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The Future of the Ban on Biological Weapons

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The Future of the Ban on Biological Weapons

The States Parties to the Biological Weapons Convention (BWC) will meet in Geneva for their Sixth Review Conference from 20 November to 8 December 2006. This meeting presents them with the opportunity to make some progress in the slow process of strengthening the Convention. It will likely fall upon the European Union, including Germany, to play a central role in this effort for two reasons. First, it is clear that the United States won't be taking the lead in this process. Second, the majority of non-aligned states have grown wary of the entire discussion about the non-proliferation of weapons of mass destruction (WMD), a discussion they view as being dominated by the West.

In contrast to the Treaty on the Non-Proliferation of Nuclear Weapons and the Chemical Weapons Convention, the BWC has no detailed verification regime to monitor compliance. Negotiations over a protocol to the BWC that would have also included verification measures broke down in 2001. This is all the more regrettable given that biological weapons (BW) are likely to become increasingly dangerous in the future as a result of the rapid advances being made in the biological sciences. This could lead to more states expressing an interest in BW, and to increasing the threat posed by bioterrorism.

Given the difficult political constellation on the eve of the BWC Review Conference, what can Germany and its European partners realistically do to help strengthen the Convention? That is the central question addressed in this study. In addition, what other fields of activity beyond multilateral arms control are relevant for strengthening the ban on biological weapons, and what can be done in these areas?

In view of the extremely complex nature of this problem, many of the relevant issues can only be outlined here. The emphasis in this study is on central elements of the BWC. But in the future, the BWC should also be more closely tied to elements that are directly or indirectly related to it. This includes national legislation and security measures, codes of conduct for bioscientists, internationally-coordinated export controls, increasing the UN Secretary-General's role in investigating the possible use of biological weapons, and, finally, improving protection against biological weapons.

The study makes the following recommendations:

1. Since resuming negotiations over a protocol for the BWC is not supported by anyone other than the EU and a few other states, Germany and its European partners should focus their efforts at the BWC Review Conference (RevConf) on adopting a new work program. Specifically, this should entail:
   - addressing once again the issue of national legislation and biological security measures. The goal would be to achieve a degree of standardization in these areas and implementation by as many of the States Parties as possible. This issue should be discussed at each of the annual meetings leading up to the Seventh Review Conference in 2011.
   - the complete revision of the confidence-building measures (CBMs) with the aim of increasing the transparency of biodefense programs. At the same time, those measures that have proved ineffective should be abandoned.
   - discussions on the advances in the biological sciences and their implications for the BWC, instead of attempting to establish a BWC Scientific Advisory Panel. This could be pitched to the countries of the non-aligned movement (NAM) as a measure in accordance with Article X of the BWC, which states that the 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." If the issue were presented in this manner, the NAM states would be more likely to support a new work program.
   - making the work program more focused by establishing working groups.
2. Even though it is likely to be vigorously resisted by the U.S., Germany and its European partners ought to at least try to take the first steps toward creating a Technical Secretariat that would be housed within the United Nations Department for Disarmament Affairs. The Secretariat could be tasked with assessing the CBM declarations and promoting universal ratification of the BWC.
3. Measures that go beyond Germany's existing legal regulations regarding access to biological materials as well as the handling and transfer of them are not necessary. However, Germany and its European partners should lobby for the formulation of codes of conduct for scientists and for requiring college-level classes on the problems associated with the ban on biological weapons and the societal responsibility of scientists.
4. Germany should also continue to work at getting more states to adhere to the principles and lists of the Australia Group, notwithstanding the fact that there are limits to increasing the membership of this "gathering" of 39 states and the European Commission to coordinate export controls for chemical and biological goods. The German federal government should be equally steadfast in its support for the implementation of Resolution 1540 of the UN Security Council and the Proliferation Security Initiative.
5. In order to improve the UN Secretary-General's ability to investigate suspicious outbreaks of diseases and the alleged use of biological weapons, Germany should push for updates to lists of relevant experts and laboratories as well as supporting training opportunities for international experts. Other measures that would grant the UN Secretary-General the power to initiate investigations into suspected breaches of the BWC should not be pursued because these would jeopardize the political neutrality of the office.
6. Germany should continue to enhance and expand its biodefense program, bearing in mind that there is a mutually beneficial relationship between such efforts and those aimed at strengthening the healthcare system generally to better combat infectious diseases.

Biological Weapons and Their Prohibition

In order to better appreciate the importance of the ban on biological weapons, one first needs to understand just how dangerous biological agents actually are and who currently has them.

How Dangerous are Pathogens and Toxins as Biological Weapons?

There is an entire spectrum of biological agents that could be used as biological weapons, comprised of various subgroups. One group consists of pathogens that are transmitted directly from person to person. The use of small poxviruses would be particularly dangerous since the vaccines against them were discontinued in 1980 and they have a death rate of around 30 percent in an unprotected population. There are still no officially approved vaccines against hemorrhagic fevers such as Ebola, Lassa or Marburg.[1] Experiments in non-human primates have shown that these viruses are quite stable as respirable aerosols. With natural outbreaks of Ebola in Africa having resulted in death rates of up to 90 percent, one has to assume that a BW attack with these viruses would have a horrendous impact. Pneumonic plague can also be transmitted from person to person, but in contrast to the above viral diseases, it can be effectively treated with antibiotics because it is caused by bacteria. This is also true of anthrax, the "classic" biological warfare agent. Although it is not transmitted from person to person, untreated respiratory anthrax will result in certain death within one to seven days. Vaccines are available, but they have to be administered many times. Moreover, they have serious side effects and are unlikely to be entirely effective against inhaled aerosolized anthrax.

Toxins, i.e. naturally occurring poisons, are another form of potential weaponized biological agents. Botulinum toxin is the most poisonous known substance of all. It can be used in aerosol form or as a food poisoning. Botulinum does not enter the body through the skin, as is also true of another well-known toxin, Ricin, which can be easily extracted from castor beans. Finally, there are pathogens that primarily affect animals or plants. As foot and mouth disease or avian flu have shown, they are capable of causing serious economic damage.[2]

In contrast to nuclear weapons, biological weapons have not yet been used on a large scale. While the images of the atomic bombs dropped on Hiroshima and Nagasaki are firmly etched in the collective memory of humanity, there is no equivalent awareness of the dangers of BW. If one realizes, however, the damage that can be wrought by naturally occurring epidemics—the World Health Organization estimates that an influenza pandemic would cause six to seven million deaths—it becomes quite clear that the use of pathogens as weapons could also cause massive human casualties.

At the forefront of concerns among experts today is that rapid advances in the biological sciences also open up new possibilities for biological warfare. This study devotes a special section to this complex problem. Moreover, the proliferation of BW, which could then be used by both states and non-state actors, raises very real fears. Both dangers result from the fact that biological weapons programs are relatively inexpensive in comparison to nuclear weapons projects. In addition, it is impossible to entirely prevent access to the pathogens and the equipment that are necessary for the production of biological weapons. Nevertheless, a biological weapons project is no trivial matter. In order for it to succeed, five prerequisites must be met:

- One must be able to obtain the pathogenic strain of a virus.
- The scientists need to know how to handle the virus properly in order to be able to work with it without infecting themselves.
- They must also have expert knowledge about the cultivation of the organism in order to ensure that

1 Vaccines against Ebola and Marburg are currently under development in the U.S., but have not yet been approved by the FDA. We thank Jonathan B. Tucker of the Monterey Institute in Washington, D.C. for this information.

2 Malcolm Dando, *Bioterrorism: What Is the Real Threat?*, Bradford Science and Technology Report Nr. 3, University of Bradford, Department of Peace Studies, (Bradford, March 2005).

the pathogenic properties of the virus are not weakened or deteriorate altogether.
- One needs to know how to store a virus culture.
- And, probably most difficult of all, one needs to know how to effectively deliver a virus.

There is considerable uncertainty about which states currently have offenisve BW programs. The U.S. believes that Russia is continuing with its Soviet-era program, particularly since Moscow has not allowed Western visitors access to four former BW research facilities that are in part under the control of the Ministry of Defense. North Korea is also believed to have a biological weapons program. According to American assessments, Iran's biological weapons research has probably been embedded within legitimate, civilian biotechnology programs. There is also uncertainty with regard to Cuba. Washington concedes that it does not know whether biological weapons are being worked on there. As far as China is concerned, the U.S. believes that the country maintains some elements of an offensive BW capability, but they are not sure whether this constitutes a breach of the BWC.[3]

Independent researchers point out that the number of states that have offensive BW programs has declined and that this number is likely to remain constant. For example, South Africa ended its offensive biological weapons activities after the end of Apartheid in the mid-nineties. UN inspectors on the ground revealed the extent of Saddam Hussein's biological weapons program after the first Gulf War in 1991, and it was apparently fully dismantled. Libya ended its program in 2003, and it is not even clear to what extent it ever really was a BW program to begin with.[4]

There have not yet been any cases of large scale terrorist acts involving weaponized biological agents. It is, however, known that the Japanese Aum cult, which released sarin gas in the Tokyo subway in March 1995, was also working on biological weapons. But their efforts remained unsuccessful. The terrorist group tried to spray anthrax from skyscrapers, but they didn't cause any damage because they were using the non-lethal vaccine strain of the virus. In October 2001, five people were killed and another seventeen were infected in the United States by anthrax spores sent in letters. The high quality of the prepared biological material suggests the involvement of a military biodefense laboratory, but to this day the case remains unresolved. Al Qaeda is also interested in biologocial weapons, as evidenced by documents that were found in Afghanistan after the arrival of American forces in the country. The projects were apparently more advanced than the U.S. had previously thought, but Al Qaeda also appears to have been unsuccessful in obtaining a highly pathogenic strain of anthrax. The extent of the terror network's biological program is still not entirely known because some documents have not yet been released to the public by the American government.

The overwhelming majority of international experts believe that terror organizations are not capable of cultivating dangerous viruses on a large scale and delivering them effectively. That said, the ability of non-state actors to overcome these barriers in the future cannot be ruled out. In particular, the further development and spread of knowledge in the biological sciences could be of help to terrorists.[5]

The Biological Weapons Convention

The Extent of the Prohibition and Verification

The greatest strength of the Biological Weapons Convention, which entered into force in April 1975,[6] is the broad scope of the ban it imposes; Article I of the BWC prohibits all non-peaceful uses of biological agents and toxins. The greatest weakness of the BWC, on the other hand, is that it contains no effective verification mechanisms.[7]

Article V calls for consultation between the States Parties if a breach of the convention is suspected. This was the basis for the U.S. call for an official explanation by the Soviet Union of an anthrax epidemic in Sverdlovsk (present day Yekaterinburg) in 1979. Washington suspected—correctly, as was later shown—the

3 U.S. Department of State, *Adherence to and Compliance with Arms Control, Nonproliferation and Disarmament Agreements and Commitments*, (Washington, D.C., August 2005).

4 Milton Leitenberg, *Assessing the Biological Weapons and Bioterrorism Threat*, Carlisle: U.S. Army War College, Strategic Studies Institute, (December 2005): 11–20.

5 See Ibid., 21–64, and Dando, *Bioterrorism* [fn. 2]. For a historical overview of terrorist biological weapons activities to date, see Jonathan B. Tucker (ed.), *Toxic Terror: Assessing Terrorist Use of Chemical and Biological Weapons*, (Cambridge, Mass./London: MIT Press, 2000).

