor alpha (TNFa), which mediate reactions designed to regulate immune responses and fight infections. When these cytokines are produced in moderate amounts, mild inflammatory reactions occur that contribute greatly to defence mechanisms directed against pathogens and to the healing process in general. If they are produced in particularly large amounts or continually during chronic illnesses, this can lead to various inflammatory disorders such as coronary insufficiency, thrombus formation, hypoglycemia, and in some cases to autoimmunity, or even shock and death.[58] This makes these activities particularly vulnerable to malign modulation, such as by targeting the TLRs with PAMPs to induce over-reactions. On the other hand, inhibiting the production of these cytokines by using substances that can negatively regulate their synthesis could result in a lack of innate immune protection.

There have been several recent reports in the scientific literature describing the possibilities of targeting the innate immune system with different TLR agonists for therapeutic purposes. Agonists are substances that exert effects on cells, usually through the interac-

55. R, Medzhitov, P. Preston-Hurlburt and C.A. Janeway, Jr., 'A human homologue of the *Drosophila* Toll protein signals activation of adaptive immunity', *Nature*, vol. 388, 1997, pp. 394-97.

56. A. Poltorak, X. He, I. Smirnova, M.Y. Liu, C.V. Huffel, X. Du, D. Birdwell, E. Alejos, M. Silva, C. Galanos et al., 'Defective LPS signaling in C3H/HeJ and C57BL/10ScCr mice: mutations in *Tlr4 gene', Science*, vol. 282, 1998, pp. 2085-88.

57. S. Akira, 'Mammalian Toll-like Receptors', *Current Opinion in Immunology*, vol. 15, 2003, pp. 5-11; M. Triantafilou and K. Triantafilou, 'Lipopolysaccharide recognition: CD14, TLRs and the LPS-activation cluster', *Trends in Immunology*, vol. 23, 2002, pp. 301-04.

58. E.T. Rietschel and H. Brade, 'Bacterial endotoxins', *Scientific American*, vol. 267, 1992, pp. 54-61.

tion with receptors; in this case the agonists are the PAMPs referred to above, either in natural form or designed. One TLR agonist (Aldara, an imidazole quinolone developed by 3M Pharmaceuticles of St. Paul, Minnesota) is licensed for use in humans for certain viral infections and skin cancers, while other agonists are in advanced stages of clinical development.[59] For example, some imidazole quinolones (such as Aldara) have been used to target TLR7 and TLR8 in the treatment of genital warts and other diseases caused by human papillomaviruses,[60] and also for treatment of chronic hepatitis C.[61] Oligodeoxynucleotides (pieces of DNA) from bacteria that contain non-methylated CpG motifs (regions of DNA containing an increased density of the nucleoside base sequence cytosine-guanine linked by a phosphate group) can be used to target TLR9 in an approach to shift allergic antibody responses (type Th2) to cell-mediated cytokine responses (type Th1). Treatment of asthma patients with CpG oligodeoxynucleotides seems to reduce the disease, without the serious side effects seen when treating patients with Th1-type cytokines directly.[62]

Indeed, TLR9 agonists apparently provide broad protection against bacterial and viral infections through Th1-type immune responses. Studies in rodents have shown that CpG oligodeoxynucleotides have immunoprotective effects against a wide variety of bacteria and viruses (including several of potential biological weapons relevance), as well as one fungus and several animal parasites. In this regard, targeting one TLR with one agonist such as CpG oligodeoxynucleotides will give generic protection. For this reason, there is a great deal of interest in developing TLR agonists for biodefence purposes. The use of CpG oligodeoxynucleotides in most animal models requires that they be administered 3 to 6 days before infection.[63] In one study, protection was evident for a period of from approximately 2 days after treatment up to 2 weeks later.[64] These studies caution, however, that excessive activation of innate immune responses can result in autoimmune disease and septic shock. Indeed, inflammation and autoimmune disease has been described in mice treated with CpG oligodeoxynucleotides administered through the intranasal route.[65] This detrimental reaction can apparently be limited by activating the receptors for a short time only, but re-treatment may be necessary to maintain protection.[66]

The special position held by innate immunity relative to the control over infectious diseases is attested by the fact that the National Institute of Allergy and Infectious Diseases (NIAID) of the US

59. C. Amlie-Lefond, D.A. Paz, M.P. Connelly, G.B. Huffnagle, K.S. Dunn, N.T. Whelan and H.T. Whalen, 'Innate immunity for biodefense: A strategy whose time has come', *Basic and Clinical Immunology*, vol. 116, pp. 1334-42.

60. R.J. Ulevitch, 'Therapeutics targeting the innate immune system', *Nature Reviews Immunology*, vol. 4, 2004, pp. 512-20.

61. C. Schmidt, 'Toll-like receptor therapies compete to reduce side effects', *Nature Biotechnology*, vol. 24, 2006, pp. 230-31.

62. R.J. Ulevitch, op. cit.

63. Amlie-Lefond et al. (2005), op. cit.

64. D.M. Klinman, 'Immunotherapeutic uses of CpG oligodeoxynucleatides', *Nature Reviews Immunology*, vol. 4, pp. 249-59.

65. F. Obermeier, N. Dunger, L. Demi, H. Herfarth, J. Scholmerich and W. Falk, 'CpG motifs of bacterial DNA exacerbate colitis of dextran sulfate sodium-treated mice', *European Journal of Immunology*, vol. 34, 2002, pp. 251-62.

66. Amlie-Lefond et al. (2005), op. cit.

National Institutes of Health (NIH) expanded its programme significantly in 2003 to attract immunologists to the area of biodefence research.[67] In this regard, NIAID reported that it 'awarded a multi-component grant to create an "encyclopedia" of innate immunity: a comprehensive and detailed picture of this ancient, essential first line of defense against bacterial and fungal diseases'. The stated goal of this undertaking is to gain knowledge that could lead to the development of treatments for infectious diseases. At the same time, however, this information could provide a blueprint for malign attacks on the innate immune system.

Nanotechnology

In the past five years nanotechnology has grown to be a world-wide scientific and industrial enterprise.[68] Nanotechnology can be defined as dealing with 'structures of sizes between 0.1 nanometre (single atom) and 100 nanometres (large molecule)'. One nanometre is equal to 10^{-9} of a metre, or a billionth of a metre.[69] In the present context, nanotechnology can be viewed as a converging technology, 'providing a common hardware for molecular engineering and allowing for the realisation of desirable architectures. Nanotechnology enables biotechnology by developing new imaging techniques, probes and sensors; and it contributes to the miniaturization demands of information technology.'[70] Further definitions of nanotechnology include: 'arranging molecules (atoms) as precisely as possible so as to perform a designated function, doing with real molecules what computer graphics does with molecular models, and putting what you want where you want it and having it do what you want it to do'.[71] In the following sections, more specific ways in which nanotechnology has a potential as an enabling technology will be discussed.

The pharmacological revolution

We are right in the middle of what has been termed the pharmacological revolution, in which combinatorial chemistry, genomics and proteomics all play essential roles in drug-discovery.[72] Indeed, the development of patient- and genome-specific 'designer drugs' has been identified at a recent workshop organised by the National Academy of Sciences in the US as one of the likely major trends in the global pharmaceutical industry.[73] Combinatorial chemistry

67. NIH (2003) NIAID biodefense research agenda for CDC category A agents. *Progress Report*, August 2003. http://www.niaid.nih.gov/biodefense/research/bioresearchagenda.pdf

68. R. Service, 'Nanotechnology grows up', *Science*, vol. 304, 2004, pp. 1732-34.

69. J. Altmann, *Military Nanotechnology: Potential Applications and Preventive Arms Control* (London: Routledge, 2006).

70. National Academies of Science (NAS), Chapter 4: 'Emerging and converging technologies', in *An International Perspective on Advancing Technologies and Strategies for Managing Dual-Use Risks: Report of a Workshop*. Committee on Advances in Technology and the Prevention of Their Application to Next Generation Biowarfare Threats, Institute of Medicine and National Research Council. (Washington, D.C.: The National Academies Press, 2005), pp. 57-71. See: www.nap.edu.

71. Ibid.

72. M. Wheelis, 'Biotechnology and biochemical weapons', *The Nonproliferation Review*, vol. 9, 2002,

73. NAS, Chapter 3: 'Drivers of international biotechnology development', *An International Perspective on Advancing Technologies and Strategies for Managing Dual-Use Risks: Report of a Workshop*, op. cit., pp. 35-56.www.nap.edu.

refers to the methods used to create complex sets or repertoires of compounds, whose reactivities with other molecules can be tested. One example of this is phage display, in which a set of recombinant bacteriophage clones is made to display a peptide component, whose structure may be varied from clone to clone.[74] These displayed peptides can then be tested with various other molecules for their reactivities in systems similar to the enzyme-linked immunosorbent assay (ELISA).

Proteomics is the large-scale study of proteins, normally by using biochemical methods for protein preparation and identification.[75] For example, one and two-dimensional gel electrophoresis systems can be used to separate complex mixtures of proteins, which can be identified with the help of antibodies. Other techniques such as affinity chromatoraphy or high pressure liquid chromatography can also be used to separate and isolate proteins. The most significant breakthrough in proteomics has been the matrix-assisted laser description ionisation time of flight mass spectrometry (MALDI-TOF-MS), in which pulsed energy from a laser is transferred to the molecules to be analysed with the help of a matrix.[76] The molecules are ionised and released into the gas phase of the mass spectrometer, which results in a time-of-flight distribution of molecules in a mixture. These can then be identified by their characteristic peaks in the mass spectrum. MALDI-TOF has also been used for rapid identification of micro-organisms.[77] Improvements in the methods of detection and identification of micro-organisms and biochemical agents can be expected in the near future through developments in nanotechnology, for example, in the form of miniaturised biosensors such as 'lab on a chip' chemical/biological agent sensors.[78]

Within the drug discovery campaign, it can be expected that many of the substances produced will fall into the category of bioregulators (compounds that are chemical in nature and regulate the operation of physiological systems). Bioregulators will be gaining more and more significance for biochemical arms control as time progresses.[79]

Bioregulators

Bioregulators are 'naturally occurring organic compounds that regulate diverse cellular processes in multiple organ systems and are essential for normal homeostatic function.'[80] They are diverse

74. C. Rader and C.F. Barbas-III, 'Phage display of combinatorial antibody libraries', *Current Opinion in Biotechnology*, vol. 8, 1997, pp. 503-08.

75. A. Pandey and M. Mann, 'Proteomics to study genes and genomes', *Nature*, vol. 405, 2000, pp. 837-46.

76. Ibid.

77. M.A. Claydon, S.N. Davey, V. Edwards-Jones, and D.B. Gordon, 'The rapid identification of intact microorganisms using mass spectrometry', *Nature Biotechnology*, vol. 14, pp. 1584-86.

78. J. Altmann, (2006), op. cit.

79. M. Dando, (2001), op. cit.; M. Wheelis (2002), op. cit.

80. E. Kagan, 'Bioregulators as instruments of terror', *Clinics in Laboratory Medicine*, vol. 21, 2001, pp. 607-18.

in structure and play key roles in many vitally important bodily functions such as respiration, blood pressure, heart rate, body temperature, mood and consciousness, as well as innate and adaptive immune responses. Most bioregulators operate by targeting specific cell receptors and components of biochemical signal transduction pathways, ultimately leading to the transcription of genes and production of bioactive proteins. Several different types of bioregulators are considered potential threat agents: cytokines, e.g. the pro-inflammatory agents interleukin (IL) 1 beta (IL-1b), IL-6 and tumour necrosis factor alpha (TNFa) or cytokines regulating immune responses (IL-2, IL-4, IL-12, IL-10); hormones (e.g. catecholamines, insulin); neurotransmitters and neuropeptides; eicosanoids (e.g. prostaglandins, leukotrienes) and nucleic acids (e.g. DNA, RNA).[81]

RNAi: a negative bioregulator system

A bioregulator system that deserves particular mention is RNA interference (RNAi). This is emerging as the most potent, effective and practical method of interfering with or silencing the expression of a specific target gene. The effectors of this method of gene silencing are short (21-29 nucleotides) double-stranded RNA (dsRNA) molecules. These are recognized by an RNA-induced silencing complex (RISC) which mediates the degradation of gene transcripts (specific messenger RNA expressed by that gene) that are complementary in nucleotide base sequence to one of the strands of the small, interfering dsRNA molecules. This essentially ablates, turns off or 'knocks down' the activity of that specific gene since no product can be synthesised from that degraded gene transcript.[82]

Indeed, RNAi has become an invaluable research tool. However, one limitation of the system lies with the problem of getting the small dsRNA effector molecules into the desired target cell. In this regard, traditional methods of cell transfection (introduction of nucleic acid into a recipient cell) are very inefficient or do not work at all on many types of cells, particularly non-dividing cells. One way of overcoming this limitation is to use a viral vector as a type of nucleic acid ferry. The strategy is to have the virus encode the information for the production of a particular type of dsRNA upon infection of a cell. For this purpose, a great deal of recent work has been invested in the development of lentivirus (the subfamily of retroviruses to which the AIDS virus belongs) delivery systems, as

81. NAS (2005) Chapter 4: 'Emerging and converging technologies', op. cit., pp. 57-71.

82. P. Sandy, A. Ventura and T. Jacks, 'Mammalian RNAi: a practical guide', *BioTechniques*, no. 39, 2005, 215-24.

these viruses are very efficient in infecting cells and achieving stable expression of the transferred genes in those cells. Although lentiviruses normally have a very narrow host range, this can be broadened or altered by a process called pseudotyping.[83] This involves engineering lentiviruses to contain new surface proteins derived from other enveloped viruses that govern the ability of the virus to infect particular cells. This is what is known as changing the tropism of a virus. For example, lentiviruses pseudotyped to express the vesicular stomatitis virus envelope glycoprotein (VSV-G) infect a wide variety of mammalian cells with high efficiency.[84] A replication-defective form of the human immunodeficiency virus (HIV) has also been pseudotyped with the (envelope glycoprotein from the Ebola Zaire EboZ) filovirus.[85] It was shown that high-level gene transfer was achieved in cells lining the submucosa of mice which had been instilled with the engineered virus administered into the airway.[86]

Although the use of the RNAi system to target genes *in vivo* for research and therapeutic purposes has not yet been fully developed, knowledge about this system is accumulating at breakneck speed and improvements are inevitable. It can be seen from the few examples of pseudotyping lentiviruses presented above that potentials for both benefit and misuse are rapidly being created.

Systems biology: the complexity of the dual-use dilemma

The possible relevance of biochemical bioregulators in the dual-use dilemma has to be viewed within the complex arena of interacting physiological systems. The nervous, the endocrine and the immune systems are three vital physiological systems that interact intricately and interdependently with one another. The nervous system and the endocrine system are so closely involved with one another that they are referred to as the neuroendocrine system. Naturally, the proper functioning of these vital systems is crucial for the well-being of the individual, and their functions are extremely vulnerable to modulation or manipulation with biochemical bioregulators.

The immune and neuroendicrine systems are interconnected through the hypothalamus-pituitary-adrenal (HPA) axis via cytokines, hormones, neurotransmitters, neuropeptides and their receptors, and also through hardwiring of neural and lymphoid organs.[87]

There is a fine network of checks and balances exerted on the

83. J. Cronin, X.Y. Zhang and J. Reiser, 'Altering the tropism of lentiviral vectors through pseudotyping', *Current Gene Therapy*, vol. 5, 2005, pp. 387-98.

84. S.N. Bailey, S.M. Ali, A.E. Carpenter, C.O. Higgins and D.M. Sabatini, 'Microarrays of lentiviruses for gene function screens in immortalized and primary cells', *Nature Methods*, vol. 3, 2006, pp. 117-122.

85. J.M. Wilson, 'Adeno-associated virus and lentivirus pseudotypes for lung-directed gene therapy', *Proceedings of the American Thoracic Society*, vol. 1, 2004, pp. 309-314.

86. M.F Medina, G.P. Kobinger, J. Rux, M. Gasmi, D.J. Looney, P. Bates and J.M. Wilson, 'Lentiviral vectors pseudotyped with minimal filovirus envelopes increased gene transfer in murine lung', *Molecular Therapy*, vol. 8, 2003, pp. 777-89.

