United States biodefense, international law, and the problem of intent

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ABSTRACT. **Since the anthrax attacks of 2001 in the United States, annual U.S. government spending on biodefense programs has increased enormously. U.S. biodefense was once exclusively the domain of military agencies and was aimed principally at protecting battlefield troops against the products of state-run biological warfare programs. Today, it is engaged in and promoted by a variety of government agencies contemplating "bioterrorism," and it is aimed principally at protecting the American civilian population. I ask if certain U.S. biodefense policies, pointedly those funding "threat assessment" projects, make biological attacks paradoxically more likely by undermining international norms against deliberately causing disease. I conclude that they do and consider the ramifications of this answer.**

In the weeks following the 11 September 2001 attacks on the World Trade Center and the Pentagon, five Americans died after being deliberately infected with *Bacillus anthracis* distributed through the postal system. Although the first and second sets of events were almost certainly of separate origin and were demonstrably of much different scales, they merged to generate intense fears of mass-casualty biological attacks. The U.S. government had perceived an increasing potential for biotechnology to be misused long before the anthrax attacks, and the Clinton administration had begun bolstering U.S. biodefense capabilities in the late 1990s. In the post-"9/11" atmosphere, however, annual federal government spending on biodefense programs increased quickly and has become enormous, going from $US414 million in FY2001 to $US7.6 billion in FY2005.[1] For 2002 to 2005, the average amount spent annually on biodefense was $US5.4 billion.[2]

Most biodefense work is purely defensive and clearly benign: for example, development of biological-agent detection, filtration, exclusion, and decontamination procedures and systems; first-responder training; medical-facility outfitting; interagency communication and coordination; and epidemiological surveillance implementation. Such efforts bring the direct, practical benefits of reducing and possibly avoiding the human damage that would result from the use of biological weapons (BW). In terms of international law and security, however, a logically complementary class of biodefense projects — those describable as "threat assessment" activities — are less credibly defensive and benign. Under the 1972 Biological Weapons Convention (BWC), the area between prohibited offensive activity and permitted defensive activity is gray, and it is wide. Here is explored the weapons potential of pathogenic microorganisms — or microorganisms that might be *made* pathogenic — so as to develop countermeasures.

This article discusses legal questions arising from past and current U.S. research in this threat-assessment area. Although U.S. biodefense policy is peaceful in its intent as stated, some forms of threat assessment nevertheless have raised the possibility that international law might be breached and "defensive" BW proliferation stimulated in other countries. The U.S.

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approach to biodefense is singled out for analysis not because it is the most problematic, but rather because it is the most conspicuous. It is possible that many of the challenges highlighted in this article are also relevant in countries which are less open and to which fewer scholars have turned their critical attention.

The main challenge for the United States is to pursue biodefense in a way that does not endanger the norm against deliberately causing disease, the norm that discourages biological attack by keeping the moral impediment high and the threat of global condemnation sure. To explore this challenge, I examine four issues: (1) the legal status of threat-assessment projects under the BWC; (2) claims that the U.S. has already breached the BWC; (3) the practicality of genetically engineering novel pathogens; and (4) the transparency and anti-proliferation integrity of biodefense programs.

Threat Assessment

At the Los Alamos National Laboratory in New Mexico, U.S. scientists have built elaborate computer models of cities and then simulated the fallout from a hypothetical "terrorist" attack. Simulations of smallpox releases in a major city have been useful; they have, for example, focussed debate between proponents of targeted and mass vaccination. In July 2005, a scientist on the smallpox simulation project, James Smith, told the *Washington Post*, "[w]e're trying to be the best terrorists we can be. Sometimes we finish and we're like, 'We're glad we're not terrorists.'" If ever these simulations got into the wrong hands, Smith said, "[i]t would be a terrorist recipe for doing something terrible."[3] Computer modeling of a smallpox event does not contravene international law, although the Los Alamos example illustrates how information obtained in the interests of defense could be used for offensive purposes.