6 To date, 155 states have joined the BWC.

7 The full text of the BWC can be found in: Nicholas A. Sims, *The Evolution of Biological Disarmament*, Stockholm International Peace Research Institute: Chemical and Biological Warfare Studies No. 19, (Oxford: Oxford University Press, 2001): 192–194.

outbreak was caused by an accident in a BW production facility. Moscow, however, refused to comply with U.S. demands. In 1997, Cuba accused the U.S. of dropping insects from an airplane over Cuban territory with the intention of destroying the grain harvest. This led to consultations in Geneva, but the matter was never clearly resolved.

As such, Article V has so far proved to be ineffective. Article VI, on the other hand, has not even been used to date. It gives the States Parties the power to lodge a complaint with the United Nations Security Council if they suspect that the Convention has been violated. The Security Council can then initiate further investigations. Such action has, however, never been undertaken, probably not least due to the veto rights of the Council's five permanent members.

Has the Ban on Biological Weapons Been Implemented Effectively?

The absence of an effective verification mechanism is not the only problem; implementation of the ban on biological weapons has also been inadequate. This was made especially clear after the dissolution of the Soviet Union, when former Russian President Yeltsin admitted in January 1992 that Moscow had in the past "lagged" in its implementation of the BWC. Without providing official details regarding the nature and extent of the former Soviet Union's BW program, he promised to immediately terminate all projects in violation of the BWC.

In an effort to clarify the matter, the U.S. and the U.K. succeeded in getting Moscow to sign a Joint Statement in September 1992 in which the signatories agreed to visits of non-military biological sites on a trilateral basis. There were also plans to include visits of military biological research facilities, but they were never conducted due to the premature suspension of the trilateral process in 1995.[8] The breakdown of the process began when Russia insisted on reciprocal visits to Great Britain and the U.S. During their inspections of private facilities in the U.S., the Russian delegation behaved in a very uncooperative manner. This caused significant problems for the Clinton administration, which, lacking any legal basis to require them, had had to convince private industry representatives to agree to the visits. As a result, the trilateral process fizzled out.[9] The other States Parties to the BWC were never informed of the outcome of the process.

No further measures have ever been undertaken to investigate the former Soviet Union's biological weapons program. Although the American government and many other Western states consider it very likely that Russia continues to engage in activities that violate the BWC, no measures against Moscow have been taken. In other words, the successor state to the country that in all likelihood violated the BWC by operating a huge offensive BW program has never been held accountable for its actions. This bad example is likely to make it difficult to implement the ban on biological weapons in the future, too.

Confidence-Building Measures

The weaknesses of the BWC became quickly apparent to the States Parties. They therefore instituted politically binding confidence-building measures at the Second Review Conference in 1986, which were subsequently expanded at the Third RevConf in 1991. Among the requirements are that the States Parties provide annual reports on their maximum containment laboratories (BioSafety Level 4)[10] and on their biodefense programs. In addition, they have to provide information on an annual basis regarding human vaccine production facilities, national legislation related to the BWC, and unusual outbreaks of diseases. They are also encouraged to publish the results of research related to the BWC and to promote contacts between scientists engaged in biodefense projects. Another CBM asks BWC signatories to declare past offensive or defensive programs. Unfortunately, however, these CBMs have not been implemented effectively by the overwhelming majority of the States Parties. Around half of them have never submitted a report, and only eight states have done so every year. The quality of the reports submitted varies greatly and is

8 Oliver Thränert, "Chemical and Biological Disarmament in the CIS and the West", in: Hans-Georg Ehrhart, Anna Kreikemeyer, and Andrei V. Zagorski (eds.), *The Former Soviet Union and European Security: Between Integration and Re-Nationalization*, (Baden-Baden: Nomos, 1993): 245–259.

9 Michael Lawson, "How Did It Come to This? The United States and the Biological Weapons Convention", *Rusi Newsbrief*, 21 (1 September 2001) 9: 100f.

10 Biosafety Levels are determined according to World Health Organization criteria. For further information, visit: <www.who.int/csr/resources/publications/biosafety/Labbiosafety.pdf> (accessed on 29 August 2006).

often a far cry from meeting the original expectations of improving transparency.[11]

Negotiations on a BWC Protocol: 1995–2001

Revelations about the Iraqi biological weapons program in operation prior to the first Gulf War in 1991 and the debate surrounding the former Soviet Union's huge program motivated the States Parties in the beginning of the nineties to take further steps to strengthen the BWC that went beyond the CBMs. At the 1991 RevConf a group of governmental experts (VEREX) was established, which presented a report to the States Parties at a special conference in 1994 on potential verification measures from a scientific and technical standpoint. The special conference in turn presented an Ad Hoc Group (AHG), in which all States Parties could participate, with a mandate to conduct negotiations on a protocol to the BWC. The goal of such a legally binding document was to improve the BWC in all of its aspects, including verification.

The negotiations, which began in 1995, suffered from the outset from the fact that the U.S. did not take a leadership role. Russia also offered little in the way of constructive negotiation proposals. It seems Moscow wanted to avoid getting embroiled in issues regarding the former Soviet BW program that might have arisen as a consequence of the application of the protocol. For their part, some NAM states were more interested in loosening the export controls of Western industrialized countries than in contributing to better verification of the BWC. Against this background, the EU states and a few other countries that were interested in strengthening the BWC were unable to make the AHG talks a success.

In March 2001, the chairman of the negotiations, the Hungarian diplomat Tibor Toth, presented a draft protocol. His proposed text contained the following elements related to verification: establishment of a BWC organization, including an Executive Council and a Technical Secretariat; submission of declarations on, among other things, biodefense programs, maximum containment laboratories and vaccine production facilities; creation of a visitation system with three types of visits (transparency, clarification, and voluntary); and provisions for investigations of alleged breaches of the Convention. Shortly thereafter, however, the proposal was rejected by the U.S., which argued that it did not improve the ability to verify the BWC and, furthermore, that it would endanger legitimate national security programs and economic interests. By killing the draft proposal, the U.S. spared many other signatories that were also critical of it from receiving bad press.

At the BWC Review Conference in November 2001, the U.S. went one step further and recommended withdrawing the AHG's mandate. The Bush administration, which had taken office in January 2001, wanted to end all multilateral efforts at improving the BWC. All the other delegates were completely caught off guard by this proposal, and it was roundly resisted. In order to save the Review Conference from complete failure it was adjourned for a year.

The "New Process": 2002–2006

The EU members states and a few other Western countries were still interested in continuing multilateral talks in one form or another. At the reconvened RevConf, however, Washington initially appeared to have little interest in a successful outcome. In a concerted effort by Germany, France, and the U.K. to change the Bush administration's position, they proposed a series of annual meetings of the States Parties, to be preceded by conferences of experts. These intersessional meetings were to take place between 2002 and the next BWC Review Conference in 2006 and were to address issues that Washington considered important.[12]

In a statement on 1 November 2001, President Bush made a series of proposals for strengthening the ban on biological weapons. He proposed, among other things, that the States Parties:

- "enact strict national criminal legislation against prohibited BW activities;
- establish sound national oversight mechanisms for the security and genetic engineering of pathogenic organism;

11 BioWeapons Prevention Project, *BioWeapons Report 2004*, p. 26ff, <www.bwpp.org/documents/2004BWRFinal_000.pdf>.

12 On the history of the BWC protocol negotiations, see Oliver Thränert, "The Compliance Protocol and the Three Depository Powers", in: Susan Wright (ed.), *Biological Warfare and Disarmament – New Problems/New Perspectives*, (Lanham: Rowan & Littlefield, 2002): 343–368; Oliver Thränert, "Die Bemühungen um die Stärkung des B-Waffen-Übereinkommens", in: Dorothee de Neve, Petra Dobner, Stefan Göhlert, and Reinhard Wolf (eds.), *Terror, Krieg und die Folgen*, (Frankfurt a.M.: P. Lang, 2002): 171–184.

- commit to improving international disease control and to enhance mechanisms for sending expert response teams to cope with outbreaks;
- establish an effective United Nations procedure for investigating suspicious outbreaks or allegations of biological weapons use;
- [and] devise a solid framework for bioscientists in the form of a code of ethical conduct."[13]

These were precisely the issues that the Europeans proposed as agenda items for a new work program for 2003–2006. Europe, along with a few other Western states, saw this as the only way to continue to engage the U.S. in a multilateral process.

The drawback of this strategy was that the proposed work program represented a purely Western agenda. But, at the resumption of the Review Conference in November 2002, the negotiations chairman Tibor Toth presented the Western proposal as his own and declared it non-negotiable. As a result, despite the initial resistance of some non-aligned states,[14] the Review Conference came to a successful conclusion. The States Parties agreed to meet annually between 2003 and 2005, with each of these meetings to be preceded by a meeting of experts. The proposed agenda for discussion reflected almost exactly the proposals made by President Bush on 1 November 2001. According to the plan, the 2006 BWC RevConf would then decide on further action in light of these discussions. It was also hoped that the process would promote mutual understanding.[15]

Some experts denounced this approach to multilateral talks, which quickly became known as the "new process," as "treading water." In their opinion, the States Parties failed to commit to taking any concrete action.[16] Others viewed the development more positively, noting that the States Parties would get used to annual meetings, at which they would have the opportunity to engage in in-depth discussions on specific problems. This was something that could not be accomplished in the framework of the Review Conferences, given that they only took place once every five years. The "new process" also facilitated a wide-ranging sharing of information, particularly regarding measures enacted at the national level, such as legislation. This process of international dialogue has required the States Parties to examine in detail their national implementation activities.[17]

Indeed, all the intersessional meetings were well attended by many of the States Parties.[18] Participation in the talks, however, was often limited to the usual group of committed delegations from the European Union and other Western countries. Some NAM states repeatedly expressed their dissatisfaction with the limited, Western-oriented agenda. They also pointed out that the discussion rounds had no negotiating mandate. Nevertheless, on the whole, the "new process" can be viewed as a success. In a largely positive work environment, the stragegy succeeded in engaging in multilateral talks both the U.S., despite its initial reluctance, and those NAM states that had been critical of the entire process since 2001. A further

13 George W. Bush, *Strengthening the International Regime against Biological Weapons*, Washington, D.C., 1 November 2001.

14 In this study, the terms "non-aligned states" and "NAM states" are used interchangeably. The States Parties to the BWC continue to be divided into three regional groups: the Group of NAM & Other Countries , the Western Group, and the Group of Eastern European States. The groupings are still used for the purposes of organizing the structure of negotiations; for example, the chairmanship of the Review Conferences rotates among the groups. However, with the exception of the Western Group, group ties are no longer very significant. Nevertheless, the group members still operate as negotiating blocks, inasmuch as they continue to coordinate with one another on certain key issues outside the context of the plenary debates.

15 See the Fifth 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, *Final Document*, Geneva 2002 (BWC/Conf.V/17). The following issues were agreed upon: "adoption of necessary national measures to implement the prohibitions set forth in the Convention, including the enactment of penal legislation; national mechanisms to establish and maintain the security and oversight of pathogenic microorganisms and toxins; enhancing international capabilities for responding to, investigating and mitigating the effects of cases of alleged use of biological or toxin weapons or suspicious outbreaks of disease; strengthening and broadening national and international institutional efforts and existing mechanisms for the surveillance, detection, diagnosis and combating of infectious diseases affecting humans, animals, and plants; the content, promulgation, and adoption of codes of conduct for scientists."