87. R.H. Straub, J. Westermann, J. Schölmerich, and W. Falk, 'Dialogue between the CNS and the immune system in lymphoid organs', *Immunology Today*, vol. 19, 1998, pp. 409-413.

operation of these systems by the elements within them. The perturbation of the elements of one system will invariably affect the operation of the other, so it is easy to see that the possible ways in which these systems can be malignly manipulated suddenly take on a whole new dimension because of this interdependence.

To illustrate how the one system can affect another, with possible detrimental effects on both, the interaction of bioregulators of the immune system (cytokines) and the neuroendocrine system (hormones and neurotransmitters) within the HPA axis will be taken as an example. First of all, we will take a look at what occurs normally during an infection. Proinflammatory cytokines are produced by cells of the immune system after contact with microorganisms or their PAMPS.[88] The cytokines gain entry into the circulation from sites of the immune response in tissues and organs. Normally, the cytokines are of such large size that it would be impossible for them to pass through the blood-brain barrier. However, an area of the hypothalamus (the part of the brain involved in the control of such diverse functions as eating, drinking, sleep, thermoregulation, cardiovascular regulation and hormone secretion) represents a window in the barrier, allowing the entry of the cytokines into this region.[89] They subsequently bind to receptors on cells in the hypothalamus and trigger reactions collectively known as sickness behaviour, which is characterised by fever, drowsiness, lethargy and loss of appetite.[90] In this way, the immune system is signalling the brain that rest is needed to help speed recovery.

However, if the reaction is too strong, it could be very debilitating. To keep the actions of the proinflammatory cytokines from getting out of hand, these same bioregulators have another effect on the hypothalamus, which is to induce the production of the bioregulator corticotropin-releasing factor (CRF).[91] This is a hormone that is involved in immune regulation. It causes the pituitary gland to produce adenocorticotropic hormone (ACTH). This hormone enters the circulation and acts on the adrenal gland cortex to induce the production of glucocorticoids, which are bioregulators that have a profound effect in suppressing immune responses, thus turning off the production of the proinflammatory cytokines before they are overproduced.

Balance is the key. CRF could have a potentially detrimental effect on the central nervous system if it is overproduced. CRF has been associated with major depression, anorexia nervosa and

88. L. Steinman, 'Elaborate interactions between the immune and nervous systems', *Nature Immunology*, vol. 5, 2004, pp. 575-81.

89. J. Licinio and P. Frost, 'The neuroimmune-endocrine axis: pathophysiological implications for the central nervous system cytokines and hypothalamus-pituitary-adrenal hormone dynamics', *Brazilian Journal of Medical and Biological Research*, vol. 33, 2000, pp. 1141-48.

90. A. Inui, 'Cytokines and sickness behaviour: implications from knockout animal models', *Trends in Immunology*, vol. 22, 2001, pp. 469-73.

91. Straub et al., (1998), op. cit.

Alzheimer's disease.[92] Overproduction of CRF has also been implicated with damage to brain cells in animal studies. In these investigations, a stroke was induced in the animals. It could be shown that the damage to brain cells (neurons) which occurred as a result of the stroke could be prevented, if the action of CRF was inhibited by certain specific inhibitory substances.[93] Normally, these interactions within the HPA axis work as a check and balance system. However, it is easy to see that a selective overproduction of proinflammatory cytokines could tip the balance to enhance detrimental effects on both the immune and the neuroendocrine systems, leading to debilitating sickness behaviour, significant immune suppression and even damage to brain cells.

This is just one relatively simple example of what could happen if the neuroendocrine-immune system is modulated in a particular way. Mood changes and cognizance are further targets that would be vulnerable to modulation in this system. A point to be made here is that the interaction of these systems and the interdependence of the resulting reactions on this interaction raises the dual-use dilemma to a new order of complexity. Therefore, we not only have to be concerned about the accelerating pace of new developments, but also about the complexity of information that is being generated. Trying to deal with this complexity in order to exploit the benefits while minimising the risks without impeding vital progress in life sciences research is going to become an enormous task in the future.

The dual-use risk of bioregulators was considered minimal in the past because of their lack of suitability for aerosolisation and the fact that they would lose their effectiveness rapidly after atmospheric release. However, new knowledge and advancing technologies, particularly delivery technologies, have raised new concerns about biochemical regulators.[94]

Targeted delivery systems

The possibilities for misuse of biochemicals regulating the functions of physiological systems are intricately involved with dual-use aspects of targeted delivery technology. Targeted delivery systems are comprised of components that allow an activity to be targeted to a particular site in the body where that activity is desired. There are several potential means of achieving this.

92. Licinio and Frost (2000), op. cit.

93. Ibid.

94. NAS (2005), 'Emerging and converging technologies', op. cit., pp. 55-71.

Viral vectors

An example of a delivery system are viruses that are used as vectors or gene ferries to transfect a foreign gene into cells for the purpose of immunisation or for gene therapy. Infection with the virus would lead to the synthesis of the product of the foreign gene. Pseudotyping lentiviruses to produce targeted delivery vectors to induce the RNAi system has been discussed above. Vaccinia virus (used in the past for immunisation against smallpox) has been investigated for immunisation purposes because of its large genome, which can carry several foreign antigen genes at once, and its general effectiveness as a vaccine.[95] Although the vaccine is effective, it causes a rather high incidence of serious side effects, which was the main reason for the cessation of its use following eradication of smallpox. Alternatively, the development of adeno-associated viruses as vectors for gene delivery seems promising, as these viruses are defective by nature and have thus never been shown to have any pathogenic effects in humans.[96] Also, adeno-associated viruses were thought not to integrate into the genome of the host to any appreciable extent (in contrast to retroviruses), thus avoiding the risk of an unwanted mutation in the genetic material of the host. However, subsequent investigations have shown that these viruses can indeed integrate into the host genome at much higher frequencies than were predicted, so that a re-evaluation of their safety for gene therapy purposes is in order.[97] The safety aspect would presumably be of little concern to a proliferator bent on using a viral vector to deliver a biological weapons agent to a chosen target.

Several studies using both adenoviruses and adeno-associated viruses have been aimed at modifying the tropism of the viruses in order to target them to particular cell types or tissues.[98] While this would be a particularly powerful tool for gene or cancer therapy, it is not difficult to see that this technology could be used to target particular receptors with malign intent.

The feasibility of using a viral agent to deliver a desired effect would depend upon how well the virus can be disseminated to achieve infection, how efficiently the genes will be expressed after infection and whether the expressed proteins will reach the desired target once they are produced. In any case, it is evident that the potential for delivering cytokines effectively by viruses engineered to carry cytokine genes is a reality. In the mousepox experiment, introduction of the gene for the cytokine interleukin 4 into an oth-

95. J.A. McCart, J.M. Ward, J. Lee, Y. Hu, H.R. Alexander, S.K. Libutti, B. Moss and D.L. Bartlett, 'Systemic cancer therapy with a tumor-selective vaccinia virus mutant lacking thymidine kinase and vaccinia growth factor', *Cancer Research*, vol. 61, 2001, pp. 8751-57.

96. B.J. Carter, 'The promise of adeno-associated virus vectors', *Nature Biotechnology*, vol. 14, 1996, pp. 1725-726.

97. E. Check, 'Harmful potential of viral vectors fuels doubts over gene therapy', *Nature*, vol. 423, 2003, pp. 573-74.

98. S.C. Noureddini and D.T. Curiel, 'Genetic targeting strategies for adenoviruses', *Molecular Pharmaceutics*, vol. 2, 2005, pp. 341-47; L.M. Work, H. Buning, H.E. Hunt, S.A. Nicklin, L. Denby, N. Britton, K. Leike, M. Odenthal, U. Drebber, M. Hallek and A.H. Baker, 'Vascular bed-targeted in vivo gene delivery using tropism-modified adeno-associated viruses', *Molecular Therapy*, vol. 13, 2006, pp. 683-93.

erwise relatively harmless virus had the devastating effect of suppressing an essential arm of immunity, thus making that virus into a killer.[99] Conceivably, other bioregulators might also be sucessfully delivered by this means.

Immunotoxins and fusion proteins

Another example of a targeted delivery system are immunotoxins. These are molecules that contain the antigen-binding specificity portion of an antibody molecule coupled to a toxin molecule. The aim is to target the toxin activity to specified cells such as tumour cells in a tumour therapy protocol; in this case, the antibody specificity is directed against tumour cell antigens. The toxins that have been used to produce immunotoxins include ricin, *Shigella* toxin, and diphtheria toxin,[100] as well as toxic chemicals[101] A number of clinical trials using immunotoxins have been completed, while others are still going on. To date, results have been promising in leukemia and lymphoma patients, but responses in patients with large tumours have been disappointing.[102] Clinical trials have highlighted several problems with the administration of immunotoxins, including vascular leak syndrome, veno-occlusive disease, liver toxicity, and toxicity to tissues of the central nervous system.[103] However, these problems would possibly be of little concern to a proliferator intent on using them as a biological weapon.

Another problem involves the initiation of an immune response to the immunotoxins that would reduce their efficacies. To reduce the immune response, hybrid genes that can be used to produce antibody-toxin fusion molecules in bacteria have been designed, using only the antigen-binding portion of a single chain antibody molecule attached to the toxic portion of a toxin molecule.[104] If the immunotoxins are, for example, to be used for human therapy, mouse monoclonal antibodies can be 'humanised' by fusing only the antigen-binding portion of the mouse antibody molecule to the remaining portion of a human antibody molecule via genetic engineering.[105]

Fusion proteins consist of a protein molecule (ligand) that can bind a particular receptor fused to the toxic fragment of a toxin molecule that is also a protein. This fusion is made frequently by joining the genes for both the ligand and the toxin in a vector. The vector is taken up in cells, the fused genes are expressed, and the fused protein is subsequently produced by that cell.

99. Jackson et al. (2001), op. cit.

100. R.J. Kreitman, 'Immunotoxins in cancer therapy', *Current Opinion in Immunology*. vol. 11, pp. 570-78.

101. M. Ortin, 'Immunotherapy of haematological malignancies: what is new?', *Annals of Oncology*, Supplement 2, pp. ii53-ii62.

102. R.J. Kreitman, (1999), op. cit.; M. Ortin, (2005), op.cit.

103. Ibid.

104. R.A. Goldsby, T.J. Kindt, B.A. Osborne and J. Kuby, *Immunology*, Fifth Edition (New York: W.H. Freeman and Company, 2003).

105. M.S. Hayden, L.K. Gilliland and J.A. Ledbetter, 'Antibody Engineering', *Current Opinion in Immunology*, vol. 9, 1996, pp. 201-212; C.H. Chang, P. Sapra, S.S. Vanama, H.J. Hansen, I.D. Horak and D.M. Goldenberg, 'Effective therapy of human lymphoma xenografts with a novel recombinant ribonuclease/anti-CD74 humanized IgG4 antibody immunotoxin', *Blood*, vol. 106, 2005, pp. 4308-14.

Again, the feasibility of using an immunotoxin or a fusion protein would depend upon the successful dissemination of the agents through the aerosol route and how well the agents would be taken up and processed by this route.

Aerosol delivery

Aerosols are particles in the form of a liquid or a powder that are suspended in air and can be inhaled. Aerosolisation of vectors carrying foreign genes could represent an effective delivery system, especially if the vector is a virulent micro-organism, as most infections begin at the mucosa (mucous membranes). If the agent is not a micro-organism, such as in the case of bioregulators, fusion proteins or immunotoxins, successful delivery by the aerosol route would depend greatly upon the physical-chemical properties of that vector and how it might interact with the mucosa.

The potential of this route is being extensively investigated in connection with interests in drug delivery. Indeed, it has been stated that the greatest potential for delivering drugs is through the pulmonary route by inhalation of particles of a particular size.[106] In this regard, the production of defined nanoparticles combined with new methods for making substances absorbable through the nasal and respiratory tracts represent advances that could create a potential for greatly improved delivery of bioactive compounds, but at the same time create a potential for misuse.

For the delivery of drugs, the normal route of choice is by mouth (oral). However, this route may not be advantageous in certain situations. For example, oral administration would not be possible if rapid onset of the effect is required, if a drug is poorly absorbed across the gastrointestinal tract or is largely degraded by pH conditions or enzymes within the lumen of the intestine and/or by liver metabolism.[107] Therefore, in recent years alternative routes of delivery have been actively investigated. One method of delivery that has emerged as being of particular choice is the nasal administration route. This route provides rapid absorption into the circulation with little or no degradation, particularly if the substances have lipophilic characteristics. Nasal delivery also has the potential of providing direct access of drugs to the brain via the olfactory region.[108] More polar compounds such as polar low-molecular weight drugs, peptides and proteins are absorbed relatively poorly across the nasal mucosa, so that strategies have

106. S. Shohet and G. Wood, 'Delivering biotherapeutics – technical opportunities and strategic trends', *Journal of Commercial Biotechnology*, vol. 9, 2002, pp. 59-66.

107. S.S. Davis and L. Illum (2003), 'Absorption enhancers for nasal drug delivery', *Clinical Pharmacokinetics*. vol. 42, pp. 1107-28.

108. L. Illum, 'Transport of drugs from the nasal cavity to the central nervous system', *European Journal of Pharmaceutical Sciences*, vol. 11, 2000, pp. 1-18; C.L. Graff and G.M. Pollack, 'Nasal drug administration: potential for targeted central nervous system delivery', *Journal of Pharmaceutical Sciences*, vol. 94, 2005, pp. 1187-95.

been developed aimed at improving their absorption properties.[109]

According to Davis and Illum,[110] an ideal absorption promoter 'should carry the drug molecule across the cell [contained in the mucosal epithelium] from apical to basolateral surface. The carrier should be potent, pharmacologically inert at the concentration used (nontoxic and nonallergenic) and have no irritant or disruptive effect on the cell membrane. The carrier should be compatible with drugs and physically rather than covalently associated with the molecule. The mode of action of the carrier should be known, preferably involving a natural process such as ion transport/cell signalling. The carrier should remain in contact with the mucosa long enough to achieve maximal effect. The effect should be transient and reversible. The carrier should have no taste or offensive odour, should be readily available and inexpensive. If the carrier is absorbed together with the drug it should be metabolised to provide acceptable breakdown products.'

Many substances that have been used effectively for improving absorption of drugs across the nasal mucosa can be classified as membrane active and have a disruptive effect on transport pathways. These include bile salts, fatty acids and other surfactants. They are often irritating and have been associated with mucosal tissue damage, so that their use is limited.[111] One enhancer that has been under recent investigation is the cationic polymer chitosan, which apparently satisfies all of the criteria listed above, and has been successful in animals and humans for improving nasal delivery of drugs.[112] Chitosan consists of co-polymers of glucosamine and N-acetylglucosamine, and it is normally derived from crustacean chitin by partial deacetylation. It can be used as a nasal absorption enhancer in liquid or powder formulations. It also apparently encapsulates the substance that is to be delivered and thereby protects it from degradation.[113]

The mechanism of action appears to be a combination of bioadhesion and a transient opening of the tight junctions in epithelial cell layers to allow polar drugs to pass through.[114] Normally, the presence of intercellular tight junction complexes renders the epithelium of the mucosa impervious to hydrophilic drugs that are larger than the gap junctions and that cannot diffuse across the lipid bylayer of the cell membrane. Tight junctions are structures that join cells such as the epithelial cells of the nasal mucosa tightly together. These structures consist of three major types of integral

109. S.S. Davis and L. Illum (2003), op. cit.

110. Ibid.

111. P.H. Johnson and S.C. Quay, 'Advances in nasal drug delivery through tight junction technology', *Expert Opinion on Drug Delivery*, vol. 2, 2005, pp. 281-98.

112. S.S. Davis and L. Illum (2003), op. cit.

113. M. Köping-Höggard, A. Sanchez and M.J. Alonso, 'Nanoparticles as carriers for nasal vaccine delivery', *Expert Review of Vaccines*, vol. 4, 2005, pp. 185-96.