Research and development projects on BW threat assessment involve experimenting with offensive applications of pathogens so as to determine appropriate countermeasures — a practice known as "red teaming." However, such projects carry a security risk. On the one hand, against a specific biological threat, experimentation for threat assessment purposes might on balance be worth that risk. And ethical justifications for such research might be strong. That is, faced with a specific threat, could the consciences of scientists and policy makers tolerate not doing as much as they could to prepare? On the other hand, threat assessments might push beyond the bounds of international law and so damage operative moral norms as to make BW threats *more* numerous, not less.

To develop defenses against a putative BW agent requires understanding numerous topics: pathogenicity, including infectivity and virulence; evasion of the human immune system; resistance to antimicrobials; dispersal effects on infectivity. These and many topics of similar sort are also exactly what a BW developer would have to master if novelty were a goal.[4]

Article I of the BWC prohibits development, production, and stockpiling of BW but is silent on the question of research. In accordance with National Security Decision Memorandum 35, issued by National Security Advisor Henry Kissinger on 25 November 1969, the United States interprets its responsibilities under the BWC as permitting "research into those offensive aspects of bacteriological/biological agents necessary to determine what defensive measures are required."[5] The memorandum did not specify what types of research were justified for defensive purposes. On 23 December 1975 National Security Advisor Brent Scowcroft issued a second memorandum authorizing "vulnerability studies" as permissible under the BWC, but no express authority for the creation of novel pathogens or weaponization techniques for threat assessment purposes was cited.[6] In May 1989, however, in testimony before the U.S. Senate Committee on Government Affairs, the U.S. Army Medical Research Institute for Infectious Diseases (USAMRIID) commander David Huxsoll stated that research on microorganisms to enhance virulence or stability and to facilitate dissemination was prohibited by the BWC.[7]

Such comments by a U.S military officer today would not reflect the apparent attitude of his or her government regarding what constitutes defensive work. At present, a number of U.S. government agencies are undertaking or plan to undertake research in exactly the areas cited by Huxsoll. Most prominent among these is the National Biodefense Analysis and Countermeasures Center (NBACC). Due to be completed in 2008, it is intended to provide the United States with high-containment laboratory space for biological threat characterization and bioforensic research. According to the U.S. Department of Homeland Security, NBACC will form part of the National Interagency Biodefense

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Campus at Fort Detrick, Maryland, alongside existing USAMRIID facilities. Its programs will investigate the infectious properties of biological agents, the effectiveness of countermeasures and decontamination procedures, and techniques of forensic analysis. Part of NBACC is the Biological Threat Characterization Center, which will undertake laboratory studies of risks and will help development tailored responses, such as detectors, vaccines, drugs, and decontamination technologies and protocols.[8]

Many of the activities to be undertaken by NBACC could readily be interpreted by outsiders as the development of BW under the guise of threat assessment. In particular, weaponization feasibility studies and the engineering of novel pathogens arguably breach Article I of the BWC. In a February 2004 presentation, George Korch, Deputy Director of NBACC, revealed that one of the Center's research units intended to pursue a range of topics including "aerosol dynamics," "novel packaging," "novel delivery of threat," "genetic engineering," and "red teaming." At one point in his presentation, Korch summarized the threat assessment task areas as: "Acquire, Grow, Modify, Store, Stabilize, Package, Disperse."[9, 10] Such language is identical to that which would describe the functions of an offensive BW program.

Indeed, a 1998 report from the Office of the U.S. Under Secretary of Defense for Acquisition and Technology stated: "Stabilization and dispersion are [BW] proliferation concerns because these technologies increase the efficacy of biological agents."[11] And in the light of planned NBACC activities as described by Korch, a 2005 U.S. State Department report which assessed that "China maintains some elements of an offensive BW capability in violation of its BWC obligations" appeared to reflect an American double standard on BW when it warned that:

> From 1993 to the present, [Chinese] military scientists have published in open literature the results of studies of aerosol stability of bacteria, models of infectious virus aerosols, and detection of aerosolized viruses using polymerase chain reaction technology. Such advanced biotechnology techniques could be applicable to the development of offensive BW agents and weapons.[12]

To demonstrate exactly how a BW threat assessment project might contravene international law, the next section weighs the details of three past U.S projects against the prohibitions contained in Article I of the BWC.

