The 1972 Biological Weapons Convention (BWC), which currently has 165 states-parties, is the principal international legal instrument against biological warfare. [1] Developments in science and technology pose a continuing challenge to the treaty and the broader biological weapons nonproliferation regime. If they are applied to state or nonstate biological weapons programs, these developments can undermine the treaty’s prohibitions.

Therefore, the possible impact of science and technology on the development, production, stockpiling, transfer, or use of biological agents for “hostile purposes or in armed conflict,” as the BWC puts it, needs to be assessed periodically. On the other hand, science and technology collaborations are critical to the full and effective implementation of the BWC’s Article X provisions on economic cooperation and development (see box, p. 17). It is important for states to conduct periodic reviews of implementation at an operational level in order to achieve a proper balance between preventing biological warfare and fostering economic cooperation and development.

The need to prevent the spread of technology that would assist weapons programs while allowing and in fact promoting technology dissemination for peaceful purposes is not unique to the BWC. Debates on this issue are a regular feature of conferences to review the nuclear Nonproliferation Treaty. In the case of the BWC, however, the tension and the need for review may be particularly acute because of the rapid pace of advances in the life sciences.

At their review conference in December 2011, BWC states-parties agreed to continue the process of intersessional meetings—meetings that take place between the treaty’s quinquennial review conferences—for 2012-2015 “to discuss, and promote common understanding and effective action” on agreed agenda items, including science and technology and cooperation and assistance. [2] The first of these meetings of experts, chaired by Boujemâa Delmi of Algeria, took place July 16-20. The next meeting of parties will occur December 10-14.

As with the sets of intersessional meetings that preceded the 2006 and 2011 review conferences, states-parties will exchange views and best practices through the tabling of national papers. Notably, states-parties will consider science and technology systematically for the first time since the 1992-1993 Ad Hoc Group of Governmental Experts to Identify and Examine Potential Verification Measures from a Scientific and Technical Standpoint (VEREX). [3]

This article analyzes the ways in which the new intersessional process may address Article X and science and technology, taking account of linkages between them. It poses broader questions of how the treaty can be upheld and strengthened in the light of scientific and technological advances. Governments, the public, and other interested parties should consider at least four overarching questions: Does the regime have the capacity to react to concerns that the treaty is not being fully implemented or that its implementation needs to be adapted to new developments? Is this view shared by all states-parties, as well as the broader international community including international organizations, industry, and civil society? What specific processes and decisions are required to maintain and strengthen the regime without hindering progress in science and technology and international cooperation in the life sciences? Finally, can the regime be used effectively to identify and explore new opportunities for peaceful cooperation among the parties?
Article X

The standing agenda items of the intersessional process are cooperation and assistance, with a particular focus on Article X; review of developments in the field of science and technology; and strengthening national implementation. The 2012 meetings also are considering ways to “enable fuller participation in the confidence-building measures,” which are data declarations covering a variety of topics relevant to compliance with the convention, such as national biodefense programs and unusual outbreaks of infectious disease. In addition, as part of their consideration of science and technology, the meetings are focusing on so-called enabling technologies, that is, technologies that enable the practical application of discoveries in the life sciences or facilitate research and collaboration in this field.

The 2011 review conference mandated that the 2012-2015 intersessional process should cover the following broad subject areas: national reports by states-parties on how they are implementing Article X, practical measures to support full and complete implementation of Article X, improvement in the capacity of states-parties in selected areas such as biosafety and biosecurity and disease surveillance and response, and coordination of cooperation with other stakeholders.

In addition, the review conference participants decided to establish a database, administered by the BWC’s Implementation Support Unit (ISU), to facilitate assistance and cooperation among member states. States-parties will submit data to the ISU on requirements for and offers of assistance, including transfers of equipment and material, as well as science and technology information regarding the peaceful use of biological materials and toxins. Requests are to be matched with offers of states-parties and relevant international organizations to provide or facilitate such assistance.

The underlying assumption behind the database project appears to be that the parties themselves and some international organizations are the principal drivers for collaboration in the life sciences. In the review conference’s final document, however, the countries observed that the private sector plays a strong role in the transfer of technology and information.

There continues to be disagreement within the BWC regime over the legitimate extent of controls and restrictions on transfers of materials, equipment, and technology in the life sciences among states-parties in good standing. Countries from the Non-Aligned Movement in particular often have argued that transfer controls for arms control purposes are unjustified and discriminatory when the recipients are abiding by their obligations to the relevant multilateral treaty regime. In recent years, the legitimacy and utility of strategic trade controls have become more widely accepted, particularly in view of the measures states are obliged to take under the terms of UN Security Council Resolution 1540.