114. G. Ranaldi, I. Marigliano, I. Vespignani et. al, 'The effect of chitosan and other polycations on tight junction permeability in the human intestinal Caco-2-cell line', *Journal of Nutritional Biochemistry*, vol. 13, 2002, pp. 157-67; P.H. Johnson and S.C. Quay (2005), op. cit.

membrane proteins including occludins, claudins and junctional adhesion molecules, of which the claudins may be the single most important component.[115] Possibly, interaction of chitosan with the cell surface may lead to the activation of intracellular signalling events involving the participation of second messengers and protein kinases known to regulate tight junctions.[116]

The ability of chitosan-drug formulations to effect a transient opening in tight junctions of epitheilial layers may also be relevant for the delivery of bioregulators across the blood-brain barrier. The nasal route can also provide direct access to the brain by entry into the olfactory bulb via axonal transport along nerve cells; however, this route is apparently slow, and therefore not so efficient for delivery.[117]

One factor that is very important in successful delivery of drugs across the nasal mucosa with the absorption enhancer chitosan is the size of the particle. Translocation of particles into the blood stream was highest for 20nm-sized particles.[118] In this regard, new particle engineering technology is providing means of producing nanostructured particles of appropriate size,[119] and the ability to design nanoparticles with defined properties that can discriminate among different cell types as well as among different physiologic states of the same cell type[120] will greatly aid in drug delivery. This emphasises once again the importance of nanotechnology as a converging and enabling technology.

Nasal administration of vaccines is also currently under active investigation because of the ease of administration and the possibility of enhancing the mucosal immune response. As an example, plasmid DNA encoding a portion of the M2 protein of respiratory syncytial virus (an important pathogen of the lower respiratory tract, especially in newborns, young children and elderly individuals) was formulated with chitosan and used as a vaccine to immunise mice by the nasal route.[121] In this case, it is presumed that transport of the particles across the nasal mucosa results in uptake by lymphoid tissue cells associated with the mucosal tissue. This is followed by expression of the viral genetic material and production of the M2 protein component that acts as an antigen to stimulate an immune response. The results of this investigation showed that the vaccine induced peptide- and virus-specific cytotoxic T cell immune responses that were comparable to those induced via intradermal immunisation. In addition, a significant reduction in the virus load was observed in the lungs of immu-

115. Ibid.

116. W.F. Stenson, R.A. Easom, T.E. Riehl and J. Turk, 'Regulation of paracellular permeability in Caco-2 cell monolayers by protein kinase C', *American Journal of Physiology*, vol. 265, 1993, pp. 955-62.

117. C.L. Graff and G.M. Pollack (2005), op. cit.

118. J. Brooking, S.S. Davis and L. Illum (2001), op. cit.

119. R. Russell, 'New particle engineering technology improves drug solubility', *Pharmaceutical Technology*, vol. 27, no. 1, January 2003, pp.18-19 and 114.

120. R. Weissleder, K. Kelly, E.Y. Sun, T. Shtatland and L. Josephson, 'Cell-specific targeting of nanoparticles by multivalent attachment of small molecules', *Nature Biotechnology*, vol. 23, 2005, pp. 1418-23.

121. M. Iqbal, W. Lin, I. Jabbal-Gill, S.S. Davis, M.W. Steward and L. Illum, 'Nasal delivery of chitosan-DNA plasmid expressing epitopes of respiratory syncytial (RSV) induces protective CTL responses in BALB/c mice', *Vaccine*, vol. 21, 2003, pp. 1478-85.

nised mice following challenge with the virus.

In another example, administration of a protein antigen directly through the nasal route was carried out. In this case, an anthrax vaccine consisting of recombinant protective antigen (rPA) from *Bacillus anthracis* mixed with chitosan plus CpG oligodeoxynucleotides as adjuvant was tested in rabbits by aerosol challenge with anthrax spores.[122] This vaccine provided complete protection of the animals. However, three doses through the nasal route were required to achieve responses that were comparable to those obtained with one or two injections via the intradermal or intramuscular routes. The vaccine in dry powder form was more effective than in liquid form for nasal administration.

These two examples show that delivery of substances through the nasal route can be successful if formulated with the proper enhancers of absorption and protection. Of course, it is not known whether bioregulators, fusion proteins or immunotoxins can be delivered successfully by applying similar methods of delivery. It would depend particularly on whether sufficient material can be delivered by aerosolisation as opposed to nasal infusion, as was applied in the studies cited above. Nevertheless, a huge potential for more effective delivery of bioregulators is being created by advancements in nanotechnology, microencapsulation and methods of increasing absorption through the respiratory/nasal route.

Plants as delivery systems

There is at present a great deal of interest in developing plant foods as delivery systems. This is particularly true of using plant foods as vaccines. This involves the transfer of a gene encoding the antigen of interest into the genome of plants, with subsequent expression of that gene and biosynthesis of the antigen in the plant tissues. Eating the plant tissues would then deliver the antigen to the gut, where it would be taken up by special epithelial cells of the small intestine (M cells) and transferred to the underlying lymphoid tissues, resulting in an immune response to that antigen. There would be several advantages of inducing an immune response in this way, including increased safety, economy and stability of the vaccine, as well as the prospect of inducing mucosal immunity, that is, to localise immunity at mucous membrane sites, where most infections begin.[123]

122. J.A. Mikszta, V.J. Sullivan, C. Dean, A.M. Waterston, J.B. Alarcon, J.P. Dekker III, J.M. Brittingham et al., 'Protective immunisation against inhalational anthrax: a comparison of minimally invasive delivery platforms', *Journal of Infectious Diseases*, vol. 191, 2005, pp. 278-88.

123. G.J.V. Nossal, 'Vaccines', in W.E. Paul (ed.), *Fundamental Immunology*, Fifth Edition (Philadelphia: Lippencott Williams & Wilkins, 2003), pp. 1319-69; S.J. Streatfield, J.M. Jilka, E.E. Hood, D.D. Turner, M.R. Bailey, J.M. Mayor, S. L. Woodard, K.K. Beifuss, M.E. Horn, D.E. Delaney, I.R. Tizard, and J.A. Howard, 'Plant-based vaccines: unique advantages', *Vaccine*, vol. 19, 2001, pp. 2742-48

Although the advantages of edible vaccines are many, there are numerous technical and immunological hurdles that have to be overcome in order for them to be practical. One of the first is the avoidance of degradation of the antigen in the digestive tract. Even if the antigen would survive this degradation, oral tolerance mechanisms would have to be overcome. This is a type of tolerance to antigens administered orally, which prevents immune responses to the micro-organisms residing in the intestine or to protein antigens acquired continually in food. This tolerance might be overcome if the vaccine is administered with a mucosal adjuvant (a special type of immune response booster) or if the antigen is in the form of particles. Furthermore, oral immunisation usually requires multiple doses in larger amounts than antigen administered over other routes; responses are weak, unreliable and also shorter lived.[124] Indeed, results to date show that immunisation with plant foods is in some cases possible, but the responses are usually modest and appear only after more than one dose.

One of the most successful preparations to date is that of an edible vaccine for hepatitis B.[125] Volunteers who had been previously immunised parenterally (by injection, not by mouth) with the licensed, recombinant hepatitis B vaccine in yeast were given three doses over a period of 28 days of the hepatitis B antigen (HBsAg) as a recombinant protein in potatoes. The doses consisted of 100 to 110 grams of the potato that were ingested by the volunteers. 9 of the 17 volunteers responded with significant antibody production over those values measured before they ingested the potatoes. The serum antibody titers increased up to 56 fold (range 1.3-56 fold) in these individuals. This showed that the plant vaccine without any adjuvant could produce a significant response in individuals that had been immunised previously with the commercial, licensed HBsAg vaccine. These studies did not, however, test the response of subjects that had not been previously immunised; responses of these individuals would have presumably been weaker. The success of this particular vaccine is no doubt due to the fact that the recombinant protein is one that can assemble into aggregates. This property of HBsAg is well-known and has been responsible in the past for its success as a recombinant protein parenteral vaccine in vehicles such as yeast cells.

This discussion serves to illustrate that immunisation with plant foods is by no means readily achievable. In this regard, it is unlikely that these techniques can be used successfully in the near

124. G.J.V Nossal (2003), op. cit.; E. Marquet-Blouin, F.B. Bouche, A. Steinmet and C.P. Muller, 'Neutralizing immunogenicity of transgenic carrot (*Daucus carota L.*)-derived measles virus hemagglutinin', *Plant Molecular Biology*, vol. 51, 2003, pp. 459-69.

125. Y. Thanavala, M. Mahoney, S. Pal, A. Scott, L. Richter, N. Natarajan, P. Goodwin, C.J. Arntzen and H.S. Mason, 'Immunogenicity in humans of an edible vaccine for hepatitis B', *Proceedings of the National Academy of Sciences USA*, vol. 102, 2005, pp. 3378-82.

future in malign ways, e.g. for vaccination of unaware populations, thus forcing upon them an involuntary immunity or marking them as possible targets. Nevertheless, there is great interest in developing such vaccines for peaceful use and improvements are actively being sought,[126] which will no doubt be achieved. Work is focusing at the moment on producing plant vaccines consisting of an antigen fused to a protein that can produce a local immunity on the mucous membranes, where most infections begin.[127] Therefore, developments in this area should be closely monitored.

The possibility that transgenic plants could serve as factories for the production of proteins should also be considered. In this regard, transgenic plants could be used to deliver toxins or bioregulators. However, some of the same problems in using transgenic plants as vaccines also apply in this case. A major technical problem is low protein expression levels from transgenes in plants, which would require eating great amounts of the plant food to obtain a desired effect.[128] This would seem to limit the immediate threat level posed by plants used as delivery systems. However, this is an area of intensive research in which improvements are being actively sought in order to overcome the major problems associated with this method of delivery. Plant delivery could offer a viable option to those with malign intent in the not all too distant future, although it is difficult to see how it could significantly affect large groups of people.

Relevance of bioregulators for biochemical arms control

The relevance of bioregulators for biochemical arms control was made clear in the report of a recent workshop of the National Academy of Sciences in the USA:

'A major theme that emerged from these discussions is that pathogens are not the only potential bioterrorist agents. Some experts argue that bioregulators, which are non-pathogenic organic compounds, may pose a more serious dual-use risk than had been previously perceived, particularly as improved targeted delivery technologies have made the potential dissemination of these compounds much more feasible than in the past.'[129]

Renewed interest in so-called 'non-lethal' chemical weapons (which include bioregulators) threatens to undermine the current CBW control regimes and calls into question their future robustness.[130] For one, the US military shows a strong interest in develop-

126. E. Marquet-Blouin et al. (2003), op. cit.; S.J. Streatfield, J.R. Lane, C.A. Brooks, D.K. Barker, M.L. Poage, J.M. Mayor, B.J. Lamphear, C.F. Drees, J.M. Jilka, E.E. Hood and J.A. Howard, 'Corn as a production system for human and animal vaccines', *Vaccine*, vol. 21, 2003, pp. 812-15.

127. N. Matoba, A. Magerus, B.C. Geyer, Y. Zhang, M. Muralidharan, A. Alfsen, C.J. Arntzen, M. Bomsel and T.S. Mor, 'A mucosally targeted subunit vaccine candidate eliciting HIV-1 transcytosis-blocking Abs', *Proceedings of the National Academy of Sciences USA*, vol. 101, 2004, pp. 13584-89; M. M. Rigano, M.L. Alvarez, J. Pinkhasov, Y. Jin, F. Sala, J.C. Arntzen and A.M. Walmsley, 'Production of a fusion protein consisting of the enterotoxigenic *Escherichia coli* heat-labile toxin B subunit and a tuberculous antigen in *Arabidopsis thaliana', Plant Cell Reports*, vol. 22, 2004, pp. 502-08.

128. NAS, Chapter 2: 'The international perspective on the biotechnology landscape. Plants as a manufacturing platform', *An International Perspective on Advancing Technologies and Strategies for Managing Dual-Use Risks: Report of a Workshop*, op. cit., pp. 19-33. See: www.nap.edu.

129. Ibid., Chapter 4: 'Emerging and converging technologies', pp. 57-71.

130. A. Kelle, 'Science, technology and the CBW control regimes', *Disarmament Forum*, vol. no. 1, 2005, pp. 7-16.

ing this kind of capability.[131] The BTWC prohibits any agent categorically 'for hostile purposes or in armed conflict'.[132] However, it may be difficult to determine just what a hostile purpose might entail. The Chemical Weapons Convention (CWC)[133] prohibits all chemical agents for non-peaceful purposes, but the convention contains an exception, permitting the use of such agents for purposes of 'law enforcement', in which case this is also difficult to define. From a scientific and technical point of view the major problem with 'non-lethal' weapons lies in the fact that they are not non-lethal, as the Moscow theatre hostage crisis in 2002 clearly demonstrated.[134] Although it can be claimed that the use of the fentanyl derivative by the Russian security forces in the Moscow theatre incident falls under the CWC law enforcement provision, a thorough discussion of the matter in the interest of clarification at the First Review Conference was prevented by a few powerful states.[135] 'This does not speak well for the capability of the CWC to deal with changes that might affect the sustainability of the prohibitory norm against chemical weapons.'[136]

Conclusions and recommendations

It is extremely difficult to predict what advances in science and technology will occur in the future and the exact risks involved for the BTWC. As has been pointed out in a recent National Academy of Sciences report:

'About the only thing one can predict is that the life sciences will continue to advance quickly, in a variety of directions, and that new and previously unanticipated paradigm-shifts are very likely to occur in the future.'[137]

With a view to the Sixth Review Conference of the BTWC in 2006, it is imperative for the States Parties to assure that there will be a Final Declaration re-affirming that the prohibitions in Article I cover all new developments in the life sciences over the past 10 years. Looking further ahead, advances in the life sciences are occurring too rapidly and have too great a relevance for the BTWC to be left to an assessment every five years at the review conferences. Therefore, the States Parties to the BTWC should carry out thorough reviews and analyses of advances in science and technology relevant to the Convention at more frequent intervals than just at the review conferences. Since these developments are of acute con-

131. M. Dando, 'Scientific and technological change and the future of the CWC: the problem of non-lethal weapons', *Disarmament Forum*, vol. no. 4, 2002, pp. 33-45; N. Lewer and N. Davison, 'Non-lethal technologies – an overview', *Disarmament Forum*, vol. no. 1, 2005, pp. 37-51; See also the website of the Sunshine Project for documentation of the US non-lethal weapons programmes, at www.sunshine-project.org.

132. United Nations (1972): *Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction. United Nations General Assembly Resolution 2826 (XXVI)*, United Nations, New York. (full text available at http://www.brad.ac.uk/acad/sbtwc).

133. United Nations (1993): *Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction*. (full text available at www.opcw.nl/cwcdoc.htm).

134. P.E. Wax, C.E. Becker and S.C. Curry, 'Unexpected gas casualties in Moscow: A medical toxicology perspective', *Annals of Emergency Medicine*, vol. 41, pp. 700-05.

135. A. Kelle, 'The CWC after its first review conference: is the glass half full or half empty?', *Disarmament Diplomacy*, vol. no. 71, June/July 2003, pp. 31-40.

136. A. Kelle (2005), op. cit.

137. NAS, Chapter 1, 'Framing the Issue', *Globalization, Biosecurity, and the Future of the Life Sciences*. Committee on Advances in Technology and the Prevention of Their Application to Next Generation Biowarfare Threats, Institute of Medicine and National Research Council. (Washington, D.C.: The National Academies Press, 2006), p. 14. See: www.nap.edu/catalog/11567.html.

cern to all States Parties to the BTWC, a mechanism should be established whereby delegations can collectively and interactively respond to these analyses. At those times State Parties should also assess whether Article I has been implemented accordingly by national legislation that will cover all new developments.

These same thoughts are reflected in a background paper on new scientific and technological developments produced by the UK in preparation for the Fifth Review Conference of the BTWC in 2001:

'Given the accelerating pace in science and technology, the UK wonders whether it is prudent to maintain a five-year gap between such assessments under the BTWC. The UK suggests that the upcoming Review Conference should consider establishing a mechanism for States Parties to work together on a more frequent basis to conduct such scientific and technical reviews ...'[138]

Unfortunately, in the chaos of the 2001-2002 Fifth Review Conference, which ended without a formal declaration by the States Parties, this idea was not properly aired. It has been over ten years now since this subject was collectively assessed by the States Parties. Given the rapidity and complexity of the developments in science and technology this is a proposal that has particular urgency and requires strong leadership to take it forward into the Sixth Review Conference. Since this leadership is not likely to come from the US, the EU as a whole should follow the lead of the UK and put its strength behind this proposal. If the opportunity to act on this matter is lost at the Sixth Review Conference, this will have far-reaching consequences for the BTWC.