16 Amy E. Smithson, "Biological Weapons: Can Fear Overwhelm Inaction?" in: *The Washington Quarterly*, 28 (Winter 2004–2005) 1: 165–178.

17 John Freeman, "The Biological and Toxin Weapons Convention Review Process: What More Can It Contribute", in: *The CBW Conventions Bulletin*, (September/December 2005) 69/70: 1–4.

18 While work at the meetings of States Parties was conducted at the diplomatic level, the meetings of experts also included the participation of representatives from academia, industry associations, and NGOs.

positive factor was the participation, particularly at the expert meetings, of international organizations, industry representatives, and scientific experts. This made it possible to have in-depth discussions on issues of vital importance to the future of the ban on biological weapons. Furthermore, it enabled the sharing of best practices, which undoubtedly has helped some States Parties in their implementation of the BWC.

The BWC and the Dual-Use Potential of the Biological Sciences

In discussing the future of the ban on biological weapons, there is always some question about the extent to which the knowledge and skills resulting from scientific advances in the rapidly developing biological sciences in general, and in biotechnology in particular, will be misused for military or terrorist purposes rather than to benefit humanity.[19] The dramatic progress that has been achieved in these research areas in the last 20 years has led to repeated breakthroughs that were previously unimaginable.

Article I of the BWC prohibits all "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." Earlier BWC Review Conferences have repeatedly affirmed in their final documents that this prohibition also applies to all new developments in the natural sciences. And the upcoming BWC Review Conference will once again address this issue. As such, a continuous assessment of the results of scientific advances in the various areas of the biological sciences is an integral part of the BWC Review Conference process. The issue of scientific developments also played an important role in the negotiations over a BWC protocol, particularly in connection with the definition of terms pertaining to declarations to be submitted by the States Parties. But so far, no concrete guidelines have been developed within the framework of the BWC to bar the non-peaceful use of scientific advances. This is not surprising since no international agreement could accomplish such a task. However, the debate on codes of conduct for bioscientists that took place at the 2005 intersessional meeting of states indicates that the States Parties are striving to define common principles for national framework conditions for research in the biosciences that also prevent it from being misused as much as possible.[20]

In the following section a few examples will help highlight areas of scientific advancement that have both peaceful and non-peaceful applications. Due to their dual-use capability, these issues represent a major challenge for the future of the ban on biological weapons.

Scientific Advances and the Potential for Non-Peaceful Use

The popular term "biosciences" refers to a series of scientific disciplines, including biology, chemistry, and medicine. Biotechnology is located at the intersection of these disciplines, and it involves both applied research and production process technology. The aim of biotechnology is the manipulation and utilization of biological processes, largely through the use of the methods of molecular cell biology.[21]

The first step involves systematically searching for appropriate microorganisms in nature. These are then altered, primarily through genetic processes. The resulting products are used in agriculture, the food industry, and in the production of new medicines. Ultimately, developments in biotechnology will confront us with the issue of the ability to manipulate life itself.

Genetic and medicinal therapies are leading the way for the medical use of bioscientific research, with biochemistry[22] and bioinformatics[23] providing the most important contributions. The first steps in this procedure are to research the structure and function of genes and the building blocks of cells (e.g. proteins) as well as cell metabolism and cell cycle regulation. Thanks to continuous improvements in diagnostic methods, researchers now have a vast quantity of

19 See, for example, United Nations General Assembly, *Uniting Against Terrorism: Recommendations for a Global Counter-Terrorism Strategy*, Report of the Secretary-General follow-up on the outcome of the Millennium Summit, (New York, 27 April 2006): 11–12.

20 See also, Malcom R. Dando, "New Developments in Biotechnology and Their Impact on Biological Warfare", in: Oliver Thränert (ed.), *Enhancing the Biological Weapons Convention*, (Bonn: J. H. W. Dietz Nachfolger, 1996): 21–56.

21 Molecular cell biology is a subdiscipline of biology that involves the study of the structure and function of cells using the techniques of molecular biology.

22 Biochemistry is the study of the chemical processes of living organisms.

23 Bioinformatics involves using computers to analyze biological data.

information about the human genome, and they also know a great deal about the infectious microorganisms that cause diseases in people. This knowledge, in turn, serves as the foundation for the development of new therapies and medicines.

Modern biotechnology offers a variety of ways to combat significant pathogens. Improvements in the understanding of the interaction between pathogens and the immune system are opening up avenues for the development of new medicines, including vaccines. And biotechnological knowledge is also being used more and more in cancer therapy, or more precisely, in fighting tumor cells. Another area in which biotechnology is being applied is the regeneration of cellular tissue, which, for example, is used to treat extensive skin damage.[24]

However, the results of biotechnology research are not only useful for advances in medical capabilities or other skills beneficial to humanity. They can also be misused for military and other non-peaceful purposes. The following section presents a few examples which highlight the potential dangers.

New Techniques and Products

Synthetic Biology

In the process of gene sequence analysis, modern molecular cell biology produces a large quantity of data fragments. Biologists rely on computer technology in order to be able to represent, analyze, and work with this mass of data. This particular research field is known as bioinformatics. The decoded genomes of many organisms have been stored in huge databanks.

Modern biotechnology also enables this process to be reversed. In a process known as synthetic biology, biologically active genes can be created from electronically stored gene sequences using chemical synthesis. The first breakthrough in this field was published by the virologist Eckard Wimmer in 2002. With the help of gene maps from the Internet and chemically produced gene fragments, his research team succeeded in manufacturing a fully functional poliovirus.[25] While the Wimmer team needed three years to complete their project, a year later, in 2003, another team led by genetic pioneer Craig Venter succeeded in synthesizing another infectious virus in just two weeks.[26]

The upshot is that in the long run, microorganisms will be much more readily available for research and industrial purposes. This will speed up the development and production of new biological products. As it becomes easier to design viruses or, in the more distant future, even bacteria on computers, the risk of military or non-peaceful application of this technology will also rise. In this regard, it is particularly problematic that gene sequence information for pathogens that can also be used as weaponized biological agents is available electronically.

New Delivery Systems for Active Agents

In order to increase the efficacy of medicines or to make them easier to take, medical researchers have recently sought new methods of drug delivery. A prime example is dry powder pulmonary technology, which makes it possible to deliver fine, respirable dry powders to the deep lung for efficient distribution of the active molecules. This is done with the use of compact, pressurized inhalators. Through a combination of delivery molecules and active molecules, dosages can be formulated for either local lung or systemic delivery.[27] The dry powders are also very stable, which gives them a long shelf life and makes them relatively convenient to use.

One example of the use of this technology is the flu medication Relenza, which was launched in 1999. It was developed as a pulmonary dry powder because it was not well absorbed in tablet form. Other drugs utilizing this technology, particularly for the treat-

24 The international market for biotech products is growing enormously. In 2001, the biotech industry achieved global sales of $35 billion. By 2005, that figure had risen to $63 billion. The leading company on the global market, U.S.-based Amgen, alone recorded sales of $12.4 billion in 2005. During the same period, total sales of the nearly 400 German biotech companies amounted to a mere EUR 832 million. See Ernst &Young, *Beyond Borders – Global Biotechnology Report 2006*, (April 2006): 5.

25 Jeronimo Cello, Aniko V. Paul, and Eckard Wimmer, "Chemical Synthesis of Poliovirus cDNA: Generation of Infectious Virus in the Absence of Natural Template," in: *Science*, 297 (9 August 2002) 5583: 1016–1018.

26 Hamilton O. Smith, Clyde A. Hutchison, Cynthia Pfannkoch, and J. Craig Venter, "Generating a Synthetic Genome by Whole Genome Assembly: X174 Bacteriophage from Synthetic Oligonucleotides," in: *Proceedings of the National Academy of Sciences USA*, 100 (23 December 2003) 26: 15440–15445.

27 For an explanation of this technology, see the website of the U.S. company Nektar, which manufactures the inhalators: <www.nektar.com/wt/page/dry_powder_technology> (accessed on 1 June 2006).

ment of diabetes, are on the verge of being launched on the market. For those suffering with this chronic disease, the ability to inhale insulin rather than having to inject it would be very welcome. With many companies currently working on products using this technology, knowledge about how to manufacture and deliver dry powders containing active molecules will spread in the long run.

The inherent potential risks of this very useful technology becomes clear when one realizes that the main difficulty in developing an effective military or terrorist use of pathogens lies in being able to deliver them efficiently in aerosol form with the right particle sizes. While the technology's application for bacteria would be severely limited, it might well be possible to use it for bacterial spores (anthrax) as well as viruses or toxins.

New Production Methods

New concepts and technologies for biotech production methods are also emerging. The latest trend is the move away from relatively static production lines with large stainless steel tanks and complex networks of tubes and valves to disposable fermentors and the process components that go along with them.[28] This allows different biological agents to be produced much faster and easier in a single, flexible facility.

But there are also risks associated with disposable fermentors and related components. Because of their compact size, they are not easily detected by export controllers. And, although these modern process technologies are currently still very expensive, as their use spreads, it is likely to become even more difficult to discover biological weapons programs of states or terrorists. On the one hand, this is because the facilities can be relocated more rapidly thanks to considerable improvements in the scalability and portability of the components and the end products for storage. On the other hand, if on-site inspections were possible, it would be much more difficult to prove that such a production facility had been misused because the entire production chain could be rapidly disposed of and exchanged with new, sterile containers and piping.

28 Explanations of this technology can be found on the website of a German manufacturer of such products, available at: <www.sartorius.co.uk/sartorius_products.asp?catID=16> (accessed on 30 August 2006).

The Manipulation of Genetic Information

The modification of genetic information represents a key area of bioscience research. Knowledge in this specialized area could, however, also open up possibilities for military or terrorist use.

Analysis and Modification of Surface Molecules (Antigens)

The first research area that presents problems of possible dual-use capability is the analysis and modification of the surface molecules (antigens) of pathogens. The aim of work in this very active field is to better understand the modulation of antigens. Some pathogens, such as the influenza virus, use antigenic modulation to make it more difficult for the human immune system to recognize them. As a result, by the time the specific immune response has kicked in, the virus has already multiplied so much that it causes serious disease symptoms.[29] Researchers want to better understand this functional mechanism of pathogens in order to find new approaches for the development of therapies, medicines, and vaccines.

But this new knowledge could also be used for non-peaceful means. Instead of helping the immune system to better adjust to variable surface structures of pathogens, the pathogens could actually be modified so that the human immune system does not identify them at all or does so much too late. This would have serious consequences for the course of the disease, not least because the disease would be harder to diagnose since immunological laboratory tests often only react to certain surface "fingerprints." This would also affect prevention, as vaccines would provide little or no protection.