Nevertheless, there remains a tension between, on one hand, the obligation to promote technology transfers between states-parties for the purpose of fostering economic cooperation and development and, on the other hand, the requirements of strategic trade controls in cases where a state-party believes that another state poses a proliferation risk and therefore should not have access to dual-purpose materials, technology, equipment, or information. Furthermore, despite the generally agreed objective of reducing international trade restrictions, various other legal regimes require states to impose controls and oversight for such reasons as human and environmental health or for legal enforcement reasons such as investigating possible tax avoidance. The practical measures that states take to ensure that such control and oversight efforts are effective may coincide with transfer control measures adopted for BWC implementation purposes, thereby strengthening perceptions that the BWC requirement to promote collaborations and exchanges between states-parties is not being fully met.

Such divergence in perception is not unique to the BWC. The Organisation for the Prohibition of Chemical Weapons (OPCW) has long experienced challenges in its implementation of Article XI of the 1993 Chemical Weapons Convention (CWC). A 2011 report by a high-level advisory panel chaired by Ambassador Rolf Ekéus of Sweden addressed this point. The panel focused on the OPCW’s priorities after the destruction of chemical weapons stockpiles, an activity that will gradually wind down, and proposed “an approach whereby any State Party feeling discriminated against over transfer denials
could address a complaint to the Director-General, who might use his good offices to bring the parties together to discuss and if possible resolve the matter including by addressing the reasons that have led to the denial. Such a mechanism might increase transparency and help to dispel concerns.” [7] The CWC parties have not acted on that proposal, but could do so at next year’s CWC review conference. Whether a similar approach could be discussed in the BWC context remains uncertain.

**Peaceful Cooperation Under the BWC**

**Article X of the Biological Weapons Convention deals with cooperation among the parties for peaceful purposes. The full text of the article is below.**

- (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) agents 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.

**Science and Technology**

Last year’s BWC review conference mandated that the intersessional process consider new developments in science and technology that have potential hostile applications. At the same time, the discussions should identify possible measures to strengthen biological risk management, which could include voluntary codes of conduct or similar governance measures, as well as education and awareness raising in the life sciences community. Developments in science and technology should also be reviewed so as to improve the efforts of international organizations that work in fields relevant to the BWC. [8] A further special topic for 2012 is “advances in enabling technologies, including high-throughput systems for sequencing, synthesizing and analyzing DNA; bioinformatics and computational tools; and systems biology.” [9]

Many specific science and technology developments were assessed with regard to their possible impact on the BWC in the lead-up to the review conference. [10] Rapid progress in the life sciences has created a “time compression effect” whereby the period from innovation to general application in society has shrunk from perhaps a century to a decade or less. Enabling technologies allow for the processing and quantitative analysis of vast amounts of data and their distribution and utilization by research groups internationally. New investigative techniques, instrumentation, and methods such as combinatorial synthesis and high-throughput screening facilitate the acquisition of large amounts of biological data.

Furthermore, biology is converging with disciplines including chemistry, engineering sciences, modeling, and simulation, thus creating new insights into the function of biological systems and new medical treatments as well as targeted drug delivery. [11] Although biology remains essentially an empirical science, there is a gradual shift from descriptive to predictive approaches. Once science overcomes certain obstacles, such as the generation of the vast amounts of required biological data and the development of more-sophisticated mathematical algorithms to deal with the complexities of biological systems, the transition of the life sciences to a new level of accelerated and fundamental advancement will be inevitable. [12]

The OPCW advisory panel observed that the convergence between chemistry and biology, although not in itself a cause for treaty convergence, underlines the importance of “exchanges of experience and joint technical reviews” between the two regimes and recommends that the OPCW Technical Secretariat establish a “liaison” with the BWC implementation process. [13] Notably, many of the
same national delegates and technical experts attend both the BWC and CWC meetings. Both treaties are rooted in the 1925 Geneva Protocol, cover toxins, and have prohibitions that embody a “general purpose criterion,” which prohibits all toxic chemicals and their precursors and biological materials except for permitted purposes. This criterion is the legal mechanism by which the treaties’ prohibitions remain relevant in the face of scientific and technological developments. States-parties to both treaties have devoted insufficient attention to developing ideas for better operationalizing it.