Putative U.S. breaches of the BWC

In September 2001, the *New York Times* revealed the existence of three classified U.S. biodefense projects. From 1997 to 2000, Project Clear Vision involved building and testing a Soviet-model bomblet for dispersing bacteria. In 1999 and 2000, Project Bacchus investigated whether a would-be terrorist using commercially available materials and equipment could assemble an anthrax production facility undetected by the U.S. and foreign governments. In early 2001, Project Jefferson involved the reproduction of a vaccine-resistant strain of anthrax bacteria.[13]

The article's authors — Judith Miller, Stephen Engelberg, and William Broad — had presumably known about these projects for several months already because they soon afterwards published a book containing more details.[14] An important caveat to what follows is that the work of these authors appears to be the only publicly available source regarding these three named projects.

Although other authors have already questioned them in a general legal sense,[15, 16, 17] I question Clear Vision, Bacchus, and Jefferson according to the precise wording of Article I:

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

1. Microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes;
2. Weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict.

Clear Vision. Of the three projects, the one most likely to have contravened the BWC was Clear Vision. This project reportedly involved tests of bacteria bomblets, built according to a Soviet design and conducted by Battelle — a large, not-for-profit science-and-technology management-and-testing enterprise headquartered in Columbus, Ohio, but perennially contracting with America's national laboratories, research universities, and defense establishment. The

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bomblets were filled with simulant pathogens and tested for their dissemination characteristics and reliability under different atmospheric conditions. Experiments in a wind tunnel revealed how the bomblets, after being released from a warhead, would fall on targets.[14] Before the testing took place, some U.S. government legal experts had argued the experiments were not a breach of the BWC provided they were not *intended* for offensive purposes. Other officials argued that a weapon was, by definition, meant to inflict harm and therefore crossed the boundary into offensive work: "A bomb was a bomb was a bomb."[14]

Indeed, on a close reading of Article I, a strong case is to be made that the BWC bans delivery systems *categorically*, whether intended for defensive purposes or not. Article I, paragraph (1), of the Convention permits the use of biological agents or toxins of types and in quantities justified for "prophylactic, protective and other peaceful purposes." This phrase is generally construed to include the development of pharmaceutical and other defenses against biological attacks. Paragraph (2), however, is worded differently. It prohibits "weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict." The difference between the words "intended" and "designed" is critical, such that paragraph (2) necessarily refers to the engineering features of a physical object rather than the intent of its user. For example, a person might *intend* to use a rifle for the peaceful purpose of stirring a can of paint, but the rifle itself is *designed* for the hostile purpose of firing bullets. There is no provision in Article I for delivery mechanisms to be justified for "prophylactic, protective and other peaceful purposes," and paragraph (2) does not contemplate *intent*, one way or another. Indeed, Article I makes illegal mere *retention*, with no exemption even for curatorial retention, at least not in a facility, such as a museum, operated by a signatory state.

The drafting of international treaties is an arduous process involving careful and deliberate choices of language. The complementarity of paragraphs (1) and (2) of Article I must therefore be accepted as significant. Former U.S. ambassador James Leonard, who led the original U.S. negotiations of the BWC, has explained why the language of Article I with regard to delivery devices is more restrictive. According to Leonard, the BWC was never intended to legitimize the development and production of delivery devices for defensive purposes. If it had been, countries would all along have been able to develop and build the components for an entire weapon in the name of defense.[18] Such an interpretation is supported by the Convention's Preamble, which contains this statement:

> The States Parties to this Convention ... [are] Determined for the sake of all mankind, to exclude completely the possibility of bacteriological (biological) agents and toxins being used as weapons.