Increasing the Persistence of Pathogens in the Environment

Successes in increasing the persistence of pathogens in the environment could also be misused for non-peaceful means. Microorganisms are generally very sensitive to environmental influences such as heat, humidity, or UV rays. Since various bacteria need to be used to

29 Andrew J. McMichael, "HIV. The Immune Response," in: *Current Opinion in Immunology*, 8 (1996): 537–539; Jim Ho, "Future of Biological Aerosol Detection," in: *Analytica Chimica Acta*, (2002) 457: 125–148.

clean outdoor surfaces that are heavily polluted (e.g. with heavy metals or toxins), increasing their longevity—even under sometimes extreme environmental conditions—would be commercially attractive. One method, for example, that makes it possible to increase the resistance of bacteria to UV rays is to implant them with carotenoid genes. An E. Coli bacterium that was furnished with various carotenoids showed clearly increased protection against UV radiation.[30]

In addition to commercial uses, this process for manipulating bacteria could also be used to dramatically reduce a pathogen's rate of degradation. As a result, it would remain infectious in the environment for longer periods of time, which in turn would increase the potential for becoming infected. Pathogens manipulated in this manner and delivered as weaponized biological agents in aerosol form could cause much greater damage. In this scenario, they would no longer rapidly lose their infectiousness due to environmental conditions.

Making Pathogens Resistant to Antibiotics

A third risk of advances in biotechnology being used for non-peaceful purposes involves one of the field's basic techniques, namely introducing antibiotic-resistant genes into pathogens. This is routinely done in biotech research to mark cells into which genes are to be implanted. The technique has become accessible to an increasing number of researchers. In addition to its function as a marker, the introduction of antibiotic-resistant genes can also help determine the potential for supplementing a patient's antibiotic therapy with vaccine treatment. For example, in controversial experiments, researchers developed an effective *Bacillus anthracis* bacterium as a living vaccine with multiple antibiotic resistance. This enabled them to show in hamsters that treatment with the vaccine was effective when used in conjunction with an antibiotic.[31]

The threat of dual-use capability is readily apparent. Pathogens designed to be resistant to antibiotics would make very good weaponized biological agents. The sick would be defenseless against germs, just as they had been before the discovery of antibiotics. This could lead to catastrophic mortality rates for infectious diseases.

Introducing Virulent and Toxic Genes into Microorganisms

A fourth controversial area related to the manipulation of genetic information involves the introduction of virulent and toxic genes. This technique makes it possible to transform harmless microorganisms into pathogens. The structure and function of pathogens has been extensively studied in basic and applied medical research. In experiments, the transfer of virulent and toxic genes serves to explain the functional interactions of diverse toxins, which is necessary for the development of medical therapies or medications.

However, it has proved to be very difficult to transform microorganisms into pathogens by implanting them with toxic genes. This makes it unlikely, at least for now, that this process will be used to create entirely new types of viruses that could be used for military or terrorist purposes. On the other hand, it appears quite possible to increase the virulence of weak pathogens by implanting them with toxic genes. This could be done by introducing gene production enhancers that stimulate the production of the toxic genes already present.[32]

Introducing Bioregulator Genes

A further area of research focuses on introducing decoy or bioregulator genes[33] into viruses or bacteria. In addition to providing further data for basic research, these sorts of transferred genes are used in the development of new therapies. Genetically modified immune cells that produce and discharge therapeutic active ingredients could lead to more targeted medications. Treating sick cells with specific, localized

30 Thomas Götz, Ute Windhövel, Peter Böger, and Gerhard Sandemann, "Protection of Photosynthesis against Ultraviolet-B Radiation by Carotenoids in Transformants of the Cyanobacterium *Synechococcus* PCC7942," in: *Plant Physiology*, 120 (1999) 6: 599–604.

31 A. V. Stepanov, L. I. Marinin, A. P. Pomerantsev, and N. A. Staritsin, "Development of Novel Vaccines against Anthrax in Man," in: *Journal of Biotechnology*, 44 (1996): 155–160.

32 Stanley Falkow, "From Wimp to Pathogen," in: *American Society for Microbiology News,* 55 (1989): 10.

33 A bioregulator is a chemical messenger that influences the production of the building blocks (amino acids) of cells. This allows essential intracellular processes (e.g. immune reactions, metabolism, and reproduction) to be regulated in a variety of ways.

medication reduces the amount of active ingredient that is necessary and results in a decrease of undesired side effects.

However, this technique is also subject to misuse. Viruses could be manipulated to cause atypical disease symptoms, which would make diagnosis significantly more difficult. This would result in the loss of valuable time in starting effective therapy. In addition to introducing toxic genes masked by "decoy" genes, a gene coding for a bioregulator could be transferred to a pathogen. This bioregulator could damage the function of the immune system.

This potential danger was borne out by a particularly well-known experiment by Australian researchers. The aim of the laboratory experiment was to sterilize mice with the aid of a virus in order to decimate Australia's rodent population. But instead of simply sterilizing the mice, the experiment resulted in something unexpected: The suppression of a specific immune response resulted in the death of all the mice, even those that had been vaccinated against mousepox.[34]

This disastrous experiment showed that altering the regulatory process of cells can have dramatic effects. Pathogens can be made more virulent by the coordinated introduction of malicious "decoy" genes and directly active (e.g. toxin coding) genes. Introducing "bioregulator" genes into pathogens can have terribly destructive effects. However, it should be noted that such multiply-altered viruses are more complex than "simple" manipulation of a pathogen because it is more difficult to keep track of the various interactions.

Are "Ethnic Weapons" Viable?

Biotech research produces a huge amount of genetic data that is compiled in gene libraries. These provide the basic information for analyzing and manipulating organisms. In the HUmanGenOm Project (HUGO) and other research projects, gene libraries are searched with the aid of special software for potential targets for the development of new therapies or drugs. But, this knowledge about selected gene profiles could also be misused by using comparative studies of the differences in the human genome to produce target profiles.[35] Some authors fear that these genetic target profiles could be used to design "ethnic weapons" that make use of the so-called polymorphisms of particular groups of people.[36] Target profiles that are built into bioweapons would be capable of distinguishing between people of different ethnicities, and they could be designed to only be effective against a particular group.

However, a series of hurdles must still be overcome in order for this dystopia to become a reality. One problem lies in precision targeting. So far it has been impossible to tease out genetic characteristics that are clearly distinguishable from one ethnic group to another. As a result, it is currently not possible to develop ethnic weapons. But there are already some drugs, for example the heart medication "BiDil," which were approved for use by specific ethnic groups.[37] As such, it is possible that in the distant future, genome research could lead to information that could be used to design ethnic weapons.[38]

These examples highlight the dilemma posed by the dual-use capability of research findings in the biosciences and biotechnology. But scientific progress per se should not be stigmatized for being militarily useful. Researchers in this field are primarily interested in applications that are beneficial to humanity (and the environment). Nevertheless, the public should be made aware of the potential for misuse of this branch of science. And, the most important conclusion to be drawn from this in terms of politics, is that efforts to strengthen the ban on biological weapons should continue with even greater determination.

34 Ronald J. Jackson, Alistair J. Ramsay, Carina Christensen, Sandra Beaton, Diana F. Hall, and Ian A. Ramshaw, "Expression of Mouse Interleukin-4 by a Recombinant Ectromelia Virus Suppresses Cytolytic Lymphocyte Responses and Overcomes Genetic Resistance to Mousepox," in: *Journal of Virology*, 75 (Februar 2001) 3: 1205–1210; Rachel Nowak, "Disaster in the Making. An Engineered Mouse Virus Leaves Us One Step Away from the Ultimate Bioweapon," in: *New Scientist*, 2273 (13 January 2001): 4–5.

35 Declean Butler, "Talks Start on Policing Bio-weapons Ban as 'Designer Weapons' Threat is Disputed," in: *Nature*, 388 (24 June 1997) 6640: 317.

36 Kathryn Nixdorff, Dagmar Schilling, and Mark Hotz, "Wie Fortschritte in der Biotechnologie missbraucht werden können: Biowaffen," in: Biologie in unserer Zeit, 32 (2002) 1: 58–64.

37 Stephanus Parmann, "Die Ethnopille," in: *Die Zeit*, 11 November 2004: 41.

38 Claire M. Fraser and Malcolm R. Dando, "Genomics and Future Biological Weapons. The Need for Preventive Action by the Biomedical Community," in: *Nature Genetics*, 29 (22.10.2001) 3: 253–256, available at: <http://ethics.ucsd.edu/seminars/2002/summaries/FutBiololWeapons.pdf> (accessed on 1 June 2006).

The Future of the Biological Weapons Ban

As we have seen, the biosciences are rapidly developing and its findings and techniques can also be used for non-peaceful means. It is thus imperative that the international community address the issue of how to prevent the misuse of this scientific field with a greater sense of urgency than it has to date. The best way would undoubtedly be to enact measures that would make the BWC more robust. But, in the future, there will also have to be more action taken in other areas. Though not immediately concerned with strengthening the BWC (e.g. in the sense that a protocol is), the majority of such efforts are still directly or indirectly related to the Convention. This connection is apparent, for example, in the BWC calls on the signatories to implement national legislation, and in the work program agenda item dealing with the development of codes of conducts for bioscientists. At the same time, there is a series of issue areas in which the requirements of the BWC overlap with measures to be taken by the States Parties at the national level. In some instances, the states have sought to cooperate with one another on these matters. The best example of this is in the area of export controls. These are necessary in order to ensure that the States Parties live up to their obligation to not support other states in the production of biological weapons (see BWC Article III). The members of the Australia Group[39] coordinate with one another on their export controls in an effort to make them more effective. Other States Parties, however, view the controls as discriminatory. In their view, these controls violate Article X of the BWC, which outlines the need for cooperation among the States Parties in the peaceful use of biology.

The political prospects for strengthening the BWC are limited. Although a group of experts appointed by UN Secretary-General Kofi Annan has called for negotiations on a BWC protocol to resume soon,[40] it seems clear that for the foreseeable future there will be no return to the negotiating table.

Not only would the U.S. reject such negotiations, many other States Parties, including Russia, China, and the majority of NAM countries, are also not really interested. If a protocol were initially only to be accepted by those states that continue to consider it indispensable, there is a risk that this would be limited to the EU member states and a few other countries such as Australia, New Zealand, and Canada. In other words, those states that clearly abide by the conditions of the BWC would end up visiting one another, while those whose compliance is questionable would not be involved.

That is not to say that a BWC protocol should be ruled out forever. But in the short to mid-term, efforts should focus on continuing with the activities that were initiated with the 2003 work program, which enjoys the participation of the majority of the States Parties.

How to Move Forward with the BWC

The Political Framework

The political situation on the eve of the sixth BWC Review Conference is anything but encouraging. Many developing and emerging states have been generally dissatisfied with the progress of multilateral arms control for some time now. They object to the focus on issues which in their view are only in the interests of Western states, such as verification, while matters such as cooperation between the signatories on civilian use of science and technology are neglected.

In his second term as U.S. President, George W. Bush is interested in improving relations with his European partners. As such, the U.S. will not *a priori* block the passage of a new work program. But, they would be just as happy if a work program failed to materialize. In any case, Washington is likely to vigorously reject discussing issues that are counter to its

39 The Australia Group is an informal "arrangement" of 39 states and the EU Commission. All participating states are parties to the CWC and BWC. The group was founded in 1985, and it discusses ways of using export control measures to prevent the proliferation of chemical and biological weapons. See <http://www.australiagroup.net>

40 United Nations. High-level Panel on Threats, Challenges and Change, *A More Secure World: Our Shared Responsibility. Report of the Secretary-General's High-level Panel on Threats, Challenges and Change*, (New York: United Nations, 2004): 41.

own interests. In particular, they have no interest in talks on Article X of the BWC, which is concerned with cooperation among the States Parties to promote the peaceful use of biological activities. U.S. objection is based on Washington's impression that some non-aligned states want to try to loosen or even entirely abolish the export controls of the leading industrialized countries. Indeed, some States Parties, for example Iran, have for years used every opportunity they get to rail against the Australia Group, decrying the export controls of the West as discriminatory.