Moving Forward

A key difficulty for the intersessional process is how to move beyond merely compiling and reviewing advances in science and technology to actually assessing their impact on the BWC and developing policies and practical measures to manage the associated risks and opportunities. There are numerous difficulties associated with the assessment of the possible and actual effects of science and technology on the BWC, especially when the assessment is carried out in a multilateral framework.

Some officials say they have difficulty envisaging whether or how the conduct of research or the application of new technology in the life sciences might constitute a treaty violation. This is particularly true in cases where such an application is not part of traditional state-level biological weapons programs. Another difficulty is how the implications of science and technology, in all of their variety and complexity, can be absorbed meaningfully by negotiators and acted on by policymakers.

Another important issue is the extent to which BWC representatives should focus science and technology discussions on achieving a better understanding of defense sector evaluation methodologies for assessing national security threats and military capacity requirements. Such methodologies reflect threat perceptions, domestic and international defense-related developments, and the drivers of weapons acquisitions programs. Exchanges of views in such areas may raise red flags in national defense establishments and therefore should be approached with care and discretion.

Some of the interactions during the current BWC intersessional meetings will be process oriented, while others may focus on specific developments of concern, such as the 2012 publication describing the experimental increase in transmissibility of an avian influenza H5N1 strain in an animal model. The meetings, however, will not decide any collective actions by BWC states-parties. Practical steps will be left largely to national implementation measures. The intersessional process is not empowered with decision-making authority, and any multilateral decisions will have to wait until the next review conference in 2016. The gap between the pace of science and technology and the diplomatic processes to manage the risks associated with these advances is likely to expand further.

The intersessional process will discuss the various issues placed on its agenda by the 2011 review conference on an individual basis, but it may be worthwhile for the states-parties also to consider the operational interlinkages and relationships among them. Advances in science and technology create risks, but also present opportunities for the regime, for example by improving the conditions for Article X implementation. Science and technology advances often have been evaluated primarily in the context of Article I of the BWC, that is, with regard to how they affect the prohibitions against biological warfare. Yet, as the major documented and acknowledged biological weapons programs recede into history and the regime’s focus is shifting to broader topics such as best practices in biosafety and biosecurity, this assessment has moved beyond a traditional threat assessment to an evaluation of strategies to mitigate the risks of science and technology advances, many of which are dual purpose.

To manage or contain such inherent, yet wide-ranging risks and simultaneously reap the benefits for humanity will require the right balance between maintaining controls and creating incentives and conditions that favor applications that benefit society, promote economic and technological development, and keep countries in compliance with the treaty. Such strategies will be essential given the nature of the science and technology process, but they come with a degree of uncertainty with regard to some states’ intentions and a loss of some control over societal actors by states generally. This is a consequence of a shift toward a postproliferation context, which reflects the
increasing international dissemination of science and technology and is not specific to the implementation of the BWC. Thus the dual-purpose nature of the science and technology must be managed, but is not amenable to a conventional solution such as technology transfer controls and denial.

In addition, some researchers and analysts have challenged the general appropriateness of applying export controls and censorship by states to certain research data. This became apparent in the debate about whether to publish the full research papers that show how a modified avian influenza virus strain became readily transmissible among ferrets. The weight of the scientific community, as expressed by a World Health Organization committee that was established to consider the appropriateness of withholding some of the research data from publication, was against any recommendation for the censoring of any of the research. As a result, both of the papers in question were published in full earlier this year.

One broad policy question raised by this episode is whether it is possible to describe scientific research on its merits for peaceful purposes alone when the research has the potential of causing security threats. A related question is how to determine the point in the research cycle at which potential dual-use issues should be addressed. This discussion affects research funding, publication policies, principles in research oversight, and safety and security standards. Some tension between the scientific community and national security establishments is likely and perhaps inevitable. A better-informed and more regular dialogue between these communities is needed to prevent them from drifting apart over how to manage the risks inherent in dual-use research.

In the context of the BWC, there is a need for an effective bridge between the security-driven discussions in the intersessional meetings and the mainstream of the science and industry communities. Past consideration of science and technology by VEREX was operationally focused on supporting states-parties in determining whether prohibited weapons activities were occurring. The dynamic of today’s evaluation of science and technology by the intersessional process is more generic, more wide ranging, and tied to more of the other main provisions of the treaty. Advances in science and technology are assessed not merely with regard to their impact on the BWC’s prohibitions, but also with regard to whether national implementation measures need to be adapted, how they affect international collaborations for peaceful purposes, whether they call for the adoption of additional governance measures in industry and research, and how they may enhance the ability of governments to investigate allegations that states or other actors have misused biological or toxin agents.