We not only have to be concerned about the deliberate misuse of science and technology for the production of biological weapons, but also about the inadvertent creation of a potential for misuse. Scientists working in areas of relevance to the BTWC need to be aware of the dual-use aspects of their work. However, this awareness is largely lacking among life sciences researchers, which has been very clearly demonstrated by a recent study.[139] Many States issue licences or permits to primary investigators (heads of scientific projects) allowing research in the areas of genetic engineering and work with pathogenic micro-organisms. This is, for example, standard practice in Germany. These permits are contingent upon receiving instruction designed to increase biosafety and biosecurity. The primary investigators are then required to pass on this instruction to others involved in the projects. Usually, however,

138. Background Paper: 'New Scientific and Technical Developments Relevant to The Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction', Document BWC/CONF.4/Add.1. (Geneva: United Nations, 26 October 2001).

139. M. Dando and B. Rappert, 'Codes of Conduct for the Life Sciences: Some insights from UK Academia', *Bradford University Briefing Paper* no. 16, 2005, available at: http://www.brad.ac.uk/acad/sbtwc/.

dual-use aspects of life sciences work are not a part of the instruction. It is therefore suggested that the awarding of a licence or permit should also be contingent upon receiving instruction about the content of the Biological and Toxin Weapons Convention and the obligations of the scientist under this treaty, as well as instruction about dual-use aspects of research and risk-benefit assessment processes. It would take very little effort to include such additional instruction in the programmes that are already set up. This in turn would increase awareness of the dual-use problem considerably. The EU could do a great deal in this direction by making such programmes obligatory in all EU countries.

The European Union and the 6th Review Conference

Jean Pascal Zanders

Introduction

The incremental expansion of the Common Foreign and Security Policy (CFSP) during the 1990s explains why the control of biological weapons (BW) belongs to the competencies of the European Union. Since the 5th Review Conference of the Biological and Toxin Weapons Convention (BTWC) in 2001 and 2002 the EU has become a much more coherent actor in the BTWC debates. Two significant events contributed to this development, namely the EU's impotence in preventing the collapse of the negotiation of a legally binding protocol to the BTWC in 2001 and the emergence of deep divisions within the EU in the run-up to the invasion of Iraq on 20 March 2003.

This chapter traces the origins and development of the EU common policy on BW. It next discusses the two events that challenged the EU's ambition to become a unified global actor and how they contributed to pushing BW higher on the political agenda and the emergence of more coherent positions. The results of the greater attention paid to the control of BW and the active coordination of positions among EU Member States are reflected in the EU's preparations for the 6th Review Conference of the BTWC in November-December 2006. The chapter concludes by arguing that there is still ample scope for the further development of the EU's policies. In particular, there is a need to define a longer-term framework of ambitions for the BTWC – especially with regard to the creation of a verification and compliance regime – in order to avoid a series of short-term, practical measures leading to a course that suboptimises only certain aspects of the convention.

Sources of the EU strategy against unconventional weapons

The roots of the EU's involvement in the development of the BTWC regime are in the Common Foreign and Security Policy (CFSP), which was established as the second of the three pillars in the 1992 Maastricht Treaty.[1] The CFSP expanded on the earlier European Political Cooperation, whose objective was the promotion of political consultation on foreign affairs among the Member States. Under the CFSP the EU strives, among other things, to strengthen international security in accordance with the principles of the UN Charter and to promote international cooperation.[2] The point of gravity for the CFSP lies with the Council of the European Union, although the European Commission is fully associated in the tasks. The European Council sets out the general principles and guidelines and defines strategies. To this end it has two major tools at its disposal, namely 'common positions' and 'joint actions'. A common position represents general guidelines on a specific thematic or geographical security issue, which the EU Member States must conform to in order to ensure that their combined influence is exerted as effectively as possible by means of concerted and convergent action. Common positions are also upheld in international organisations and at international conferences.[3] They are communicated by the representative of the EU Member State that holds the 6-monthly rotating Presidency. A joint action is a time-limited project that requires coordinated action by EU Member States whereby human and financial resources, know-how, equipment, and so on are mobilised to attain the specific objectives set by the EU Council. Joint actions also commit the Member States in the positions they adopt and in the conduct of their activity.[4]

The Maastricht Treaty was amended in 1997 by the Amsterdam Treaty,[5] which defined new principles and responsibilities under the CFSP. It also created the position of the High Representative for the Common Foreign and Security Policy as main coordinator of the CFSP within the European Union.[6] Together with the Presidency, the High Representative communicates EU policies and acts on behalf of the EU in the execution of these policies. As such, the person holding the office also symbolises continuity in relation to the rotating Presidencies. The Secretary General of the European Council holds the position of High Representative.[7] Further modifications were introduced in the 2001 Treaty of Nice,

1. Treaty on European Union, Title V, 'Provisions on a Common Foreign & Security Policy', *Official Journal*, C 191, 29 July 1992, available at: http://europa.eu/eur-lex/en/treaties/dat/EU_treaty.html. The two other pillars are Economic and Social Policies and Justice and Home Affairs.

2. Treaty on European Union, Title V, 'Provisions on a Common Foreign & Security Policy', Art. J.1(2).

3. Ibid., Art. J.2.

4. Ibid., Art. J.3. The Harvard-Sussex Program on Chemical and Biological Weapons (HSP) maintains an updated overview of the different EU Joint Actions in the fields of biological, chemical and nuclear disarmament and arms control at: http://www.sussex.ac.uk/Units/spru/hsp/Harvard-Sussex-Program-The-EU-and-WMD.htm.

5. The Treaty of Amsterdam, Amending the Treaty on European Union, the Treaties Establishing the European Communities and Certain Related Acts, Amsterdam, 2 October 1997, available at: http://www.eurotreaties.com/amsterdamtext.html.

6. Treaty of Amsterdam, Art. J.8.

7. Treaty of Amsterdam, Art. J.16. The position is currently held by Javier Solana of Spain.

allowing for enhanced cooperation relating to the implementation of a joint action or a common position.[8]

Although the foreign and security policy was to cover all aspects of security, the originally stated priorities of the Maastricht Treaty clearly were with regional security matters, including the absorption of the consequences of the collapse of the security infrastructure in Central and East Europe and the war in the former Yugoslavia.[9] Much of the remainder of the decade was dedicated to the adjustment to the new security context in Europe and defining the EU's position in relation to the North Atlantic Treaty Organisation (NATO) and Central and East European states, the absorption of Austria, Finland and Sweden as new EU Members, and the preparations for monetary union, greater political integration and further membership expansion. Although the CFSP began to display two clear dimensions, namely the political and diplomatic component, on the one hand, and the newer security and defence component, on the other hand, it still retained much of its declaratory character. For example, with regard to biological and chemical weapons, Presidency statements were read at the meetings of the First Committee of the UN General Assembly, the 2nd BTWC Review Conference (1986) and the CWC signing ceremony in 1993.[10]

In 1996, however, the 4th Review Conference of the BTWC offered the first opportunity to present a common view on the convention and its future. On the one hand, the common position called on all EU Member States to actively promote the work of the Ad Hoc Group of States Parties to the BTWC in order to negotiate a legally binding protocol to the convention. The EU Members were to engage in the drafting of proposals to be included in the protocol, and to seek maximum progress on verification measures in the context of the Ad Hoc Group. On the other hand, it allowed the Presidency to undertake *démarches* to States Parties on matters relating to the review conference and to Non-States Parties with a view to encourage them to ratify or accede to the BTWC.[11]

In 1998 and 1999 the EU would agree on two further common positions in support of the work of the Ad Hoc Group. The first one focussed on four measures to enhance compliance with the BTWC to be included in the protocol. In addition, the EU members should pursue joint positions in the negotiations, particularly with regard to the four verification and compliance meas-

8. Consolidated Version of the Treaty on European Union, Art. 27(a) to (e), document available at: http://europa.eu/eur-lex/en/treaties/dat/C_2002325EN.000501.html#anArt28.

9. Brussels European Council, Conclusions of the Presidency, Bulletin of the European Communities, no. 10/1993, p. 8, document available at: http://aei.pitt.edu/1435/01/Brussels_oct_1993.pdf.

10. Adam Daniel Rotfeld, 'Europe: the transition to inclusive security', *SIPRI Yearbook 1998: Armaments, Disarmament and International Security* (Oxford: Oxford University Press, 1998), p. 154; Daniel Feakes, 'The emerging European disarmament and non-proliferation agenda on chemical and biological weapons', *Disarmament Diplomacy*, no. 65, July/August 2002, available at: http://www.acronym.org.uk/dd/dd65/65op2.htm.

11. Common Position of 25 June 1996 defined by the Council on the basis of Article 5.2 of the Treaty on European Union, relating to preparation for the Fourth Review Conference of the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction (BTWC) (96/408/CFSP), *Official Journal of the European Communities*, 6 July 1996, p. L 168/3.

ures. Besides authorising *démarches* by the Presidency, it encouraged the development of contacts between the governments of EU Members, the Commission and industry in order to further understanding between representatives of European industry and the negotiators in the Ad Hoc Group.[12] The second reiterated the 1998 Common Position, but expanded the list of four verification and compliance mechanisms with two additional measures.[13] It also expressed confidence that the protocol might be achieved before the end of 1999.

No common position was issued in advance of the 5th Review Conference. However, the Belgian Presidency during the second half of 2001 imposed a stricter form of coordination than had habitually been the case in BTWC discussions (notably the Ad Hoc Group). It requested all EU Members to associate themselves with the EU statement to the Review Conference and not make individual national statements (with the exception of the United Kingdom as a depositary state). Belgium also pushed to have all interventions made on behalf of the EU, but failed in this respect so that a system of division of labour was set up whereby Member States represented the EU on specific issues.[14] This was therefore the level of integration with regard to BW disarmament that the EU had achieved when it was confronted with the first major challenge to its ambition of becoming a global actor in the sphere of international peace and security.

The 5th Review Conference and beyond

By any account, 2001 was an extraordinary year for international security relations. In January, the new Bush Administration took office. Many of its members were committed to a new world order based on US predominance. In this world view there was only limited space for multilateral arms control and disarmament, whose compromises bound the US options for action. During the spring, the administration undertook a review of the BTWC and the work by the Ad Hoc Group. Its outcome was an early warning during the 23rd session of the Ad Hoc Group (23 April-11 May 2001) that the draft text then under discussion insufficiently reflected US national positions, and the statement of 25 July that the draft protocol would not achieve the Ad Hoc Group's mandate and strengthen confidence in compliance with the conven-

12. Common Position of 4 March 1998 defined by the Council on the basis of Article J.2 of the Treaty on European Union, relating to progress towards a legally binding Protocol to strengthen compliance with the Biological and Toxin Weapons Convention (BTWC) and the intensification of work in the Ad Hoc Group to that end (98/197/CFSP), *Official Journal of the European Communities*, 12 March 1998, pp. L 75/2-3.

13. Common Position of 17 May 1999 adopted by the Council on the basis of Article 15 of the Treaty on European Union, relating to progress towards a legally binding Protocol to strengthen compliance with the Biological and Toxin Weapons Convention (BTWC), and with a view to the successful completion of substantive work in the Ad Hoc Group by the end of 1999 (1999/346/CFSP), *Official Journal of the European Communities*, 28 May 1999, pp. L 133/3-4.

14. Daniel Feakes, op. cit.

tion. Later it became clear that the administration was also seeking to terminate the negotiation process.[15] On 11 September the United States came under major terrorist attack, which set in motion a chain of events that led to the invasion of Afghanistan the next month and of Iraq in March 2003. Terrorism, including acts of terrorism involving chemical and biological substances, had already become a major security concern during the 1990s. However, the murder of five people and infection of another 17 victims by means of mail-delivered anthrax spores in September-October 2001 added a new and urgent threat dimension to US security. The anthrax attacks served to confirm existing convictions in the Bush Administration that the United States had to rely primarily on its own resources for its security and that beyond the reaffirmation of the fundamental norm against the weaponisation of disease the BTWC had little to contribute to national security. In addition, more aggressive programmes involving the public naming of presumed proliferators and reversing proliferation would be pursued.

This succession of events created an uncomfortable background for the 5th Review Conference, which was held from 19 November until 7 December 2001. At the start of the year there had been high hopes of the States Parties endorsing the protocol while they were meeting in Geneva, which would have led to its opening for signature. Now it was not formally on the agenda of the Review Conference, and the States Parties were both deeply split over the future of the draft protocol and unsure about the review conference's role as regards the Ad Hoc Group.[16] Emotions were also confused in the autumn of 2001. The anger at the US move in July was mixed with feelings of sympathy towards the US for having been the victim of the terrorist attacks. Few countries, if any, appeared prepared to force a showdown over the draft protocol. In addition, the then uncertain international security consequences of these attacks and the subsequent anthrax letters generated dubiety about the value and the future role of the BTWC, which must have left quite a number of policy-makers wondering whether the draft protocol was the appropriate answer to the new challenges. Such questions and doubts, however, did not challenge their belief in the fundamentals of multilateral diplomacy, and many States Parties thought that the international response to the terrorist attacks would convince the Bush Administration of the value of multilateral security, and of arms control and dis-

15. Jean Pascal Zanders, John Hart and Frida Kuhlau, 'Chemical and biological weapon developments and arms control', in *SIPRI Yearbook 2002: Armaments, Disarmament and International Security* (Oxford: Oxford University Press, 2002), p. 671.

16. The 24th session of the Ad Hoc Group (23 July-17 August) attempted to prepare a report for the 5th Review Conference, but failed over the US refusal to have it named as being responsible for the failure of the negotiations. Graham S. Pearson,, 'Strengthening the Biological and Toxin Weapons Convention', *Chemical and Biological Weapons Conventions Bulletin*, no. 53 (September 2001), pp. 21-2.

armament treaties in particular. From the opening statements at the Review Conference it emerged that many States Parties believed that large portions of the draft protocol might be salvaged for a new type of agreement (perhaps with additional focus on terrorism) and that the negotiation process was not lost. After all, the Ad Hoc Group mandate had not been terminated.

The hope for a fresh start of the multilateral negotiations, which arose from the complex mix of emotions generated during the previous six months, appears to have underestimated the strength of the ideological convictions underpinning the Bush Administration's approach to the BTWC and the protocol negotiations. If anything, the terrorist attacks emboldened the Administration in its security policies. In his opening plenary statement at the 5th Review Conference, John Bolton, then US Undersecretary of State for Arms Control, accused four States Parties (Iran, Iraq, Libya and North Korea) and one signatory state (Syria) of pursuing biological warfare capabilities. While it was initially feared that the accusations would derail the Review Conference from the outset,[17] it was not until much later, when the United States insisted on including language on the non-compliance in the final report, while refusing to offer evidence of such non-compliance or initiate formal procedures under the BTWC to address the allegations, that a major problem for the States Parties arose.[18] On the last day, a mere two hours before the Review Conference was scheduled to end, Bolton submitted an unexpected amendment to terminate the mandate of the Ad Hoc Group. EU representatives were particularly angered by the lack of prior US consultation in the Western Group. During a brief recess, in which the different regional groupings considered their response, they even refused to participate in a Western Group meeting with the United States and met instead as an EU group. As a consequence of the US action, no final declaration was adopted and the Review Conference was adjourned until 11-22 November 2002.[19]

Could the EU have anticipated the US move at the Review Conference? Since the US delegation's indication that many of its national positions on the substance of the draft protocol were not reflected in the draft protocol presented in the late spring of 2001, the EU had been trying to accommodate those concerns in order to keep the US engaged in the Ad Hoc Group process. Following the termination of the negotiations in August, many representatives from EU Members tended to agree with the US criticism that the

17. Initial reaction was limited to denials by Iran, Iraq and Libya. North Korea did not participate in the meeting.

18. Richard Lennane, 'Blood, toil, tears and sweat: the Biological and Toxin Weapons Convention since 2001', *Disarmament Forum*, no. 3, 2006, p. 6.