In contrast, the European Union is very interested in a succesful outcome to the upcoming Review Conference. In an EU Common Position released in March 2006,[41] the Union declared that it wanted to contribute to a full review of the operation of the BWC during the conference. Although the EU remains committed to the long-term goal of improved verification, at the Review Conference they want, above all, to achieve the short-term goal of approving a new work program for 2007–2011.

In these efforts, the EU can count on the support of other countries that have also long since shown their commitment to strengthening the BWC, such as Canada and Australia. But it remains to be seen if this group will be able to wield sufficient political power to achieve its agenda. In any case, the European Union clearly bears the main burden for ensuring the meeting is a success if passing a new work program is viewed as the main criterion of success.

A New Work Program

The biggest difficulty in agreeing on a new work program will be in balancing the interests of the U.S. on one hand, and those of the non-aligned states on the other hand. Washington is likely to only accept a new work program if it focuses on issues that are in America's interests (including national implementation measures). For their part, the NAM states are unlikely to agree once again, as they did in 2002, to an agenda that clearly emphasizes Western priorities. In contrast to 2002, the Western countries are not likely to enjoy the support of a conference chairman sympathetic to their positions, for this time around the chairman is from Pakistan. Like any diplomat, he too will be interested in the successful outcome of the international meeting he chairs. But he will also be under pressure from the non-aligned states to act in their interests. Some of the more radical represen-tatives of this group, such as Iran or possibly Cuba, are likely to demand that the Covention be regarded in its entirety. They will presumably be concerned with ensuring that the agenda for the 2007–2010 intersessional meetings includes talks on Article X. At the same time, they are also likely to use the opportunity to voice their fundamental criticism of the export controls implemented by the Western industrialized countries. This is precisely the kind of thing that the U.S. is bound to resist.

National Implementation Measures

In order to accommodate American interests, the new work program should begin with a renewed debate about national implementation measures. This involves, on the one hand, passing and implementing legislation that prohibits individuals, under threat of penalty, from working with pathogens and toxins for purposes other than those allowed by the BWC. On the other hand, it is concerned with safeguards in laboratories and other facilities in which work is being done on pathogens and toxins for peaceful purposes. The objective in both cases is clear, namely to deny terrorists access to biological agents. During the 2003 intersessional meeting, at which these issues were already discussed, the States Parties agreed to review their respective laws and regulations and update them if necessary.[42]

In addition to America's strong interest, it seems worthwhile to once again address this set of issues, insofar as it ought to be in the interest of all the signatories to prohibit unauthorized access to dangerous pathogens and toxins. Moreover, many signatories to the BWC have not passed any legislation on these matters, despite the fact that they are compelled to do so according to Article IV of the Convention.[43]

As important as it seems to once again address the issue of national implementation measures in the course of the new work program, the question re-

41 Council Common Position 2006/242/CFSP of 20 March 2006 relating to the 2006 Review Conference of the Biological and Toxin Weapons Convention (BTWC), in: *Official Journal of the European Union*, 25 March 2006 (L 88/65-L 88/67).

42 The final document is reprinted in: Joachim Krause, Christiane Magiera-Krause (eds.), *Dokumentation zur Abrüstung und Sicherheit*, Vol. 30: 2003/2004, (Berlin 2005): 216–217. The English version is available at http://www.opbw.org/new_process/msp2003/BWC_MSP_2003_4_Vol.1_E.pdf.

43 Nicholas A. Sims, "Back to Basics: Steering Constructive Evolution of the BWC," in: *Arms Control Today*, (April 2006): 13–17.

mains what ought to be achieved at the 2007 intersessional meetings that was not already discussed at the first meeting where this was on the agenda in 2003. Basically, there are three important aspects:

1. Raising the issue of national implementation measures provides a chance to make it clear to those states that have been slow to enact such legislation of the importance of such efforts.
2. The States Parties could attempt to agree on certain core elements of national laws that would serve as non-binding guides. This was already tried at the 2003 meeting, but the states failed to reach a consensus at the time. Beyond this, it would also be desirable to have advanced standards for biological security.
3. Those states that have not yet enacted any national laws or whose regulations have considerable holes in them, could be offered assistance from other participants. This is another unresolved issue from the 2003 meeting.[44]

Consideration should be given to placing the issue of national implementation measures on the agenda of each annual intersessional meeting, not just one meeting, as was done in the case of the first work program. This would make it possible to carry on a sustained discussion about these crucial matters and provide the States Parties with the opportunity to report on their own activities in this area, such as the passage of new legislation.

Transparency and Confidence Building

The focus of a new work program should be on increasing transparency among the States Parties by improving the implementation of confidence-building measures. As previously described, the way the CBMs have been carried out so far leaves a lot to be desired. One possibility for improving this situation would be to reduce the current number of measures and at the same time make them more focused. The States Parties could debate the issue in detail in the course of a new work program and present recommendations at the Seventh Review Conference in 2011.

Tying the confidence-building measures more closely than previously to other vital efforts to strengthen the ban on biological weapons ought to be a key aspect in the discussion. For example, the signatories could, in addition to the already required declarations on laws and other regulations, also provide information about security regulations for laboratories and other related requirements.

Furthermore, the CBMs ought to contribute more clearly than they have in the past to the transparency of biodefense programs. For example, there could be increased refinement of the existing regulations for the declarations regarding biodenfense programs. It would also be worthwhile to provide additional support for international biodefense conferences, such as those that the Bundeswehr's Medical Service Academy has been conducting for years. These sorts of meetings provide a very good opportunity to share information in an open and transparent manner about programs and progress in biodefense.

To ensure that implementation of the CBMs is not made even more cumbersome, something that would only hamper greater participation by the States Parties, there ought to be discussions about terminating those measures that have made little or no contribution to increasing mutual transparency. Chief among them is measure C, which encourages the States Parties to declare annually findings published in scientific journals of biological research directly related to the Convention. In the past this has led to the submission of extensive lists in which the relevance to the Convention is frequently not immediately obvious. Some States Parties, such as Iran, have sometimes provided long publication lists in their annual reports, while at the same time failing to provide any information about their biodefense programs. The regulation thus allows Tehran to demonstrate its good will without having to provide substantive data that would truly contribute to increased transparency.

The usefullness of Measure F can also be called into question. This calls on the States Parties to, in the interest of improving transparency, make a one-time declaration of past activities in offensive and/or defensive programs conducted after January 1946. The measure was introduced in 1991 primarily to obtain more information about the BW program of the former Soviet Union, but it largely failed in this regard. Today this requirement could prevent some States Parties from participating at all in the CBMs. They might, for example, fear being accused of presenting incomplete reports if they do not fully disclose past activities. Making such a disclosure, however, might be difficult for some states simply because of problems in gathering internal information. As far as biodefense programs are concerned, what is more important for

44 Oliver Thränert, *The Review Process of the Biological Weapons Convention. Prospects after the Fifth Review Conference 2001/2002*, SWP Discussion Paper, (Berlin: Stiftung Wissenschaft und Politik, 2003).

improved transparency is what the States Parties are currently doing, not what they did in the past.

Advances in the Biosciences and the Consequences for the BWC

Advances in the biosciences in general and in biotechnology in particular represent a third important topic for a new work program. In this regard, as will be discussed in detail below, establishing a BWC Scientific Advisory Panel does not seem to make much sense. On the other hand, the concerns outlined in the previous section should have made it clear how rapidly these scientific disciplines are developing and the extent to which it is possible to misuse them for military purposes. Simply addressing the issues that these advances present for the status and further development of the BWC once every five years at the Review Conferences is not enough. Therefore, the work program should be used to discuss relevant findings and experience at the annual intersesssional meetings. This exchange of information could be presented to the NAM countries as a measure in accordance with Article X of the BWC. After all, this also involves knowledge transfer for non-military purposes. The U.S. is unlikely to endorse addressing this issue within the framework of a new work pro-gram precisely because of this potential connection to Article X. As such, it will take a lot of convincing to sell Washington on the advantages of a new work program that is more or less balanced.

Future Implementation of the Work Program

Finally, we need to rethink the modalities of implementing the work program and change them accordingly. Above all, during the intersessional state meetings, which are dominated by diplomats, there are often long-winded plenary debates in which only a few delegations make purposive, substantive contributions. Frequently, the speeches deteriorate into a showcase for the repitious spouting of platitudes. It would make a lot more sense to hold targeted discussions on the issues in small groups. For example, as part of a full review of the confidence-building measures, following a general debate on the matter, working groups could be formed to address specific measures. These could take a systematic look at the implementation of the measures to date and their impact and make recommendations to either further develop a particular CBM or drop it. Spokespersons for the working groups could then report to the plenum on the findings of their talks.

Institutional Enhancement of the BWC?

There has been a great deal of expectation, particularly among NGOs that follow the BWC, that the upcoming Sixth Review Conference would go beyond instituting a new work program and also make progress toward institutionalization of the BWC.[45] It is unlikely, however, that such expectations will be met. Washington is bound to adamantly reject any such propositions, fearing that this would represent the start of a renewed debate on verification, something that it wants to avoid at all costs. Many NAM states are also critical of proposals to institutionally strengthen the BWC. They suspect a Western agenda behind such efforts that focuses on verification to the neglect of other elements of the Convention, such as cooperation on promoting peaceful purposes. At the same time, it is indeed worthwhile to question what concrete advantages the institutionalization of the BWC would bring.

First Steps in Establishing a Technical Secretariat

The BWC has clearly been hampered by the fact that it was created without its own organization. Unlike the Chemical Weapons Convention (CWC), which has its own institution housed in The Hague, and the Nuclear Non-Proliferation Treaty (NPT), which is implemented by the International Atomic Energy Agency in Vienna, apart from the BWC Review Conferences once every five years, there are no regular institutions that the States Parties can turn to to manage problems in implementing the Convention. The depository governments of the United States, Russia, and the United Kingdom are responsible for receiving and informing about the instruments of ratification or accession of new signatories. Most of the other administrative tasks, such as gathering the annual CBM reports, are accomplished by the United Nations Department of Disarmament.

The creation of an organization for the BWC should at least be considered a long-term goal. Until then, a Technical Secretariat located within the UN Department of Disarmament could be built up step-by-step. This would basically ensure that the States Parties pay more attention to fulfilling their contractual obligations. A Technical Secretariat could, for example,

45 See, for example, Trevor Findlay and Angela Woodward, *Enhancing BWC Implementation: A Modular Approach*, (Stockholm: The Weapons of Mass Destruction Commission, October 2004).

assist signatories to the BWC in generating their CBM reports or in writing national legislation. At the same time, it could also make sure that enough is being done to meet Convention obligations. For example, the Technical Secretariat could publish annual statistics showing which states participated in the CBMs or have passed national legislation. Furthermore, it could translate the CBM reports (at present, they can be submitted in any of the six official languages of the UN) as well as evaluate them. The Organization for the Prohibition on Chemical Weapons (OPCW), the agency tasked with overseeing implementation of the CWC, has done well in providing support to a number of signatories to the CWC with their national implementation measures. A similar program in the context of the BWC would clearly also be useful.