Conclusions

The intersessional meetings are likely to remain process oriented and characterized by incremental evolution in implementation practice. Several practical measures can assist in this evolution.

• To reinforce trends that enhance collaborations in the life sciences while ensuring BWC compliance, states-parties should continue their dialogue with the science and technology community to better understand and take advantage of the drivers that push science and technology ahead. In this context, the concept of a biological weapon needs to be addressed as part of a wider spectrum of biological risks, ranging from natural outbreaks and emerging diseases to accidents and different forms of possible abuse. Preventing the misuse of new scientific and technological knowledge for biological weapons purposes is not merely a matter of regulations and prohibitions, but also of using incentives, funding mechanisms, oversight, and other governance measures to steer scientific progress toward beneficial applications. Such an approach should make it possible to flag problematic developments in science and technology that may require regulatory or other governance steps early on.

• The BWC parties’ assistance and collaboration database could be used as a basis for qualitative and quantitative trend analyses. Although the database will be fully accessible only to member states, the intersessional process could nevertheless help to clarify the nature of the existing cooperation and assistance among BWC states-parties, identify opportunities and ways to overcome obstacles, and provide authoritative analyses reflecting the full geographical breadth of the BWC membership.
• States-parties could further consider how the intersessional discussions could promote coordination among international organizations that have mandates relevant to the BWC. For example, the intersessional process could offer an inclusive platform to exchange methodologies for evaluating the impact and sustainability of “existing bilateral, regional and multilateral assistance, cooperation and partnerships.” [16] The Organisation for Economic Co-operation and Development (OECD) has been collecting data to characterize research and development (R&D) levels and trends in OECD member states and in some nonmember states, using such proxy indicators as patents, technology balance of payment, and “trade in R&D intensive industries” [17] to measure the output and impact of science and technology. BWC parties could apply similar methodologies to place the debate about Article X implementation on a more pragmatic and rational basis.

• Finally, science and technology evaluation and assessment methodologies should take account of newly available archival documentation on past military threat evaluation and biological weapons development and acquisition processes [18] when considering broader, longer-term factors of biological weapons arms control. In particular, states-parties could consider further the methods for sharing information on their own national risk assessment processes as they relate to the life sciences, on the role of science and technology in their defense development and acquisition processes, and on science and technology evaluation methodologies most relevant for consideration of BWC compliance.

The intersessional BWC meetings will continue to serve as a forum that allows states-parties to consult with one another on possible areas of concern and to familiarize themselves with relevant science and technology developments that may have an impact on the treaty regime. These discussions should bridge compliance and cooperation issues in order to identify operationally relevant solutions and strategies that serve the security concerns of the parties while enabling peaceful international cooperation and collaborations. The parties can maintain and strengthen the regime’s capacity to react to compliance concerns by exchanging views and best practices on science and technology evaluation methodologies. These discussions will require interaction with and input from other actors, including international organizations, the science and technology and industry communities, and civil society.

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ENDNOTES

1. Among the nonparties are 12 that have signed but not ratified the treaty (the Central African Republic, Côte d’Ivoire, Egypt, Guyana, Haiti, Liberia, Malawi, Myanmar, Nepal, Somalia, Syria, and Tanzania) and 19 that have neither signed nor ratified it (Andorra, Angola, Cameroon, Chad, Comoros, Djibouti, Eritrea, Guinea, Israel, Kiribati, Marshall Islands, Mauritania, Micronesia, Namibia, Nauru, Niue, Samoa, South Sudan, and Tuvalu). For the text of the BWC, see www.unog.ch/80256EE600585943/%28httpPages%29/04FBBDD6315AC720C1257180004B1B2F?OpenDocument.


3. On VEREX, see Nicholas A. Sims, “The Evolution of Biological Disarmament,” SIPRI Chemical and Biological Warfare Studies, No. 19 (2001), pp. 82-118.

5. Ibid., p. 22 (para. 18).

6. Ibid., p. 16 (para. 52).


8. 2011 BWC review conference final document, p. 23 (paras. 22-23).


15. In the case of the European Union, for example, some such measures can be carried out at the regional level.


18. For examples of state biological weapons verification or evaluations and associated national security and international arms control implications, see Amy Smithson, Germ Gambits: The

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