19. Jenni Rissanen, 'Anger after the ambush: Review Conference suspended after US asks for AHG's termination', *BWC Protocol Bulletin*, 9 December 2001, distributed via the Acronym Institute. See: http://www.acronym.org.uk/bwc/index.htm.

protocol text was weak, particularly as regards verification, but were particularly annoyed at the US refusal to recognise that the Western Group's accommodation of the US concerns over the previous months had been the primary cause of the weakened draft. The BTWC's woes were soon to be overshadowed by the terrorist strikes.

In hindsight, however, there were some early indicators that by the meeting of the First Committee on Disarmament and International Security of the UN General Assembly in New York (1 October-6 November) the US position on the draft protocol had hardened. Most people then attributed the US statements to raw emotions in the wake of the terrorist attacks and the anthrax letters. Many countries voiced their concern about the possible use of biological agents by terrorists. Yet, they also believed that more than ever multilateral security, as embodied by the work of the Ad Hoc Group, was the appropriate answer to the new threats. The United States, in contrast, confirmed its opposition to the draft protocol, adding that in the light of 11 September the primary focus must be on strengthening the norm against BW use.[20] As a consequence of the deepening divisions, the annual resolution in support of the BTWC (and the negotiation of the draft Protocol) was eventually downgraded to a strictly procedural request to the UN Secretary-General to continue rendering the necessary assistance to the depositary governments of the BTWC, the forthcoming Review Conference, and the Ad Hoc Group.[21] The debate on the original draft introduced by Ambassador Tibor Tóth of Hungary (who had also chaired the Ad Hoc Group meetings), which would have invited the 5th Review Conference to consider the work by the Ad Hoc Group and the question on how to proceed, threatened to repeat the debacle of the drafting of the Ad Hoc Group report in August.

While at the end of 2001 some EU members were left to feebly explain that the failure of the Ad Hoc Group was not solely the United States' responsibility, by the autumn of 2002 the EU as a whole was able to successfully resist Bolton's proposal to wrap up the resumed session of the 5th Review Conference quickly and quietly, and not to foresee any further meetings until the 6th Review Conference in 2006.[22] In fact, based on the alternative approaches to the Ad Hoc Group formally presented by Bolton to the opening plenary session of the 5th Review Conference in 2001, the EU helped to carve out the work programme for the intersessional meetings between 2003 and 2005.[23]

20. Statement by Avis Bohlen, United States Assistant Secretary for Arms Control in the First Committee, General Assembly, United States Mission to the United Nations, New York, 10 October 2001, p. 4.

21. Hungary: Draft decision 'Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction', UNGA document A/C.1/56/L.11, 18 October 2001.

22. Nicholas A. Sims, 'Towards the BWC Review Conference: Diplomacy Still in the Doldrums', *Disarmament Diplomacy*, no. 82, Spring 2006, p. 14.

23. The US alternative proposals concerned mechanisms to implement specific articles of the BTWC. 'Strengthening the international regime against biological weapons', Statement by the President, Office of the Press Secretary, Washington, D.C., 1 November 2001, http://www.whitehouse.gov/news/releases/2001/11/20011101.html, and Statement of John R. Bolton, Under Secretary of State for Arms Control and International Security, United States Department of State, to the Fifth Review Conference of the Biological Weapons Convention, United States Mission, Office of Public Affairs, Geneva, 19 November 2001.

These intersessional meetings furthered the coordination of EU positions on various aspects of the BTWC. They consisted of a two-week meeting of experts (around the middle of the year) and a one-week meeting of the States Parties (at the end of the year). At each session, the Presidency delivered a statement on behalf of all the EU members and a number of associated states.

The articulation of a common policy for the BTWC

The second factor shaping EU positions regarding the BTWC was the European disunion over Iraq. Deep divisions emerged over the circumstances under which democracies could attack and invade another country, however reprehensible its regime, without a UN Security Council resolution under Chapter VII of the UN Charter or prior provocation. The two justifications developed throughout 2002 by proponents of an invasion of Iraq were: (1) Iraq's refusal to allow UN inspectors on its territory and the belief that it was actively continuing the development and production of biological, chemical and nuclear weapons, as well as their delivery systems, in defiance of UN Security Council Resolution 687 (1991) and subsequent resolutions; and (2) the links between Al Qaeda and Saddam Hussein's regime, which included allegations of Iraqis training Al Qaeda operatives in chemical and biological warfare techniques.

While those debates were ideologically highly charged, they had less visible, but nonetheless profound implications for the question whether the BTWC was verifiable. As has been noted elsewhere,[24] there have always been doubts about the verifiability of a BW disarmament treaty, but they have never prevented states from trying to develop adequate verification tools. However, after Iraq's ejection from Kuwait in 1991, the UN Security Council created the UN Special Commission on Iraq (UNSCOM) to oversee the termination of Iraq's biological and chemical weapon and missile programmes and the destruction of existing arsenals.[25] UNSCOM was granted an intrusive inspection mandate. It made good progress in destroying chemical weapons and missiles, but the Iraqis were far less forthcoming with regard to their BW programmes. Significant discrepancies remained between the Iraqi declarations and what UNSCOM inspectors were able to certify. In the eyes of the sceptics, UNSCOM's inability to close the BW file

24. See chapters one and two.

25. UN Security Council Resolution 687 (1991), 3 April 1991.

by the end of 1998 (when the inspectors were evicted from the country) proved the unfeasibility of a verification regime for the BTWC. In December 1999 UNSCOM was replaced by the UN Monitoring, Verification and Inspection Commission (UNMOVIC).[26] Three years later, after an ultimatum issued by President Bush in his address to the UN General Assembly in September 2002,[27] UN inspectors returned to Iraq. In several reports to the Security Council, UNMOVIC was unable to confirm that Iraq had continued or expanded its BW programmes since 1998. However, it did not fare any better than UNSCOM in closing the BW dossier.[28] In the eyes of those who were already convinced of Iraq's duplicity, there was no purpose in continuing useless inspections. Today there are many accounts detailing that the decision to go to war had already been taken before the autumn of 2002 and how raw intelligence on Iraq's alleged BW programmes and holdings had been constructed or selectively used to justify the forthcoming invasion.[29] Inspections carried out by US teams after the occupation of Iraq also failed to turn up evidence of concealed BW activities. However, in 2002 and 2003 support for the war based on Iraq's hidden arsenals and weapon programmes implied a serious lack of faith in inspection and verification regimes. The split over Iraq in the EU was thus at odds with the common goal to make the BTWC verifiable as evidenced by the many years of work required to develop the legally binding protocol. (The Common Position of 25 June 1996 related to the 4th Review Conference stated that 'Member States will accordingly seek maximum progress on verification measures in the context of the *ad hoc* Group and at the Review Conference'. The Common Position of 17 May 1999 on the Ad Hoc Group negotiations listed the specific types of verification measures the EU considered central to the future BTWC Protocol.)[30] In a broader sense, the split also highlighted the EU's inability to present itself as a unified, and therefore influential, actor on the global scene of international security relations.[31]

As a consequence, in 2003 the EU Members embarked on the development of a coherent strategy to deal with the security challenges posed by unconventional weapons.[32] They were able to draw on earlier moves within the overall CFSP framework to build common positions on disarmament and non-proliferation, which, as previously noted, had already led to the attempt by the Belgian Presidency to present a unified EU position at the 5th

26. UN Security Council Resolution 1284 (1999), 17 December 1999.

27. President's Remarks at the United Nations General Assembly, Office of the Press Secretary, 12 September 2002: http://www.whitehouse.gov/news/releases/2002/09/20020912-1.html.

28. The UNMOVIC reports are available at: http://www.un.org/Depts/unmovic/new/pages/document_list.asp.

29. See, for instance, Michael R. Gordon and Bernard E. Trainor, *Cobra II: The Inside Story of the Invasion and Occupation of Iraq* (New York: Pantheon Books, 2006); Thomas E. Ricks, *Fiasco* (Penguin Press: New York, 2006); and Ron Suskind, *The One Percent Doctrine* (London: Simon & Schuster, 2006).

30. Common Position of 25 June 1996 defined by the Council on the basis of Article 5.2 of the Treaty on European Union, relating to preparation for the Fourth Review Conference of the Convention on the prohibition of the development, production and stockpiling of bacteriological (biological) and toxin weapons and on their destruction (BTWC), *Official Journal of the European Communities*, 6 July 1996, p. L168/3, Article 2(2); Common Position of 17 May 1999 adopted by the Council on the basis of Article 15 of the Treaty on European Union, relating to progress towards a legally binding Protocol to strengthen compliance with the Biological and Toxin Weapons Convention (BTWC), and with a view to the successful completion of substantive work in the Ad Hoc Group by the end of 1999, *Official Journal of the European Communities*, 28 May 1999, pp. L133/3-4, Article 3.

31. See, for example, the speech by Jack Straw, then Secretary of State for Foreign and Commonwealth Affairs, to the Centre for European Policy Studies, Brussels, 19 May 2003, available at: http://europa.eu.int/constitution/futurum/documents/speech/sp190503_en.pdf.

Review Conference of the BTWC.[33] In 2002 the EU had also begun to elaborate and assess a range of concrete measures to address the terrorist threat in its non-proliferation, disarmament and arms control policy.[34] This then formed the basis of the EU Council initiative of 14 April 2003 to outline parameters for EU policies on the non-proliferation of unconventional weapons. Less than two months later, on 10 June, the Political and Security Committee agreed on thirteen basic principles, in a document which was forwarded to the EU Council for consideration.[35]

According to the document, the central pillar of EU policies are the multilateral disarmament and non-proliferation treaty regimes, which form the normative basis for all non-proliferation efforts. The EU should pursue their universalisation. In addition, the document indicates the EU's intention to make the best use of existing verification mechanisms and support the establishment of additional verification instruments.

Furthermore, the document identifies multilateral treaties and export control regimes as a first line of defence. In the event of proliferation concerns, the specialised international organisations like the Organisation for the Prohibition of Chemical Weapons (OPCW) and the International Atomic Energy Agency (IAEA) should be first involved. Only when measures like political dialogue and diplomatic pressure have failed would the EU be prepared to consider coercive measures under Chapter VII of the UN Charter and international law (sanctions, interception of shipments and, if appropriate, the use of force). In this process, the EU is to reserve a central role for the UN Security Council.

The EU should, according to the document, not limit itself to addressing the symptoms, but also deal with the underlying feelings of insecurity that contribute to states wanting to obtain unconventional weapons. Nevertheless, at the same time it should make explicit that there exists no justification for the illegal development of such weapons.

The document also identified the need for an EU common assessment of the global proliferation threats, to be prepared and updated by the EU Joint Situation Centre. The national intelligence services of the EU Members should be involved in the process. (A third factor, but which is less relevant in the present discussion on the shaping of policies with regard to the BTWC, was the reality of the threat posed by terrorist and criminal acts involving pathogens in the wake of the anthrax letters.[36])

32. Oliver Meier and Gerrard Quille, 'Testing time for Europe's nonproliferation strategy', *Arms Control Today*, vol. 35, no. 4, May 2005, available at: http://www.armscontrol.org/act/2005_05/Oliver_Quille.asp; and Aline Dewaele, 'The EU WMD Budget: Bridging the Gap between Objectives and Financial Resources', *SGP Issue Brief*, no. 8, September 2006, p. 1, available at: http://www.sgpproject.org/publications/SGPIssueBrief/DewaeleIssueBrief.pdf.

33. 5th Review Conference of the States Parties to the BTWC, Statement by Belgium on behalf of the EU, 19 November 2001 (unofficial translation), document available at: http://www.sussex.ac.uk/Units/spru/hsp/2001-1119%20EU%20RC5%20stmnt.pdf.

34. 'Draft report on the implementation of the list of concrete measures with regard to the implications of the terrorist threat on the non-proliferation, disarmament and arms control policy of the European Union', Note from Secretariat to Delegations, Council of the European Union document no. 15905/02, 20 December 2002.

35. 'Basic Principles for an EU Strategy against Proliferation of Weapons of Mass Destruction', Note from Secretariat to Delegations, Council of the European Union document no. 10352/03, 10 June 2003.

36. See Jean Pascal Zanders, 'The chemical and biological weapons threat', in Gustav Lindstrom and Burkard Schmitt (eds.), 'Fighting Proliferation –European Perspectives', *Chaillot Paper* no. 66 (Paris: EUISS, December 2003), pp. 59-87. One of the recommendations in the paper was the need to establish an independent threat assessment capability.

The document with 13 principles was shortly followed by a proposal for 'An Action Plan for the Implementation of the Basic Principles for an EU Strategy against Proliferation of Weapons of Mass Destruction'.[37] It called among other things for the adoption of a Common Position or Council declaration expressing a firm engagement for the promotion of the universalisation and reinforcement of multilateral agreements (including the BTWC and CWC) by the end of 2003. The proposed Action Plan identified the need for some steps to be undertaken immediately, including in the areas of nuclear and chemical proliferation and export controls. Biological weapons were only listed among longer term proposals. The cited reasons were the absence of a verification mechanism for the BTWC and the need for the EU to find ways to strengthen compliance. The EU Council document also preceded the August meeting of experts on national implementation measures, which was to be the first of three annual gatherings in the intersessional process that the EU had helped to salvage from the 5th Review Conference. Part of the longer-term strategy regarding BW involved commitments to ensure concrete outcomes from the expert meetings and to take the lead in supporting the national implementation of the BTWC, for example, by providing technical assistance. Other proposed measures included the strengthening of national legislation and control over pathogenic micro-organisms and toxins in EU member states and acceding countries, and the initiation of a dialogue with the biotechnology industry in Europe on the control of dangerous pathogens and the encouragement of a dialogue between the EU and US industry in the framework of the Transatlantic Business Dialogue with a view to enhance awareness of the issues involved.

At the Thessalonika meeting (19-20 June 2003) the EU Council adopted a Declaration on the Non-Proliferation of Weapons of Mass Destruction, requesting the Council to develop the action plan based on the basic principles further as a matter of urgency.[38] In October the urgency was reflected through the strengthening of the Council Secretariat. Javier Solana, High Representative for the Common Foreign and Security Policy, appointed Ms. Annalisa Giannella as Personal Representative on Non-Proliferation of Weapons of Mass Destruction to further develop and coordinate the implementation of the EU's policies on unconventional weapons. By the end of the year, the EU had

37. 'An Action Plan for the Implementation of the Basis Principles for an EU Strategy against Proliferation of Weapons of Mass Destruction', Note from Secretariat to Delegations, Council of the European Union document no. 10354/03 REV 1, 13 June 2003.

38. Presidency Conclusions, Thessaloniki European Council, 19-20 June 2003, Annex II, pp.37-39, document available at: http://europa.eu.int/constitution/futurum/documents/other/oth200603_en.pdf.

produced three documents that laid out the basic premises of all future policies with regard to arms control, disarmament and non-proliferation of unconventional weapons. The first was a Common Position on the universalisation and reinforcement of multilateral agreements.[39] Besides the call for the universalisation of existing arms control and disarmament treaties, including the BTWC, the document confirmed as formal EU policy the goal to reinforce treaty compliance by enhancing the detectability of violations and strengthening enforcement of the treaty obligations. In addition, it confirmed the EU's belief in the role verification mechanisms can play in the generation of confidence in treaty compliance and called for the establishment of additional verification instruments. Finally, it also recognised the need to strengthen the role of the UN Security Council, which has the primary responsibility for the maintenance of international peace and security.