Finally, a Technical Secretariat could contribute to promoting the universality of the BWC. With its 155 States Parties, the BWC falls way behind both the CWC (currently 178 States Parties) and the NPT (188). The Technical Secretariat could implement an action plan for talking directly with states that have not yet joined the BWC. Funding for this plan could potentially be provided by the European Union, which passed its own action plan to promote the universality of the BWC in February 2006. The EU plan calls for, among other things, holding workshops on the issue.[46] The States Parties would have to bear the costs for the Technical Secretariat.

Is a Scientific Advisory Panel Worthwhile?

While a Technical Secretariat seems to be worthwhile, even if it is presently unlikely to find political favor, it is questionable whether it makes any sense to establish a Scientific Advisory Panel, which has also been repeatedly called for. Though it is true that the CWC has such a body, this alone is not a reason to create a corresponding BWC panel, not least since experience with the CWC advisory panel has not been very positive. The panel's members, who are often professors emeriti, tend to be experts in particular subfields. This makes it difficult for them to contribute much to a general debate on improving the implementation of the CWC.

Yet, given the dual-use capabilities of knowledge in the biosciences outlined above, interest in a BWC Scientific Advisory Panel that would continuously oversee advances in bioscientific disciplines in terms of their potential misuse for military purposes is quite understandable. For example, the panel could be responsible for performing risk analysis of papers published in relevant scientific journals and research programs. Proponents of a Scientific Advisory Panel argue that this would enable the parties to the BWC to undertake efforts to strengthen and safeguard the Convention, including measures that keep pace with advances in science.

On the one hand, it seems to make sense to think of a Scientific Advisory Panel as a sort of early warning system for the BWC that can identify in a timely manner possible threats emerging from scientific advances. On the other hand, it would be imprudent to give such a body the task of suggesting to states that constraints be put on certain research areas.[47] Research has the capacity to benefit humanity, and thus it is essential that it remain a fundamentally free endeavor. It should not be burdened with any sort of politically-determined constraints. What is important, however, is to ensure that the broadly-defined ban on the misuse of research for offensive biological weapons programs, which is spelled out in Article I of the BWC, not be violated.

The biggest problem in establishing a Scientific Advisory Panel would likely be determining its membership. It would seem sensible to invite scientists who are internationally recognized for their work in the biosciences and other fields relevant to the BWC. If this were the only criterion, it is likely that the panel would only consist of people from Western industrialized countries, and especially from the U.S. This is unlikely to be acceptable to emerging and developing countries, who would probably demand that the composition of the panel reflect the regional distribution of BWC States Parties. This, however, would severely compromise the panel's scientific competence. There is also the danger that panel members from countries like Iran, that are suspected of having BW programs, might actually first learn of ways to misuse modern biotechnology for military purposes in Scientific Advisory Panel discussions about particular publications. Although research results are available globally, their dual-use potential is not always immediately apparent to scientists who are not familiar with the relevant projects.

46 Valentin Schröder, *Die EU und die Nichtverbreitung von Massenvernichtungswaffen – eine Bestandsaufnahme*, (Berlin: Stiftung Wissenschaft und Politik, May 2006), Discussion Paper 3/06 of the European and Atlantic Security Research Unit: 8.

47 Sims, "Back to Basics" [fn. 43].

In any case, as long as no progress is made in the institutionalization of the BWC, there is no real point in thinking about establishing a Scientific Advisory Panel. Such a panel would have to be embedded in some sort of bureaucracy, not least in order to control its expenses. There would also have to be procedures established for handling the panel's reports and dealing with issues related to its composition, and these would need to be independent of the Review Conferences.

At the moment, it is hard to say whether and to what extent the Sixth BWC Review Conference will be a success. There is simply too much skepticism on the part of Washington and in the capitols of some non-aligned states. It is also unforeseeable what impact current political developments, such as the conflict over Iran's nuclear program or North Korea's recent test of a nuclear device, will have on the conference proceedings. Whatever the case, it will be up to the European Union, and especially Germany; to work fervently, regardless of the circumstances, for the passage of a new work program that contains the elements outlined here. Otherwise there is a danger that the multilateral process that has been so painstakingly stitched together over the past few years will completely unravel. This, in turn, would cause lasting damage to the implementation of the biological weapons ban.

Further Measures for Strengthening the Ban on Biological Weapons

Beyond the 2006 BWC Review Conference, there are a number of other activities necessary for strengthening the ban on biological weapons. In part, these should be viewed in connection with any new work program for 2007-2011. One issue is whether and how senisitive knowledge can be controlled. Although such efforts are within the remit of the national states, earlier discussions within the framework of the first work program about codes of conduct for scientists have shown that international coordination in this area is worthwhile. The same is true of export controls. Proposals for increasing the UN Secretary-General's role in investigating possible cases of the use of biological weapons are also closely connected to the BWC, though in the first instance they pertain to the United Nations and the Geneva Protocol. Efforts to protect against biological weapons, on the other hand, are something for states to undertake at the national level. But the better the defense measures are, the less incentive there is for engaging in proliferation in violation of the BWC. To this extent, this issue is also closely related to the Convention.

Controlling Knowledge?

After the events of September 11 and the subsequent anthrax incidents, comprehensive legal regulations were enacted in the U.S. to prevent access to dangerous pathogens and toxins to unauthorized persons. These require all facilities and persons that possess, use or transfer listed pathogens or toxins to register with state authorities. In addition, they must show that they are in compliance with certain security measures. If a registered facility or person cannot provide a legitimate need for its possession of pathogens and toxins, these must be eliminated. Security risk assessments of scientific personnel, including students at universities who have access to relevant laboratories, are to be conducted using government screening criteria. These also prohibit access entirely to certain groups of people, including individuals from countries that are listed by the U.S. State Department as sponsors of terrorism.[48]

The new laws have been repeatedly criticized in the U.S.. The critics argue that these regulations curtail scientific freedom and are a barrier to the free exchange of ideas. Above all, making a categorical distinction between American and foreign students and the outright exclusion of students from certain countries from conducting research in some areas goes against academic principles.[49]

In a presidential directive issued in connection with the Homeland Security Act of October 2002, the U.S. government retains the right to deny the publication of articles containing "sensitive information." Against this backdrop, representatives of 32 scientific journals, including such key titles as *Science* and *Nature*, agreed to refrain from publishing papers if the potential harm of publication outweighs the potential societal benefits, were the revealed knowledge to be misused.

48 For a summary of U.S. legislation in this area, see Jonathan B. Tucker, *Biosecurity: Limiting Terrorist Access to Deadly Pathogens*, (Washington, D.C.: United States Institute of Peace, November 2003) Peaceworks Nr. 52.

49 Barry R. Bloom, "Bioterrorism and the University. The Threats to Security – and to Openness," in: *Harvard Magazine*, (November/December 2003).

However, no criteria were established for making such an assessment.[50]

The general concern over the misuse of the new knowledge rapidly being generated in the biosciences is quite justified given the dual-use capability of many new findings. It is also known that terrorist organizations such as the Japanese Aum cult and Al Qaeda scoured years of scientific literature in an effort to obtain leads relevant to biological attacks. Both organizations have also recruited scientists (or at least tried to), who they assumed had the knowledge necessary for conducting terrorist biological attacks.[51] As such, the strict security regulations for laboratories and other facilities that use dangerous agents is quite appropriate. This is also true for the security reviews on the people that work there.[52] On the other hand, attempts borne of security related concerns to interfere with the scientific process are problematic for a number of reasons.

We have to assume that it is impossible to completely prevent the misuse of biological knowledge for non-peaceful purposes, whether by states or terrorists. This is true not least because major interference in research jeopardizes scientific progress, and thereby also threatens to undermine the development of new techniques that could benefit humanity. Scientific freedom is essential, and scientists need to be able to share information with each other, including across national borders.

Conversely, prohibiting access to certain research areas does not necessarily increase security. Students can learn the principles of gene technology using simple, unlisted agents and then later—for example, after returning to their countries of origin where controls are less strict—apply their knowledge to work with dangerous pathogens. It has even been argued that constraints on biological research, and particularly on publishing, could undermine security in the long run. The argument is that the brightest scientists would not engage in fundamental research if they have to assume that publication of their results would be prohibited. These researchers would thus also not practice the important protective research. But above all, there is a danger that talented young scientists would no longer pursue research on the causes of dangerous infectious diseases.

In addition, restrictions on the publication of scientific findings are problematic for other reasons. The question is whether it wouldn't be better to consider the potential security implications of a scientific study at the outset, rather than to ban the publication of the results at the end of the study. One also has to realize that nearly a half a million papers in the biosciences are submitted to scientific journals annually. It is a veritable flood that is barely manageable, and the sheer volume would make it difficult to also have to consider the security relevance of a paper. Decisions of this sort would require extensive discussion among the publishers and would take up an extraordinary amount of time. It is not even clear whether journal publishers are capable of recognizing and assessing the security implications of the papers they review. Apart from that, it seems problematic to give responsibility for these sorts of decisions, with their potentially far-reaching security implications, to the publishers of scientific journals There is also the question of whether the parameters of what is relevant to security should be defined more broadly or more narrowly. A narrower definition would mean that many papers could no longer be published. This, in turn, would severely hamper scientific progress. Furthermore, many scientists believe, for example, that it was right to publish the Australian experiment on mousepox outlined above (see p. 17) because this provided researchers around the world with the opportunity to familiarize themselves with the problem and to develop countermeasures. Proposals that call for limiting the information that is published about certain potentially security-relevant experiments go against the scientific principle of reproducibility.[53]

In Germany, the problems addressed here are regulated by the Foreign Trade and Payments Act, the Infection Protection Act, the Animal Infectious Disease Act, and the Genetic Engineering Act. These laws also determine who is authorized access to dangerous material and under what conditions technical support in foreign countries is prohibited. For example, there are no measures that prohibit students from specific countries access to university facilities or from studying certain subjects. It is thus largely left up to the advising professors to decide whether doctoral students should be allowed to work on senisitive projects.

50 Jeanne Guillemin, *Biological Weapons*, (New York: Columbia University Press, 2005): 200ff.

51 Leitenberg, *Assessing the Biological Weapons and Bioterrorism Threat* [fn. 4]: 68.

52 This view is also expressed by Michael Ignatieff. See his article "Freiheit und Armageddon," in: *Internationale Politik*, 60 (2005) 11: 52–62

53 Bloom, "Bioterrorism" [fn. 49]; Guillemin, *Biological Weapons* [fn. 50]: 200ff.

There is a consensus among German experts that further legal measures that go beyond the existing regulations are unnecessary. In their view, there is considerable difference in this area between European countries and the U.S., where national legislation was until recently full of holes.[54]

The debate over access to knowledge which could be used for non-peaceful purposes has given rise to an international discussion on codes of conduct for scientists. This was clearly reflected in the 2005 intersessional meetings, where the overwhelming view of the participants was that codes of conduct should not be universal. Rather, it was recommended that professional associations and standing committees develop different codes of conduct. These ought to include, as a basic principle, a commitment by scientists to ensure that their discoveries and knowledge do no harm and to uphold essential security measures.