The second document concretised the EU non-proliferation vision by requiring the inclusion of a so-called non-proliferation clause in new agreements with third countries and at the occasion of renewal or revision of existing ones with the EU and its Member States. Among other things the 'non-proliferation clause' requires that third countries contribute to the countering of the proliferation of unconventional weapons through 'the establishment of an effective system of national export controls, controlling the export as well as transit of WMD-related goods, including a WMD end-use control on dual-use technologies and containing effective sanctions for breaches of export controls'.[40]

Finally, the document entitled 'EU Strategy against Proliferation of Weapons of Mass Destruction' drew together the various elements developed over the previous months into a single policy document.[41] It was formally adopted on 13 December. It consists of three chapters. The first one reiterates the EU's perception of the proliferation threat; the second one confirms the emphasis on multilateralism with regard to arms control, disarmament and non-proliferation; and the final chapter outlines specific steps to address the proliferation threat, which include views on the role of the United Nations, the importance of fostering regional peace, security and stability, and cooperation with the United States and other allies. A centre entrusted with the monitoring of the consistent implementation of the EU strategy and the collection of relevant information and intelligence is to be set up at the EU Council

39. 'Council Common Position 2003/805/CFSP of 17 November 2003 on the universalisation and reinforcement of multilateral agreements in the field of non-proliferation of weapons of mass destruction and means of delivery', *Official Journal of the European Union*, 20 November 2003, pp. L302/34-36.

40. 'Fight against Proliferation of Weapons of Mass Destruction – Mainstreaming non-proliferation policies into the EU's wider relations with third countries', Note from the General Secretariat of the EU to Delegations, Council of the European Union document no. 14997/03, 19 November 2003.

41. 'Fight against Proliferation of Weapons of Mass Destruction – EU strategy against proliferation of Weapons of Mass Destruction', Note from the Council to the European Council, Council of the European Union document no. 15708/03, 10 December 2003.

Secretariat in association with the European Commission. Every six months the EU will also debate the implementation of the EU strategy.[42] This evaluation tool ensures that the highest EU decision-making levels will remain concerned by the efforts to curb the threat posed by unconventional weapons.

This strategy document also offered the framework for the future EU positions regarding the prevention of biological warfare and the weaponisation of disease. It identified the biological threat as follows:

> Biological weapons proliferation: although effective deployment of biological weapons requires specialised scientific knowledge including the acquisition of agents for effective dissemination, the potential for the misuse of the dual-use technology and knowledge is increasing as a result of rapid developments in the life sciences. Biological weapons are particularly difficult to defend against (due to their lack of signature). Moreover, the consequence of the use may be difficult to contain depending on the agent used and whether humans, animals, or plants are the targets. They may have particular attractions for terrorists. Biological weapons, as well as chemical weapons, pose a special threat in this respect.[43]

Besides the overall statement on multilateralism and the need for the universalisation of existing arms control and disarmament treaties, the document also includes specific visions and intentions regarding the BTWC:

> Reinforcing the BTWC and the CWC and, in this context, continuing the reflection on verification instruments. The BTWC does not contain at present a verification mechanism. The EU must find ways to strengthen compliance. A group of experts to give advice on how this could be done could be established. The EU will take the lead in efforts to strengthen regulations on trade with material that can be used for the production of biological weapons. The EU will also take the lead in supporting national implementation of the BTWC (e.g. in providing technical assistance). The EU will consider giving support to states with administrative or financial difficulties in their national implementation of the Chemical Weapons Convention and the BTWC.[44]

42. The six-monthly progress reports on the implementation of the EU's WMD strategy are available from the EU Council web site at: http://www.consilium.europa.eu/cms3_fo/showPage.asp?id=718&lang=EN&mode=g.

43. 'Fight against Proliferation of Weapons of Mass Destruction – EU strategy against proliferation of Weapons of Mass Destruction', op. cit., para. 8, p. 4.

44. 'Fight against Proliferation of Weapons of Mass Destruction – EU strategy against proliferation of Weapons of Mass Destruction', op. cit., para. 30, A(3), p. 10.

In summary, in the wake of the deep divisions brought about by the invasion of Iraq (and the underlying doubts about the effectiveness of onsite inspections to determine a state's non-compliance with international instruments banning BW) the EU was able to put together a joint policy vision on how to deal with the threats posed by the spread of unconventional weapons and their delivery systems. There is a strong commitment to global, multilateral treaties, for which the EU has committed itself to actively strive towards their universalisation and use existing or develop new verification mechanisms. The EU also reserves a central role for the United Nations, and the Security Council in particular, to resolve cases of non-compliance. Although it is still not a strong power, the EU is able to exploit its attractiveness as an economic partner in order to achieve its security goals.[45]

The implementation of a common policy in support of the BTWC

The execution of the EU policy elements regarding BW were initially low-key and in general have taken third place after nuclear and chemical weapon issues.[46] This was partly the consequence of the lack of an international organisation to cooperate with,[47] the lack of specialised expertise on BW disarmament within the EU institutions,[48] and the need to assess the outcomes of the new BTWC intersessional process. Nonetheless, as noted in the EU statement to the second meeting of the States Parties of the intersessional process in December 2004, EU members undertook several *démarches* in the capitals of many Non-States Parties in order to promote the universality of the BTWC. The statement also expressed the EU's preparedness to consider requests for support by states with administrative or financial difficulties in their national implementation of the BTWC and its willingness to cooperate with other partners or regional organisations in this regard.[49] On 26 March 2005, on the occasion of the 30th anniversary of the entry into force of the BTWC, the EU declared its dedication to universalise the convention. The statement was also remarkable for its insistence on the full implementation of all the convention's provisions (which includes the politically sensitive Article X) and its pointed use of the term 'verify' (which had became all but a taboo word during the AHG negotiations in order not to irritate the United States):

45. Oliver Meier, 'The European Union's Nonproliferation Strategy: an interview with Annalisa Giannella, the Personal Representative on Nonproliferation of Weapons of Mass destruction to the EU High Representative Javier Solana', Arms Control Association Interviews, 26 July 2005, available at: http://www.armscontrol.org/interviews/20050726_Giannella.asp.

46. For example, in the 'List of priorities for a coherent implementation of the EU WMD strategy', it was proposed to fund the support for the universalisation of the BTWC and legislative drafting assistance at a rate of €200,000 per year for five years. In comparison, around €3 million and €2 million *per annum* were suggested in support of the IAEA and OPCW respectively. 'Implementation of the WMD Strategy: 6-monthly progress report/List of priorities for a coherent implementation', Note from the Council to COREPER/Council, Council of the European Union document no. 15246/04, 3 December 2004, p. 35.

47. Meier, op.cit.

48. The need to convene a group of experts to advise the EU on ways to strengthen compliance with the BTWC and to prepare for the 6th Review Conference was recognised early on. 'EU Strategy against Proliferation of Weapons of Mass Destruction – Draft Progress Report on the implementation of Chapter III of the Strategy', Note from Secretariat to Council, Council of the European Union document no. 10448/04, 10 June 2004, p. 6; and 'Implementation of the WMD Strategy: 6-monthly progress report/List of priorities for a coherent implementation', Note from the Council to COREPER/Council, Council of the European Union document no. 15246/04, 3 December 2004, pp. 6 and 29.

49. 'EU Statement at the Meeting of State Parties to the BTWC (Geneva, 6-10 December 2004)', delivered by Ambassador Chris Sanders, The Netherlands, Geneva, 6 December 2004, paras. 5 and 6. The remainder of the address focussed on the main topics of the intersessional meeting, namely disease surveillance, detection and response.

> The EU is committed to the full implementation of all the Convention's provisions. The EU fully supports, and continues to participate actively in, the current three-year work programme. We furthermore attach high priority to the reinforcement of the Convention and remain committed to developing measures to verify compliance with the BTWC. We look forward to the 6th Review Conference in 2006, which will be a good opportunity for all States Parties to review the operation of the Convention, to reiterate their commitment to the international norm against BW and to agree on measures to strengthen the BTWC, taking into account recent developments.[50]

During the autumn of 2005, with the review conference just over a year away, the EU increased its attention towards the BTWC. A joint action in support of the convention was in the making and the project was publicly announced at the third meeting of the States Parties of the intersessional process in December.[51] The EU also indicated that it was already preparing for the 6th Review Conference and that one of the outcomes should be a further intersessional work programme for the period leading up to the 7th Review Conference. However, the statement also indicated that the EU had begun to differentiate between long-term goals and immediate, practical enhancements:

> Without losing sight of our long-term objectives for the Convention, the EU believes that the Review Conference must contribute actively to continued enhancement of the implementation of the BTWC and that our efforts should focus on specific, feasible, and practical enhancements to strengthen the Convention and its implementation.'[52]

The statement acknowledged the obvious: the resumption of any type of Ad Hoc Group activity in the near future was an illusion. However, it did leave open the question of how the EU would proceed to realise one of its long-time ambitions and central elements in its more recent policy documents and statements, namely a compliance verification regime.

In March 2006 the political statement of intent was formalised in a Council Common Position for the 6th Review Conference, published in time to communicate the EU expectations to the Preparatory Committee of the 6th Review Conference

50. Declaration of the EU at the occasion of the 30th anniversary of the Biological and Toxins Weapons Convention (BTWC), 26 March 2005, available at: http://www.eu2005.lu/en/actualites/pesc/2005/03/26ciab/index.html.

51. 'EU Statement at the Meeting of State Parties to the BTWC', delivered by Fiona Paterson, Deputy Permanent Representative to the Conference on Disarmament, United Kingdom, Geneva, 5 December 2005, para. 3. Earlier, joint actions adopted in support of IAEA and OPCW activities had already been agreed. Since then, additional joint actions have been adopted in support of the Comprehensive Test Ban Treaty Organisation (CTBT) and the implementation of UN Security Council Resolution 1540.

52. Ibid., para. 9.

scheduled for 26-28 April 2006. The core ambitions comprise a full review of the operation of the BTWC, including the implementation of the undertakings by States Parties; the adoption of a work programme for a new intersessional process between the 6th and 7th Review Conferences; and the organisation of a 7th Review Conference no later than 2011. In addition to helping achieve a consensus outcome for the 6th Review Conference, the Council Common Position also identified a broader framework of action in support of the norm against the weaponisation of disease, including the universalisation of the BTWC, amelioration and expansion of the CBMs, the full implementation of UNSC Resolution 1540 (2004) with regard to BW, support for the G8 Global Partnership programme, and the consideration of further action on the issues discussed during the 2003-2005 intersessional programme.[53]

Meanwhile, the EU had also agreed on a concrete work plan. On 27 February 2006 the EU adopted a Joint Action in support of the BTWC, which comprises two projects. The first one consists of five regional seminars specifically aimed at the Non-States Parties in an effort to have them join the BTWC. The second one supports efforts to improve national implementation legislation of States Parties, and is the EU's response to the conclusions of the first intersessional meeting of the BTWC States Parties in 2003.[54] Both components were identified early in the process of the development of a common strategy, and recur in many documents and reports relating to the implementation of the strategy.[55] In the absence of an international organisation dedicated to BW disarmament, the Geneva-based BioWeapons Prevention Project (BWPP) has been entrusted with the technical implementation of the Joint Action. It is believed that this is the first time a non-governmental organisation has been involved in the execution of an EU Joint Action. The 18-month Joint Action started on 1 April 2006.

The universalisation component began with three preparatory meetings held in Brussels, Geneva and New York in April and May to inform the diplomatic representatives of the Non-States Parties of the goals of the Joint Action and the intention to organise regional seminars. The regional meetings involve in-depth discussions on the obligations, benefits and responsibilities under the BTWC and pay specific attention to the issues that are of specific concern to the region and individual countries. Testimonies from

53. Council Common Position 2006/242/CFSP of 20 March 2006 relating to the 2006 Review Conference of the Biological and Toxin Weapons Convention (BTWC), *Official Journal of the European Union* (25 March 2006), pp. L 88/65-67. The 'G8 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction' was agreed at the 2002 G8 Summit held in Kananaskis, Canada. Its participants – Canada, the EU, France, Germany, Italy, Japan, Russia, the United Kingdom, and the United States – pledged to raise up to US $20 billion to support projects aimed at reducing the threat posed by unconventional weapons.

54. Council Joint Action 2006/184/CFSP of 27 February 2006 in support of the Biological and Toxin Weapons Convention, in the framework of the EU Strategy against the Proliferation of Weapons of Mass Destruction, *Official Journal of the European Union*, 7 March 2006, pp. L65/51-55.

55. For example, 'EU Strategy against Proliferation of Weapons of Mass Destruction – Draft Progress Report on the implementation of Chapter III of the Strategy', Note from Secretariat to Council, Council of the European Union document no. 10448/04, 10 June 2004, p.7; and 'Progress Report on the implementation of Chapter III of the EU Strategy against the Proliferation of Weapons of Mass Destruction', Note from Secretariat to Delegations, Council of the European Union document no. 9898/05, 8 June 2005, p. 5.

regional States Parties as well as expert presentations by representatives from international organisations like the World Organisation for Animal Health (OIE), UN Department for Disarmament Affairs and the World Health Organisation, as well as from EU Member States and the European Commission, are central to the seminar programme. The meetings were held or are planned for Southern and Eastern Africa (Nairobi, Kenya, June 2006), the Asia and Pacific region (Bangkok, Thailand, November 2006), Latin America and Caribbean (January 2007), West and Central Africa and the Middle East (first half of 2007). One concrete result of the universalisation project was the discovery after the Nairobi seminar that Burundi had actually ratified the BTWC on 16 June 2000 and signed, but not submitted, the instrument of ratification. Burundi deposited its instrument of ratification with Russia, the United Kingdom and the United States in October 2006. (Burundi will formally become a Party to the BTWC when the receipt of the instrument of ratification is formally acknowledged by at least one of the Depositary States). In addition, Comoros and Madagascar are advancing the process for accession/ratification.

The second pillar of the Joint Action consists of national implementation assistance, whose focus is on assisting States Parties to the BTWC that are not a member of the European Union or the Western Group in the UN Conference on Disarmament with the drafting or amelioration of national legislation or regulations as required under Article IV of the BTWC. Up to twelve assistance visits undertaken by teams consisting of the BWPP Legal Coordinator and two legal experts from EU Member States are envisaged. This pillar is under development and the first assistance visits are expected early in 2007. Meanwhile, an international conference was organised at the EU Institute for Security Studies in Paris on 25 September 2006. One of its principal aims was to promote the national implementation project of the Joint Action and invite interested States Parties to request such assistance.

In addition to the Joint Action, the EU adopted a complementary action plan on biological and toxin weapons, consisting of two measures that do not require EU funding.[56] The first one relates to the efficient use of the confidence-building measures (CBMs). EU Members are to 'ensure the fulfilment of their obligation under the BTWC to file a CBM return each year, beginning with 2006 as a first step'. Their annual compliance with the CBM

56. EU Action Plan on biological and toxin weapons, complementary to the EU Joint Action in support of the BTWC, *Official Journal of the European Union*, 9 March 2006, pp. C57/1-2.

obligations would enable the EU 'to take diplomatic action towards other States Parties to the BTWC to fulfil their obligations under the Convention' and develop thoughts on how best to improve the effectiveness of CBMs. The second measure expresses the EU wish to enhance the effectiveness of the current UN Secretary General's mechanism for investigating cases of alleged use of chemical and biological and toxin weapons,[57] and calls on Member States to update and supplement the lists of experts and laboratories available to him. Unlike the Joint Action, which has the quality of law, this action plan was published as an information and therefore functions more as a call or recommendation.

Preparation for the Review Conference

Already under the Dutch Presidency (second half of 2004) the EU began to prepare for the 6th Review Conference.[58] A seminar organised by The Netherlands in The Hague on 14-15 April 2005 yielded some common elements that then formed the basis for further EU preparatory work.[59] On 19 September 2006 the EU released its first set of working papers for the Review Conference:

- *EU Paper on BTWC Article X* (prepared by Finland): the paper notes the great developments in international cooperation in fields related to the BTWC implementation that have taken place since the 4th Review Conference in 1996, including the resolutions and the strengthening of capacities of international organisations like the FAO, IPPC, OIE and WHO, international cooperation in combatting the spread of avian flu, and the growth of international cooperation in the private sector in the fields of biology and biotechnology. It also highlights specific EU programmes and contributions in those areas. The EU requests the 6th Review Conference to reaffirm the conclusions with regard to surveillance, detection, diagnostics and combatting infectious diseases of the 2004 meeting of the States Parties to the BTWC and to review Article X in the light of the heightened consciousness about the threat of terrorism with biological agents, the role of the private sector in implementing the article, and increased exchanges of information among BTWC States Parties about the implementation of the article.

57. See chapter one, pp. 20-2.

58. 'Implementation of the WMD Strategy: 6-monthly progress report/List of priorities for a coherent implementation', Note from the Council to COREPER/Council, Council of the European Union document no. 15246/04, 3 December 2004, p. 7.

59. 'Progress Report on the implementation of Chapter III of the EU Strategy against the Proliferation of Weapons of Mass Destruction', Note from Secretariat to Delegations, Council of the European Union document no. 9898/05, 8 June 2005, p. 5. During the first half of 2005 The Netherlands continued to coordinate EU policies relating to the BTWC on behalf of the Luxembourg Presidency.

- *EU Paper on the enhancement of the CBM process* (prepared by France): The paper contains a series of concrete proposals to improve the format, process and substance of the CBMs. The annex provides a detailed overview of CBM participation based on the submissions between 2000 and 2005, with a breakdown per group in the Conference on Disarmament.[60]
- *EU Paper on Biosafety and Biosecurity* (prepared by Germany): The paper offers a detailed analysis of the role biosafety and biosecurity measures play in the implementation of Article IV of the BTWC, in particular with regard to 'prohibiting and preventing' anybody from undertaking any type of activity prohibited under the first three articles of the convention. Referring to the output from the 2003 intersessional expert meeting on biosafety and biosecurity, the EU proposes to develop and maintain a systematic catalogue of biosafety and biosecurity measures during the 2007-2010 intersessional period, with an aim to increase awareness as well as enable assistance to BTWC States Parties seeking to enact and implement appropriate legislative and other measures in this area. The EU furthermore urges BTWC States Parties to offer assistance in national implementation.
- *EU Paper on Assessment of National Implementation of the BTWC* (prepared by Germany): The paper offers a detailed analysis of the various dimensions of Article IV implementation and discusses a range of areas that should be covered by national law and regulations.
- *EU Paper on Increasing Universal Adherence to the BTW Convention* (prepared by Italy): The paper reiterates the centrality of universalisation in the EU strategy against unconventional weapons and summarises the activities undertaken so far (including the EU Joint Action in support of the BTWC and *démarches* by EU Members). In particular, it offers a detailed plan of activities that the 6th Review Conference should adopt in order to increase the number of States Parties to the level of the NPT or CWC:
  a) establishment, of a network of national (and regional) BTWC 'points of contact', *inter alia* to facilitate implementation of this Universality Strategy. These points of contact would be established on an informal basis. States Parties are requested to inform other States Parties and the UNDDA-based BTWC secretariat of their 'points of contact' and to keep their information up to date if/as details change; EU

60. See chapter two, pp. 44-5.

Member States have established such contact points and these are listed in the annexes to this paper;

b) effective promotion of universality of the BTWC by its States Parties in all relevant fora, including in regional, sub-regional and relevant international organisations, and where practicable undertaking joint activities with such organisations;

c) as part of an intersessional process, development of measures to assist States ready to join the Convention in their national preparation for implementing it;

d) in bilateral contacts with Non-Party States, promoting accession or ratification of the BTWC and offering bilateral assistance visits to States that are ready to become a Party to the Convention to assist them with this effort;

e) regional and sub-regional seminars and workshops to promote the object and purpose of the Convention, inform prospective States Parties of the obligations under the Convention and outline available assistance for both accession and national implementation measures;

f) establishment and implementation of measures to increase awareness of the Convention, and of the work of the BTWC, including publications in official languages of the final documents of the intersessional activities and of the Review Conferences;

g) promotion of the BTWC by its States Parties in bilateral, regional and other agreements with States not Party, using tools such as the EU WMD clause.

- *EU Paper on BTWC Implementation: need for a concerted and coordinated approach* (prepared by The Netherlands): This paper proposes to establish an Implementation Support Unit as a form of enhanced BTWC Secretariat with the UN Department of Disarmament Affairs (UNDDA) in Geneva.[61] While the proposal is still a big step short of an international organisation dedicated to the implementation of the BTWC, it could already take up a number of essential tasks:

a) Provide a central point of contact for States Parties for all matters concerning the Convention and its implementation, and a standard channel for communication among States Parties.

b) Assist States Parties in their efforts to promote universal adherence to the Convention, including through liaising

61. The BTWC Secretariat is a non-permanent organ within the UNDDA and its staff members do not appear in the UN organisational charts.

with Non-States Parties, and attending universality-related events.

c) Act as a 'clearing house', matching requests from States Parties for assistance with national implementation, submission of CBMs, bio-security and preparedness with offers of such assistance from other States Parties.
d) Maintain a reference collection of existing national implementing legislation, model legislation, international standards, guidelines, codes of conduct, manuals and other resources, provide an annual overview of newly enacted national implementing legislation, and provide basic advice to States Parties on drafting relevant legislation.
e) Collect and circulate to States Parties the annual Confidence-Building Measures, send out reminders for CBM submissions, and provide basic advice to States Parties on preparing and submitting CBMs.
f) Assist the Depositaries with the administration of the Convention: maintain status lists, notify States Parties of accessions, meetings, initiation of formal proceedings, etc.
g) Continue to support the intersessional process, and thereby facilitate active participation by all States Parties, by conducting research on assigned topics, preparing background papers, and liaising with relevant organisations.

- *EU Paper on The Intersessional Programme of Work: Its utility and contribution to fulfilling the object and purpose of the BTWC between 2003-2005 and a case for further intersessional work after 2006* (prepared by the United Kingdom and France): In this paper the EU offers a positive evaluation of the 2003-05 intersessional process, and strongly recommends a follow-on intersessional programme for the period between the 6th and 7th Review Conferences. As concretisation of the 'specific, feasible, and practical enhancements to strengthen the Convention and its implementation' referred to in the EU statement of December 2005,[62] it suggests the following possible topics:

a) improvements to the confidence-building measures;
b) safety and security of pathogens and toxins;
c) detection of pathogenic agents and response to epidemics in real time;
d) raising of the awareness of the biological risk in national populations;
e) judicial, police and customs cooperation on the prevention

62. 'EU Statement at the Meeting of State Parties to the BTWC', delivered by Fiona Paterson, op.cit.

of proliferation of high-risk products and illicit trade in dual-use equipment;

f) redirection of scientists previously involved in military programmes; and

g) regional and sub-regional cooperation on BTWC implementation.

The list is not necessarily limitative. As those activities would be ongoing, the EU also proposes to adopt a working budget for the whole period until the next review conference.

The EU may still release some further working papers in the run-up to the 6th Review Conference. Nevertheless, many components in the seven documents already available interlock quite well and seem to mutually reinforce each other (e.g., implementation support unit, enhancement of the CBM process and its relevance to the States Parties, organisation of assistance and cooperation with regard to national implementation and Article X matters). It may be one of the more tangible results of the increased integration of security strategies and action plans among EU Members.

The EU and the future of the BTWC

The advent of the 6th Review Conference has galvanised the EU to undertake comprehensive action in support of the BTWC. Priority areas of activity are the universalisation of the convention, enhanced national implementation and compliance, as well as a common commitment by all EU Members to submit their CBM returns in time for the 2006 deadline and the circulation of EU working papers for the Review Conference. As noted in the six-monthly progress report of June 2006, the goal of these concrete actions is to add credibility to the Common Position respecting the Review Conference adopted in March.[63]

Between 1996 and 2006 the EU has progressed considerably towards an integrated approach on BW control. Whereas the Common Position regarding the 4th Review Conference still called on *Member States* to promote progress in the Ad Hoc Group and seek maximum progress on verification measures,[64] the one relating to the 6th Review Conference stated that it is the *European Union*'s objective to further strengthen the BTWC and identify

63. 'Implementation of the WMD Strategy – Six-Monthly Progress Report on the Implementation of the EU Strategy against the Proliferation of Weapons of Mass Destruction (2006/I)', Note from the General Secretariat to Delegations, Council of the European Union document no. 10527/06, 14 June 2006, p. 6.

64. Common Position of 25 June 1996 defined by the Council on the basis of Article 5.2 of the Treaty on European Union, relating to preparation for the Fourth Review Conference of the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction (BTWC), Official Journal of the European Communities, 6 July 1996, p. L186/3, Article 2.

effective mechanisms to improve and verify compliance with the BTWC.[65] The Presidency's opening statement to the 5th Review Conference in 2001 included probably the first public reference to the EU as a single actor in the field of BW control.[66]

The surprise US attempt to terminate the Ad Hoc Group mandate in December 2001 and the intra-EU divisions over the invasion of Iraq doubtlessly accelerated this integration. Whereas the Presidency still had to concede a division of labour among individual Member States in 2001, a more coherent EU action during the resumed session of the 5th Review Conference in 2002 helped to safeguard the 2003-05 intersessional process. In 2006, the preparatory documents for the 6th Review Conference have been presented as EU papers, although there is still a residue of the division of labour through the identification of the authoring EU Member State(s). The clear advantage of this process is that these documents carry the weight of a consensus position of 25 States Parties to the BTWC. The disadvantage is that if consensus is difficult to achieve, the circulation of a document may be considerably delayed. If no agreement is possible, then the drafting EU Member State may no longer have the alternative of releasing the document, whatever its merit, as a national working paper. Whether EU diplomatic action is a 'policy straitjacket' producing the lowest common denominator or a 'laboratory of consensus' benefiting from multiple points of view is a recurring debate as the EU moves farther along the road to integration.[67] Yet the EU statement to the meeting of the Preparatory Committee for the Review Conference in April 2006 was delivered by the Austrian Presidency on behalf of a total of 35 states,[68] indicating that the output of internal deliberations can garner the support of a much wider group. This represented almost half of the 78 participating BTWC States Parties.

In its efforts to take the BTWC forward, the EU distinguishes between long-term objectives and 'specific, feasible, and practical enhancements'. Up till 2001 its vision for the BTWC consisted of a supplementary international regime to enhance transparency, compliance monitoring and enforcement, and to investigate allegations of use. An international organisation employing international inspectors was to oversee the implementation of the new regime. Since the collapse of the protocol negotiations the vision has not been repeated in any concrete way, although the formal commitment to verification and multilateral

65. Council Common Position 2006/242/CFSP of 20 March 2006 relating to the 2006 Review Conference of the Biological and Toxin Weapons Convention (BTWC), *Official Journal of the European Union* (25 March 2006), p. L 88/66, Article 2.

66. Statement by Belgium on behalf of the EU, op.cit., para. 4.

67. Feakes, op. cit.

68. The states on whose behalf the EU Presidency also spoke are Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the Former Yugoslav Republic of Macedonia, Norway, the Republic of Moldova Romania, Serbia and Montenegro, Turkey, and Ukraine. Statement by Ambassador Dorothee Auer, Austria, on behalf of the European Union, Meeting of the Preparatory Committee for the 2006 Review Conference, Geneva, 26-28 April 2006.

approaches to strengthening the convention is reiterated in all public statements. In contrast, the shorter-term enhancements have evolved, inspired in part by the outcomes of the intersessional meetings of experts and States Parties. The original two ideas in the preparatory documents for the 2003 EU non-proliferation action plan relating to the universalisation of the BTWC and strengthening the national implementation are being implemented through the Joint Action in support of the BTWC. The EU is also seeking to enhance the relevance of the CBMs by calling on its Members to submit their declarations in time. The early start in 2005 on a coordinated approach to the 6th Review Conference has resulted in a series of thematic working documents, which were circulated in September 2006. This work, together with the topics of the second series of intersessional meetings (if agreed by the 6th Review Conference), will undoubtedly further inspire the EU activities in support of the norm against the weaponisation of disease.

Despite conscious efforts to claim a leading global role in peace and security matters, the EU also recognises the limits on the goals it can achieve. In the BW area it cannot ignore the United States. Transatlantic consultation on a common agenda takes place regularly, but there is not necessarily a convergence of views.[69] The United States seeks to terminate the mandate of the Ad Hoc Group. With regard to alternative approaches to strengthening the BTWC it has drawn a number of red lines, complicating notably the establishment of a permanent international organisation (whether as a body similar to the OPCW or as a small treaty implementation support unit) or a scientific panel or advisory board. In one of its working papers for the 6th Review Conference, the EU proposes the creation of a non-permanent support unit to assist with the next intersessional work programme and some recurring tasks related to treaty implementation (e.g., the CBM process). Budget allocations would be limited until the 7th Review Conference, thus enabling review of past activities and decisions on future multilateral implementation support work. A couple of staff members would be added to the BTWC Meetings Secretariat, which is – as the name suggests – in itself a non-permanent unit within the UN Department for Disarmament Affairs that does not figure in UN organisational charts. The proposal may be a compromise formula that the United States has already signalled in private is acceptable, in which case it would be a tangible out-

69. Meier, op.cit.

come of the greater internal cohesion of the EU. Otherwise, it may become a test case for Europe's international clout as it lobbies for an idea that most States Parties to the BTWC seem to be willing to endorse.

There are also financial constraints on what the EU can undertake. According to a recent study,[70] the money allocated to the CFSP represents less than 0.1 per cent of the total EU budget. Since the start of 2003, some €30 million has been spent on projects relating to the prevention of unconventional weapons. Within that, less than €1 million has been allocated in support of the BTWC (namely the cost of the Joint Action).[71] For the next financial perspective 2007-13 almost €49.5 billion has been reserved for the CFSP, which represents a 29 per cent increase over the current financial perspective. Despite the increases, based on past experience the study also warns of sharp fluctuations between years in the money actually available for non-proliferation and disarmament projects as new, urgent demands may be made on the budget. This renders long-term planning difficult. Biological weapons traditionally have had the lowest priority among the three classes of unconventional weapons. However, the EU will have to increase the relative budget allocation to BW if it wishes to follow up on the current Joint Action in support of the BTWC and initiate activities in new areas for which the second intersessional process may be a source of inspiration.

The greatest danger present in sustained EU involvement in the prevention of biological weapons is arguably the current vagueness of its longer-term ambitions regarding the BTWC and the norm against BW. As stated in its declaration at the occasion of the 30th anniversary of the entry into force of the BTWC, the EU is committed to the full implementation of all the BTWC's provisions. Focussing on practical and feasible matters may result in a process of suboptimisation whereby certain components get ameliorated all the time, but other ones remain neglected for want of an overall upgrading plan. Through an accumulation of small incremental steps, the process may unintentionally take on a certain momentum, which later, as a consequence of its own dynamic, proves impossible to adjust.

States Parties from different parts of the world have welcomed the EU working documents as a good basis for constructive discussion at the 6th Review Conference. After the events in 2001 and 2002, 2006 is still a moment of transition, during which States

70. Dewaele, op.cit., pp. 1-3.

71. By way of comparison, about €15.4 million has been allocated for nuclear weapons (IAEA and CTBT), €3.5 million for chemical weapons (OPCW), and almost €200,000 towards the implementation of UN Security Council Resolution 1540. Much of the remainder of the money goes towards weapon elimination and safeguarding programmes in the former Soviet Union and some East European countries.

Parties must make decisions on where to take the convention. In this context, any constructive proposal is welcome. However, if the 6th Review Conference is successful in determining a future for the BTWC, then the 7th Review Conference is likely to return to the critical question of how to transform the treaty into a full instrument of multilateral security. If the EU wishes to expand and consolidate its role as a global actor in security matters in general, and with regard to the BTWC in particular, then it will need to develop a long-term, holistic vision on the convention in order to promote the specific goals that are closest to its own security interests and dedicate the necessary resources to make that vision credible across the planet.

Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction

Signed at London, Moscow and Washington on 10 April 1972.
Entered into force on 26 March 1975.
Depositaries: UK, US and Soviet governments.