Obviously, codes of conduct are not enough to solve the difficult problem of dual-use capabilities of knowledge in the biosciences. Their most important function is to raise scientists' still poor awareness of the problem and to heighten their sense of responsibility. By incorporating them into course curricula, codes would also serve as a starting point for educating scientists about the BWC and the scientific community's societal responsibility.[55] This is urgently needed, and Germany also ought to support the adoption of such codes of conduct. One way to encourage universities to incorporate education about issues related to the biological weapons ban into their curricula would be to offer them some sort of reward for doing so. This would help ensure that future scientists are aware of these matters.

Export Controls and Other Legal Measures

Export controls are an important tool for preventing the military misuse of biological agents and equipment. The Australia Group, which was founded in 1985 for the purpose of controlling the export of chemicals, has also been concerned with the issue of biological materials proliferation since 1992. This informal group is comprised of 39 states and the European Commission and meets for a plenary session once a year. They have drawn up lists of pathogens, toxins, and equipment that have been incorporated into the export controls of the participating countries. Despite being repeatedly updated, it is impossible for these lists to be all encompassing. Hence, a "catch-all" clause was also adopted which prohibits the export of unlisted agents and technologies if there is reason to suspect that the importing country will misuse them in a biological weapons program. To oversee this prohibition, it is extremely important that the members of the Australia Group share intelligence information regarding recipient countries and companies. This information enables the states to focus on a few potential proliferators.

Undoubtedly, there is less that the Australia Group can do about biological products than about chemical products. Pathogens multiply rapidly, and as a result, the transport of even the smallest amounts could be militarily relevant. Moreover, pathogens are also found in nature, and the dual-use dimension of biological materials is more complex than in the case of chemical or nuclear material. Finally, it ought to be recognized that the use of key technologies for medical and other legitimate scientific purposes that could also be militarily misused cannot be limited to a small group of reputable industrialized countries. Nevertheless, it is clearly worthwhile to use export controls to help keep important pathogens and technologies out of the hands of countries that might use them in a BW program.

A few developing and emerging countries have repeatedly called the Australia Group export controls discriminatory because the controls prevent them access to medical and scientific advances.[56] Many other states, on the other hand, have come to recognize that the Australia Group contributes significantly to preventing the proliferation of biological weapons. Indeed, they often use the Australia Group's guidelines even though they themselves are not members of the group.

One of the Australia Group's main missions is to expand the use of their standards to as many states as possible. The goal here is not necessarily to increase membership, as that would create problems for establishing the trust necessary for sharing intelligence information. Nonetheless, the members of the Austra-

54 This was evident from a workshop on the issue held at the German Foreign Office on 24 November 2004.

55 See Meeting of the States Parties to the BWC, *Report of the Meeting of States Parties in Geneva, 5.–9.12.2005*, (14 December 2005, BWC/MSP/2005).

56 Jenni Rissanen, "Calm after the Storm: General Debate Concludes as The Hard Work Begins," in: *BWC Review Conference Bulletin*, (26 November 2001), Acronym Institute for Disarmament Diplomacy 2001 – Acronym Reports, <www.acronym.org.uk/bwc/revcon3.htm>.

lia Group should continue in the future to encourage and support non-members in the adoption and further development of export controls. At the same time, the existing lists need to be continually updated. And cooperation with industry needs to be maintained, not least in order to raise their awareness of the problem of the potential misuse of even the smallest pieces of equipment.

The UN Security Council has also succeeded in taking an important step towards strengthening export controls and in propagating further legislative measures related to the international policy of non-proliferation. Under German Presidency of the Security Council, Resolution 1540 passed unanimously on 28 April 2004. Based on an American initiative, the main objective of the resolution is to deny terrorists access to WMD as well as to their components and delivery systems. It is binding for all members of the United Nations. In this sense, it should be viewed as supplementary to the existing multilateral arms control treaties, including the BWC, which are only binding on the respective States Parties. It requires all UN members to adopt national laws on the criminalization of the proliferation of WMD, to introduce corresponding export controls, and to place strict controls over material that is vital to the production of WMD.

An implementation committee was established initially for a two year period, and it has since been extended by the Security Council for an additional two years through April 2008. The committee is charged with collecting reports on national legislation and assessing them. A violation of Resolution 1540 would be referred to the UN Security Council. However, in the case of biological materials, it would not be easy to prove non-compliance with the resolution. This is because the regulations concerning safe production, stockpiling and transport of dangerous biological materials are open to interpretation. The resolution itself, for example, does not contain any corresponding lists of pathogens, toxins or equipment. Consequently, some states have declared that they would use the lists of the Australia Group as the basis for their implementation measures.

Apart from these particular problems, about a third of the UN's 192 members have not yet submitted a report in accordance with Resolution 1540. Of those that have been submitted, they vary greatly in terms of the quality of information. Many developing countries clearly have difficulties in adopting appropriate laws and implementing them. In the future, therefore, guidelines for legislative efforts should be drawn up and states that have been slow to take action should be offered international support in implementing Resolution 1540.[57]

Finally, in this connection it is also worth mentioning the Proliferation Security Initiative (PSI). This is another initiative sponsored by the United States, which aims to fully exploit national and international law to prevent the illegal trade in components for nuclear, biological and chemicals weapons as well as their delivery systems.[58] Here, too, improved cooperation between intelligence agencies is vital, as is cooperation between other relevant national agencies, such customs and police. However, in terms of the biological field, the PSI imposes the same restrictions as those of the Australia Group.

Should the UN Secretary-General's Role be Strengthened?

The Geneva Protocol of 1925 prohibits the use of chemical and biological weapons. Over the years, the United Nations Secretary-General has gradually acquired an important role in investigating allegations of the use of these weapons. This development goes back to U.S. allegations against the then Soviet Union at the beginning of the eighties of having used chemical weapons and toxins against opposition forces in Laos, Cambodia, and Afghanistan. The General Assembly of the United Nations authorized the UN Secretary-General at the time to investigate these incidents of "Yellow Rain." However, the results of the experts who were dispatched to the region were inconclusive, since too much time had passed since the alleged incidents had occurred and the governments involved were not fully cooperative.

Consequently, in December 1982 the General Assembly requested in a resolution that the Secretary-General develop mechanisms to enable the investi-

57 Elizabeth Rindskopf Parker and Bryan Pate, "Implementing UN Security Council Resolution 1540 to Combat the Proliferation of Biological Weapons," in: *Biosecurity and Bioterrorism*, 3 (2005) 2: 166–173; United Nations. Security Council, 1540 Committee, *Programme of Work of the Security Council Committee Established Pursuant to Resolution 1540 (2004) (1 January – 28 April 2006)*, <http://disarmament2.un.org/Committee1540/doc/programmeofwork06Feb2006(E).doc>.

58 Christian Schaller, *Die Unterbindung des Seetransports von Massenvernichtungswaffen. Völkerrechtliche Aspekte der "Proliferation Security Initiative,"* (Berlin: Stiftung Wissenschaft und Politik, May 2004, S 19/04).

gation of suspected violations of the Geneva Protocol. With Resolution 620, which was passed in August 1988, the UN Security Council went further by authorizing the Secretary-General to carry out on-site investigations of suspected violations against the Geneva Protocol. As a result, the Secretary-General developed guidelines for carrying out such on-site investigations and drew up lists of laboratories and experts to aid in implementing these measures as quickly as possible. Rapid reaction is especially critical in alleged uses of biological agents because biological material changes quickly, making it hard to trace after just a short period of time.

On-site analysis can, in principle, be initiated at the behest of the UN Secretary-General of his own accord or if a member state brings to his attention a possible violation of the Geneva Protocol and the allegations are of such a serious nature that they cannot be resolved through bilateral consultation. In addition, the UN Security Council has made it clear that investigations into the possible use of chemical and biological weapons can also be carried out in states that have not signed the Geneva Protocol. However, the suspected state is not obligated to grant access to its territory to the experts dispatched by the Secretary-General. But this would not necessarily hinder the success of such a mission because the use of chemical or biological weapons may well have occurred in the territory of the accusatory country. And there might also be cases where the accused state is interested in clearing its name of false accusations. This, for example, was the case when Azerbaijan accused Armenia of using chemical weapons in the conflict over Nagorny-Karabakh in 1992. Armenia responded by asking the UN Secretary-General to investigate the allegations on-site. Ultimately, an expert commission concluded that the Azerbaijani accusations were baseless.

The UN Secretary-General can decide whether the Geneva Protocol has been violated on the basis of reports submitted by the inspectors. This was the case during the 1980-1988 Iran-Iraq War, when experts sent by the UN Secretary-General determined that Iraq had used chemical weapons. However, there were no direct political consequences for Iraq as a result of the discovery, since the UN Security Council neglected to take any further action on the matter.

The BWC signatories discussed the issue of investigating the possible use of biological weapons and suspicious outbreaks of infectious diseases at their 2004 intersessional meeting. Although many of the delegations underscored the importance of an investigation mechanism under the aegis of the UN Secretary-General, some States Parties were not prepared to discuss this issue in detail within the framework of the BWC work program, arguing that it was not directly connected with the BWC.[59] Nevertheless, a number of States Parties, including Germany, subsequently updated their lists of national experts and laboratories.

The importance of updating lists of national expert should once again be emphasized at the forthcoming BWC Review Conference. There also should be an attempt to establish training courses for these experts so that they can practice working together. Such cooperation would be vital for conducting an on-site investigation. Finally, the basic equipment requirements for reference laboratories should be more precisely defined. While the U.S. and other Western countries are likely to be open to such proceedings, it remains to be seen if some of the NAM countries, such as Iran, will agree to discuss these issues. An idea that clearly lacks majority support is the establishment of a standing inspectorate that would investigate cases of alleged use of biological weapons. The majority of BWC signatories are unlikely to be willing to pay for the costs of such a body, not least since the inspectors would rarely be called into action.[60] And the temptation to involve the World Health Organization (WHO) in any way with the investigation of suspicious outbreaks of infectious disease or of possible uses of biological weapons ought to be avoided. The generally recognized political neutrality of the WHO is vital to its operation. This could be compromised if states fear that, as a result of WHO visits due to outbreaks of infectious diseases, they could suddenly be confronted with accusations of having worked on or used biological weapons.[61]

Another unconvincing proposition is that Article 99 of the UN Charter gives the UN Secretary-General the authority to initiate investigations of alleged breaches of the BWC.[62] According to Article 99, the Secretary-

59 Graham S. Pearson, "Report from Geneva: The Biological Weapons Convention Meeting of States Parties," in: *Chemical and Biological Weapons Convention Bulletin*, (December 2004) 66: 21–34.

60 Findlay and Woodward, *Enhancing BWC Implementation* [fn. 45].

61 Christian Enemark, "Infectious Diseases and International Security. The Biological Weapons Convention and Beyond," in: *The Nonproliferation Review*, 12 (March 2005) 1: 107–125.

62 Una Becker, Harald Müller, and Carmen Wunderlich, *Impulse für das Biowaffenregime*, (Frankfurt a.M.: Hessische Stiftung Friedens- und Konfliktforschung [HSFK], 2005), HSFK-Report Nr. 7. A English version of the paper is reprinted

General can bring any issue before the UN Security Council that he believes represents a threat to international peace and security. This indeed could include violations of the BWC, especially since the Security Council has already deemed the proliferation of WMD as a danger to international peace and security. It is also true that the Secretary-General is required to commence certain types of investigations, such as data analysis by experts, to help him decide whether a case should be brought before the Security Council. Finally, given the weaknesses of the consultation mechanism of Article V of the BWC on the one hand, and the high barriers to referring a case to the UN Security Council imposed by BWC Article VI on the other hand, the search for interim solutions is fundamentally understandable. This is all the more so given that it is unlikely that a BWC protocol, complete with effective verification instruments, will materialize any time soon. The proposal might also make sense in the context of giving a state that has been accused of violating the BWC another opportunity, in addition to the bilateral consultations called for by BWC Article V, to prove its innocence. The idea would be to allow the accused state to turn to the UN Secretary-General, who could help by providing an expert team at his disposal, potentially exonerating the state of a false accusation. The critical point of the proposal, however, is whether the UN Secretary-General would still be perceived as politically neutral if he himself were to initiate investigations of possible Convention violations.

During the negotiations over a BWC protocol there was vigorous discussion about how inspections should be triggered in cases of alleged violations of the Convention. One issue that was particularly controversial concerned the number of members of the proposed BWC organization's Executive Council it would take to prevent an inspection. This was seen as necessary in order to preclude intrusive on-site inspections in obvious cases of false accusations. This shows just how concerned states are to avoid being publicly suspected of violating the Convention as the result of false accusations, and it raises the question of the basis upon which the UN Secretary-General could initiate investigations into possible breaches of the BWC. Publicly available sources, especially with respect to biological programs, would hardly provide sufficient justification for starting a process that from the outset is bound to have a high political profile. On the other hand, intelligence information is not likely to be made available to the UN Secretary-General. And if it were made available, there is a risk that it would be politicized. In other words, a state might try to manipulate the process by making information available to the UN Secretary-General in order to get him to initiate an unjustified investigation into a possible violation of the BWC. Besides, intelligence information about possible BW programs is generally very sketchy.

Furthermore, it would make a big difference which state were subjected to a potential investigation by the UN Secretary-General. It seems unimaginable that he would take such action against a permanent member of the Security Council, such as Russia or the U.S. Yet, at least in the case of Russia, doubt about its compliance with the Convention could indeed be justified. If the Secretary-General were to take action against states like Iran, which are constantly subjected to harsh rhetoric from the U.S. on the issue of proliferation, he would open himself up to the accusation of letting himself be used by the last remaining superpower for its own political purposes. For all these reasons, further effort on proposals that would place the burden on the Secretary-General of initiating investigations into possible breaches of the Convention seems misguided.

Improved Protection against Weaponized Biological Agents

The better a state's armed forces can be protected against biological agents, the less sense it makes for other states that are interested in biological weapons to actually pursue them. It is simply not worth the effort and expense to develop such weapons if they are incapable of causing major damage to a well-protected opponent. In this sense, biodefense serves as a deterrent. This is also true of civil defense in general because it makes it clear to terrorists (and the rulers of other states) that they cannot cause horrific damage with weaponized biological agents. Of course, it is inordinately more difficult to protect an entire population than just an army. Still, the two defense areas overlap, such as with regard to diagnostic methods and the development of vaccines. To illustrate this, the following section briefly describes the world's most expensive biodefense research program (that of the U.S.) as well as that of Germany.

as "While Waiting for the Protocol: An Interim Compliance Mechanism for the Biological Weapons Convention," in: The Nonproliferation Review, 12 (November 2005) 3: 541–572.

The U.S. has by far the most comprehensive biodefense research program. Funding for biodefense research has expanded exponentially since September 2001, when the attacks on the World Trade Center and the Pentagon and the subsequent delivery of anthrax-laced letters not only revealed the destructive power of terrorism, but also sent waves of panic through the American public. In 2001, the U.S. Department of Health and Human Services' budget for biodefense was around $271 million. The following year it had increased to more than $2.9 billion, representing more than a tenfold increase within in a single year. The total outlays in the U.S. for biodefense rose from $417 million to $3.7 billon in 2002. By FY 2005 the sum invested in biodefense had risen to over $7.6 billion. Outlays have only recently begun to decline, but the budget for FY 2006 still amounted to $5.2 billion.[63]

Project BioShield is a key element of America's biodefense program. Passed in 2004, it has authorized $5.6 billion in funding over ten years for the acquisition of vaccines, other medicines and protective equipment. In addition to biological dangers, the project also aims to protect against chemical, nuclear or radiological attacks.

The government agencies with the highest profile in the area of biodefense are the Centers for Disease Control and Prevention (CDC), an umbrella organization housed within the Department of Health, and the United States Army Medical Research Institute of Infectious Diseases (USAMRIID). In addition, the proposed Project BioShield II would create a new organization called the Biomedical Advanced Research and Development Agency (BARDA). It would be charged with supporting the development of countermeasures against infectious diseases, particular with regard to weaponized biological agents. The initial budget for BARDA in its first year of operation is currently set at $1 billion.

But, in addition to its contribution to improving biodefense, there are also risks associated with the massive build-up of U.S. efforts to protect against biological weapons. The expanded funding has brought with it new actors involved in this area of research, which raises the probability of someone passing on or misusing sensitive information.[64]

63 Ari Schuler, "Billions for Biodefense: Federal Agency Biodefense Budgeting, FY2005-FY2006," in: *Biosecurity and Bioterrorism*, 3 (2005) 2: 94–101.

64 Martin Enserink and Jocelyn Kaiser, "Has Biodefense Gone Overboard?" in: *Science*, 307 (4 March 2005) 5714: 1396–1398.

Biodefense has also become increasingly important in Germany in the past few years. The Bundeswehr's Medical Service Academy has traditionally been the most important institution in the country's military biodefense research efforts. In addition to investigating the infection mechanism of viruses that can also be used as weaponized biological agents, research is also being conducted by the academy into early detection of pathogens. As a general rule, German biodefense efforts focus on pathogens that have been listed by the Australia Group. In addition, the Military Institute for Defense Technology in Munster focuses on the technology of biodefense. This includes, for example, optimizing verification procedures and sampling devices and improving disinfection and decontamination procedures.

Institutional changes have also taken place in Germany since September 2001. The Robert Koch Institute (RKI), which reports to the Federal Ministry of Health, is now also responsible for biodefense issues. The Center for Biological Safety, which was established at the RKI in response to the events of 2001, is charged with the prevention, identification, and damage assessment of incidents involving biological agents. To this end, the Berlin-based institute is, among other things, being equipped with a new Biosafety Level 4 (BSL4) laboratory. Furthermore, the Federal Institute for Risk Assessment (FIRA) has been in operation since 2002. It is responsible for animal diseases and food safety. As such, some of its work is also related to biodefense. For example, FIRA, which is part of the Federal Ministry of Food, Agriculture and Consumer Protection, looks into how biological agents that have been introduced into the food production chain can be detected as early as possible. Finally, there is the newly established Federal Agency for Civil Defense and Emergency Aid. Among other things, the agency funds a project for the production and deployment of mobile BL-3 laboratories that can help to rapidly detect outbreaks of biological agents.

The basic research conducted at these various institutions promotes a better understanding of how pathogens work. Studies of the molecular-genetic and chemical nature of numerous pathogens are underway which should improve the identification and classification of viruses. In addition, the interaction between pathogens and the immune system is being studied in order to help explain the pathogenesis and progression of infectious diseases. Building on the data emerging from such work, test procedures are being developed for numerous pathogens that could

also weaponized. This includes the causative agents of anthrax and Bubonic plague as well as of various hemorrhagic fevers (e.g. Marburg, Ebola).

On the whole, German biodefense research appears to be making good progress. For years, it has been carried out at a high level, and it is currently being expanded in a targeted fashion. The cooperation between the military agencies and civilian institutions with responsibilities in this area has been quite positive. One example of this is preparatory efforts for an outbreak of smallpox. The Bundeswehr's Institute for Microbiology established a mobile diagnosis team, while the RKI took the lead in procurement of smallpox vaccine dosages for the entire population and developed an emergency vaccination plan.

Military and civilian research has been mutually beneficial to both combating regularly occurring infectious diseases (which may become more frequent in the future) and protecting against pathogens that can be used as weaponized biological agents. This is exactly the right strategy, for an overall strengthening of the healthcare system helps to protect the population against both naturally occurring epidemics and the use of weaponized biological agents. We advocate a continuation of this course of action.[65]

However, this in no way means that the German population is adequately protected against biological risks. There is, as of yet, still no comprehensive concept for biodefense. Cooperation between the federal and state governments needs to be improved. For example, the Federal Agency for Civil Defense only serves a consultative role for the states. Also, training for doctors in the diagnosis of illnesses related to exposure to weaponized biological agents needs to be further promoted. Finally, there are still not nearly enough beds available in intensive care units for the simultaneous treatment of many serious illnesses or cases of contanimation.[66]

65 An overview of research activity in German biodefense can be found in the summary of presentations made at the Medical Biodefense Conference held by the Institute for Microbiology of the Bundeswehr in Munich on 26/27 October 2005.

66 On this issue, see also Oliver Thränert, *Terror mit chemischen und biologischen Kampfstoffen – Risikoanalyse und Schutzmöglichkeiten*, (Berlin: Stiftung Wissenschaft und Politik, April 2002, S 14/02): 20ff.

Conclusion

With a little luck and diplomatic skill, Germany, working together with its European and other Western partners, could succeed at the forthcoming BWC Review Conference at getting a new work program passed for 2007-2010. This alone would constitute success. At the same time, it would only be a small step on the long path to truly strengthening the ban on biological weapons. One can only hope that in the coming years there will be a more favorable international climate for taking decisive action. The rapid advances taking place in modern biotechnology needs to be met with the equally rapid development of effective ways to prevent non-peaceful uses of its findings.

At the same time, strengthening the BWC should not be the only focus. In fact, some things can be done at the national level, such as improving biodefense or incorporating education about the issue of biological weapons into college courses for biologists and related disciplines as well as introducing codes of conduct for scientists. Coordination and cooperation among like-minded states could also help improve matters, for example in areas like national legislation and security measures as well as in export controls and their implementation.

This sort of hard, painstaking work is unlikely to receive much public attention. In today's media-driven society, the general public typically only notices spectacular events. The work of diplomats, scientists and other experts is more important than ever to ensure that these sorts of horrific events, such as the use of biological agents in a military conflict or an act of bioterrorism, never take place, or if they do, that effective countermeasures can be enacted.

Acronyms

AHG	Ad Hoc Group
BARDA	Biomedical Advanced Research and Development Agency
BW	biological weapons
BWC	Biological Weapons Convention
CBM	Confidence-Building Measure
CBS	Center for Biological Safety
CDC	Centers for Disease Control and Prevention
CWC	Chemical Weapons Convention
FIRA	Federal Institute for Risk Assessment
HUGO	HUmanGenOm Project
NAM	Non-Aligned Movement
NPT	Nuclear Non-proliferation Treaty
OPCW	Organization for the Prohibition of Chemcial Weapons
PSI	Proliferation Security Initiative
RKI	Robert Koch Institute
UN	United Nations
USAMRIID	United States Army Medical Research Institute of Infectious Diseases
UV	ultraviolet
VEREX	Verification Experts Group
WHO	World Health Organization