The States Parties to this Convention,

Determined to act with a view to achieving effective progress towards general and complete disarmament, including the prohibition and elimination of all types of weapons of mass destruction, and convinced that the prohibition of the development, production and stockpiling of chemical and bacteriological (biological) weapons and their elimination, through effective measures, will facilitate the achievement of general and complete disarmament under strict and effective international control,

Recognizing the important significance of the Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, signed at Geneva on June 17, 1925, and conscious also of the contribution which the said Protocol has already made, and continues to make, to mitigating the horrors of war,

Reaffirming their adherence to the principles and objectives of that Protocol and calling upon all States to comply strictly with them,

Recalling that the General Assembly of the United Nations has repeatedly condemned all actions contrary to the principles and objectives of the Geneva Protocol of June 17, 1925,

Desiring to contribute to the strengthening of confidence between peoples and the general improvement of the international atmosphere,

Desiring also to contribute to the realization of the purposes and principles of the United Nations,

Convinced of the importance and urgency of eliminating from the arsenals of States, through effective measures, such dangerous weapons of

mass destruction as those using chemical or bacteriological (biological) agents,

Recognizing that an agreement on the prohibition of bacteriological (biological) and toxin weapons represents a first possible step towards the achievement of agreement on effective measures also for the prohibition of the development, production and stockpiling of chemical weapons, and determined to continue negotiations to that end,

Determined for the sake of all mankind, to exclude completely the possibility of bacteriological (biological) agents and toxins being used as weapons,

Convinced that such use would be repugnant to the conscience of mankind and that no effort should be spared to minimize this risk,

Have agreed as follows:

Article I

Each State Party to this Convention undertakes never in any circumstances to develop, produce, stockpile or otherwise acquire or retain:

(1) Microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes;

(2) Weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict.

Article II

Each State Party to this Convention undertakes to destroy, or to divert to peaceful purposes, as soon as possible but not later than nine months after entry into force of the Convention, all agents, toxins, weapons, equipment and means of delivery specified in article I of the Convention, which are in its possession or under its jurisdiction or control. In implementing the provisions of this article all necessary safety precautions shall be observed to protect populations and the environment.

Article III

Each State Party to this Convention undertakes not to transfer to any recipient whatsoever, directly or indirectly, and not in any way to assist, encourage, or induce any State, group of States or international organizations to manufacture or otherwise acquire any of the agents, toxins, weapons, equipment or means of delivery specified in article I of this Convention.

Article IV

Each State Party to this Convention shall, in accordance with its constitutional processes, take any necessary measures to prohibit and prevent the development, production, stockpiling, acquisition, or retention of the agents, toxins, weapons, equipment and means of delivery specified in article I of the Convention, within the territory of such State, under its jurisdiction or under its control anywhere.

Article V

The States Parties to this Convention undertake to consult one another and to cooperate in solving any problems which may arise in relation to the objective of, or in the application of the provisions of, the Convention. Consultation and Cooperation pursuant to this article may also be undertaken through appropriate international procedures within the framework of the United Nations and in accordance with its Charter.

Article VI

(1) Any State Party to this Convention which finds that any other State Party is acting in breach of obligations deriving from the provisions of the Convention may lodge a complaint with the Security Council of the United Nations. Such a complaint should include all possible evidence confirming its validity, as well as a request for its consideration by the Security Council.

(2) Each State Party to this Convention undertakes to cooperate in carrying out any investigation which the Security Council may initiate, in accordance with the provisions of the Charter of the United Nations, on the basis of the complaint received by the Council. The Security Council shall inform the States Parties to the Convention of the results of the investigation.

Article VII

Each State Party to this Convention undertakes to provide or support assistance, in accordance with the United Nations Charter, to any Party to the Convention which so requests, if the Security Council decides that such Party has been exposed to danger as a result of violation of the Convention.

Article VIII

Nothing in this Convention shall be interpreted as in any way limiting or detracting from the obligations assumed by any State under the Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, signed at Geneva on June 17, 1925.

Article IX

Each State Party to this Convention affirms the recognized objective of effective prohibition of chemical weapons and, to this end, undertakes to continue negotiations in good faith with a view to reaching early agreement on effective measures for the prohibition of their development, production and stockpiling and for their destruction, and on appropriate measures concerning equipment and means of delivery specifically designed for the production or use of chemical agents for weapons purposes.

Article X

(1) The States Parties to this Convention undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials and scientific and technological information for the use of bacteriological (biological) agents and toxins for peaceful purposes. Parties to the Convention in a position to do so shall also cooperate in contributing individually or together with other States or international organizations to the further development and application of scientific discoveries in the field of bacteriology (biology) for prevention of disease, or for other peaceful purposes.

(2) This Convention shall be implemented in a manner designed to avoid hampering the economic or technological development of States Parties to the Convention or international cooperation in the field of peaceful bacteriological (biological) activities, including the international exchange of bacteriological (biological) and toxins and equipment for the

processing, use or production of bacteriological (biological) agents and toxins for peaceful purposes in accordance with the provisions of the Convention.

Article XI

Any State Party may propose amendments to this Convention. Amendments shall enter into force for each State Party accepting the amendments upon their acceptance by a majority of the States Parties to the Convention and thereafter for each remaining State Party on the date of acceptance by it.

Article XII

Five years after the entry into force of this Convention, or earlier if it is requested by a majority of Parties to the Convention by submitting a proposal to this effect to the Depositary Governments, a conference of States Parties to the Convention shall be held at Geneva, Switzerland, to review the operation of the Convention, with a view to assuring that the purposes of the preamble and the provisions of the Convention, including the provisions concerning negotiations on chemical weapons, are being realized. Such review shall take into account any new scientific and technological developments relevant to the Convention.

Article XIII

(1) This Convention shall be of unlimited duration.

(2) Each State Party to this Convention shall in exercising its national sovereignty have the right to withdraw from the Convention if it decides that extraordinary events, related to the subject matter of the Convention, have jeopardized the supreme interests of its country. It shall give notice of such withdrawal to all other States Parties to the Convention and to the United Nations Security Council three months in advance. Such notice shall include a statement of the extraordinary events it regards as having jeopardized its supreme interests.

Article XIV

(1) This Convention shall be open to all States for signature. Any State which does not sign the Convention before its entry into force in accordance with paragraph (3) of this Article may accede to it at any time.

(2) This Convention shall be subject to ratification by signatory States. Instruments of ratification and instruments of accession shall be deposited with the Governments of the United States of America, the United Kingdom of Great Britain and Northern Ireland and the Union of Soviet Socialist Republics, which are hereby designated the Depositary Governments.

(3) This Convention shall enter into force after the deposit of instruments of ratification by twenty-two Governments, including the Governments designated as Depositaries of the Convention.

(4) For States whose instruments of ratification or accession are deposited subsequent to the entry into force of this Convention, it shall enter into force on the date of the deposit of their instruments of ratification or accession.

(5) The Depositary Governments shall promptly inform all signatory and acceding States of the date of each signature, the date of deposit or each instrument of ratification or of accession and the date of entry into force of this Convention, and of the receipt of other notices.

(6) This Convention shall be registered by the Depositary Governments pursuant to Article 102 of the Charter of the United Nations.

Article XV

This Convention, the English, Russian, French, Spanish and Chinese texts of which are equally authentic, shall be deposited in the archives of the Depositary Governments. Duly certified copies of the Convention shall be transmitted by the Depositary Governments to the Governments of the signatory and acceding states.

List of States that have ratified or acceded to the BTWC

As of November 2006, the following 155 states have ratified or acceded to the Biological and Toxin Weapons Convention (BTWC):

(Sub-Saharan) Africa (28)

- Benin
- Botswana
- Burkina Faso
- Cape Verde
- Congo
- Congo (Democratic Republic of)
- Equatorial Guinea
- Ethiopia
- Gambia
- Ghana
- Guinea-Bissau
- Kenya
- Lesotho
- Mali
- Mauritius
- Niger
- Nigeria
- Rwanda
- Sao Tome and Principe
- Senegal
- Seychelles
- Sierra Leone
- South Africa
- Sudan
- Swaziland
- Togo
- Uganda
- Zimbabwe

Asia and Pacific Region (37)

- Afghanistan
- Armenia
- Australia
- Azerbaijan
- Bangladesh
- Bhutan
- Brunei Darussalam
- China
- Fiji
- Georgia
- India
- Indonesia
- Malaysia
- Maldives
- Mongolia
- New Zealand
- Pakistan
- Palau
- Papua New Guinea
- Philippines
- Singapore
- Solomon Islands
- Sri Lanka
- Tajikistan

- Japan
- Kampuchea
- Korea (Democratic People's Republic of)
- Korea (Republic of)
- Kyrgyzstan
- Lao People's Democratic Republic
- Thailand
- Timor Leste
- Tonga
- Turkmenistan
- Uzbekistan
- Vanuatu
- Vietnam

Europe (43)

- Albania
- Austria
- Belarus
- Belgium
- Bosnia and Herzegovina
- Bulgaria
- Croatia
- Cyprus
- Czech Republic
- Denmark
- Estonia
- Finland
- France
- Germany
- Greece
- Holy See
- Hungary
- Iceland
- Ireland
- Italy
- Latvia
- Liechtenstein
- Lithuania
- Luxembourg
- Macedonia (Former Yugoslav Republic of)
- Malta
- Moldova (Republic of)
- Monaco
- Netherlands
- Norway
- Poland
- Portugal
- Romania
- Russian Federation
- San Marino
- Serbia
- Slovakia
- Slovenia
- Spain
- Sweden
- Switzerland
- Ukraine
- United Kingdom of Great Britain and Northern Ireland

Latin America and Carribean (30)

- Antigua and Barbuda
- Argentina
- Bahamas
- Barbados
- Belize
- Bolivia
- Brazil
- Chile
- Colombia
- Costa Rica
- Cuba
- Dominica
- Dominican Republic
- Ecuador
- El Salvador
- Grenada
- Guatemala
- Honduras
- Jamaica
- Mexico
- Nicaragua
- Panama
- Paraguay
- Peru
- Saint Kitts and Nevis
- Saint Lucia
- Saint Vincent and the Grenadines
- Suriname
- Uruguay
- Venezuela

Middle East (15)

- Algeria
- Bahrain
- Iran (Islamic Republic of)
- Iraq
- Jordan
- Kuwait
- Lebanon
- Libyan Arab Jamahiriya
- Morocco
- Oman
- Qatar
- Saudi Arabia
- Tunisia
- Turkey
- Yemen

North America (2)

- Canada
- United States of America

List of States that have signed, but not ratified the BTWC

As of November 2006, the following 16 states have signed but not ratified the BTWC:

Sub-Saharan Africa (9)

- Burundi
- Central African Republic
- Côte d'Ivoire
- Gabon
- Liberia
- Madagascar
- Malawi
- Somalia
- Tanzania

Asia and Pacific Region (2)

- Burma/Myanmar
- Nepal

Latin America and Caribbean (2)

- Guyana
- Haiti

Middle East (3)

- Egypt
- Syria
- United Arab Emirates

List of States that have neither signed nor acceded to the BTWC

As of November 2006, the following 24 states have neither signed nor acceded to the BTWC:

Sub-Saharan Africa (10)

- Angola
- Cameroon
- Chad
- Comoros
- Djibouti
- Eritrea
- Guinea
- Mozambique
- Namibia
- Zambia

Asia and Pacific Region (9)

- Cook Islands
- Kazakstan
- Kiribati
- Marshall Islands
- Micronesia
- Nauru
- Niue
- Samoa
- Tuvalu

Europe (2)

- Andorra
- Montenegro

Latin America and Caribbean (1)

- Trinidad and Tobago

Middle East (2)

- Israel
- Mauritania

About the authors

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Abbreviations

ACA	Agency for the Control of Armaments
ACTH	adrenocorticotropin hormone
AHG	Ad Hoc Group
AIDS	acquired immunodeficiency syndrome
BAC	bacterial artificial chomo
BTWC	Biological and Toxin Weapons Convention
BW	biological weapons
BWC	Biological Weapons Convention
BWPP	BioWeapons Prevention Project
CBM	Confidence-Building Measure(s)
CBW	chemical and biological weapons
cDNA	complementary copy of RNA
CFSP	Common Foreign and Security Policy
CpG	nucleoside base sequence cytosine-guanine linked by a phosphate group
CRF	corticotrophin releasing factor
CSCE	Conference on Security and Co-operation in Europe
CTBT	Comprehensive Test Ban Treaty
CW	Chemical Weapon(s)
CWC	Chemical Weapons Convention
DNA	deoxyribonucleic acid
dsRNA	double-stranded RNA
ELISA	enzyme-linked immunosorbent assay
ENDC	Eighteen-Nation Disarmament Committee
FAO	Food and Agriculture Organisation
FBI	Federal Bureau of Investigation
GPC	general purpose criterion
HBsAg	hepatitis B antigen
HIV	human immunodeficiency virus
HPA	hypothalamus-pituitary-adrenal
IAEA	International Atomic Energy Agency
IL-1b	interleukin 1 beta
IL-6	interleukin 6
Indels	inserted or deleted sequences
IPPC	International Plant Protection Convention
MALDI-TOF-MS	matrix-assisted laser description ionization time of flight mass spectrometry
MLST	multilocus sequence typing
NAM	Non-Aligned Movement

NATO	North Atlantic Treaty Organisation
NIAID	National Institute of Allergy and Infectious Diseases
NIEO	New International Economic Order
NIH	National Institutes of Health
nm	nanometre
NOD	nucleotide-binding oligomerisation domain
NPT	Non-Proliferation Treaty
OIE	World Organisation for Animal Health
OPBW	Organisation for the Prohibition of Biological Weapons
OPCW	Organisation for the Prohibition of Chemical Weapons
PAMPs	pathogen-associated molecular patterns
PCR	polymerase chain reaction
RISC	RNA-induced silencing complex
RNA	ribonucleic acid
RNAi	RNA interference
SNPs	single nucleotide polymorphisms
Th1	T helper lymphocytes of type 1
Th2	T helper lymphocytes of type 2
TLR	Toll-like receptor
TNFa	tumour necrosis factor alpha
UN	United Nations
UNDDA	United Nations Department of Disarmament Affairs
UNMOVIC	United Nations Monitoring, Verification and Inspection Commission
UNROCA	United Nations Register of Conventional Arms
UNSC	United Nations Security Council
UNSCOM	United Nations Special Commission
VAC	vaccinia virus artificial chromosome
VEREX	Ad Hoc Group of Government Experts to Identify and Examine Potential Verification Measures from a Scientific and Technical Standpoint
VERTIC	Verification Research, Training and Information Centre
VNTRs	variable number tandem repeats
VSV-G	vesicular stomatitis virus glycoprotein
WHO	World Health Organisation
WMD	Weapons of Mass Destruction

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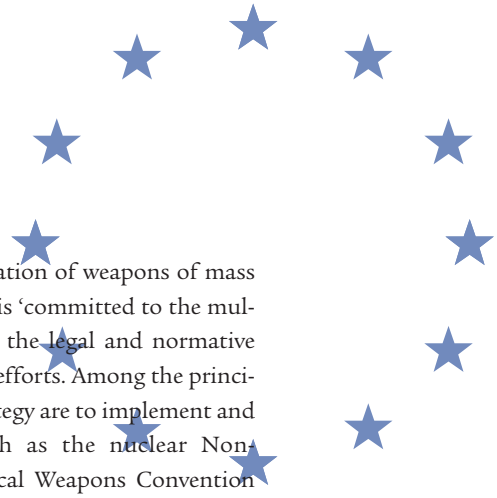

In its 2003 strategy against the proliferation of weapons of mass destruction, the EU underscores that it is 'committed to the multilateral treaty system' – considering it the legal and normative stepping stone for all non-proliferation efforts. Among the principal policy objectives outlined in the strategy are to implement and universalise multilateral treaties such as the nuclear Non-Proliferation Treaty (NPT), the Chemical Weapons Convention (CWC), and the Biological and Toxin Weapons Convention (BTWC).

With respect to the BTWC, the EU has increased its efforts to promote the universalisation and implementation of the convention since 2005. In February 2006, it adopted a Joint Action in support of the BTWC. Its two main objectives are to advocate the universalisation of the BTWC by promoting the accession of States not Party to the convention and to push for the implementation of the BTWC by the States Parties.

This *Chaillot Paper* focuses on international efforts to prevent biological agents and toxins being developed and used as weapons. It considers the evolution of the BTWC, paying particular attention to the outcomes of the past five review conferences. Its aim is to contribute to current European thinking in the light of the upcoming 6th BTWC Review Conference. Besides examining the evolution of international efforts to promote disarmament, the paper considers challenges to the convention, such as issues of verification and the impact of advances in the field of science and technology. Weaknesses and limitations in current policymaking are identified and analysed.

This *Chaillot Paper* is the latest addition to the Institute's series of publications on non-proliferation.

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