"*[T]o exclude completely the possibility*" was the interpretation to be applied: none other. This restrictive textual guidance for interpreting Article I was adopted in draft recommendations for a biodefense code of conduct distributed by a group of non-governmental organizations (NGOs) to delegations attending the resumed session of the Fifth BWC Review Conference in November 2002. The NGOs argued that the construction of delivery mechanisms designed for hostile use, whether or not hostile use was intended at the time of construction, was not permissible, even for defensive purposes.[19]

Although it would be outside the limits of the BWC, a weaponization project like Clear Vision could nevertheless be considered legal under U.S. domestic law, assuming ratified treaties could be abrogated *simply* by domestic law. Applying here is Article VI of the U.S. Constitution, but this article, over which much jurisprudential ink has been spilled, addressed the possibility of conflict between federal and state authority, not between prior treaty law and newer federal law:

> This Constitution, and the Laws of the United States which shall be made in Pursuance thereof; and all Treaties made, or which shall be made, under the Authority of the United States, shall be the supreme Law of the Land; and the Judges in every State shall be bound thereby, any Thing in the Constitution or Laws of any State to the Contrary notwithstanding.

In the United States Code, Title 18, Section 175 ("Prohibition with respect to biological weapons"), which entered into law in 1990 and has been amended as recently as 2002, prohibits the development, production, stockpiling, transfer, acquisition, retention, or possession of any biological agent, toxin, or delivery system for use as a weapon. However, the legislation defines the term "for use as a weapon" to *exclude* "the

development, production, transfer, acquisition, retention, or possession of any biological agent, toxin, or delivery system for prophylactic, protective, or other peaceful purposes." In other words, the U.S. legislation, irrespective of treaty obligations, contemplates "peaceful" delivery systems. The difference in wording compared to that of Article I of the BWC may well have led U.S. officials to believe Project Clear Vision was legitimate.

Bacchus. Project Bacchus (named after the Roman god of fermentation) reportedly built a functioning facility that turned out two pounds of *B. anthracis* simulants: *B. thuringiensis* and *B. globigii*. Dried-particle diameters ranged from one to five microns — sizes suitable for inhalation. And, as the journalists who revealed the existence of this project observed, "[i]f anthrax spores had been dropped into the fermenters, the United States could have made enough biological agent to mount a deadly attack."[14]

On a favorable reading of Article I of the BWC, emphasizing the words in paragraph (1), Bacchus produced a harmless *type* of biological agent in small *quantities* and therefore plausibly had the *peaceful purpose* of investigating the capabilities of potential enemies of the United States. Another reading, emphasizing paragraph (2), might be that, regardless of whether the biological agents used were harmless, the United States had produced *equipment* that was *designed* to use biological agents for *hostile* purposes. In effect, the United States had assembled everything necessary to produce BW short of an actual microorganism capable of causing disease in humans. Thus, the legality of Bacchus under the BWC was at best questionable and certainly hard to square with its text.

Jefferson. Closer to being permissible under the BWC was Project Jefferson. This involved experiments to reproduce the results of Russian research, as published by *Vaccine* in 1997, that had created a vaccine-resistant anthrax strain. The original researchers had inserted genes from *B. cereus* into *B. anthracis*, making strains of the latter highly lethal against hamsters protected with Russia's standard anthrax vaccine.[20, 21] The U.S. officials involved in Project Jefferson were reportedly mindful of the BWC and the need for defensive intent. Accordingly, the project was to produce only small quantities — one gram or less — of transgenic bacteria.[14]

The relevant BWC wording is contained in Article I, paragraph (1). On one interpretation, Project Jefferson had *produced* a biological agent capable of evading a vaccine and was therefore of a *type* which, in *quantities* however small, had no peaceful purpose. However, a more favorable reading of the Convention, and probably a fairer reading, is that the project *re*produced a *type* of biological agent for the *protective* purpose of developing countermeasures against a known threat. By the same reasoning, however, doubt must persist about whether a "peaceful purpose" is behind any military-linked effort to duplicate a genetic manipulation making *B. anthracis*, a pathogen with acknowledged offensive potential, resistant to the countermeasure most likely to be taken against it. On this point of doubt turns the BWC legality of some U.S. biodefense research into genetically modified pathogens.

Genetic engineering of pathogens

Recombinant technology has already brought many benefits to medicine and has great potential to bring more in the future. For example, research to produce an AIDS vaccine has for years looked into splicing genes from the HIV virus into salmonella bacteria. And selected nonpathogenic portions of the HIV and the Ebola virus have been used to test gene therapy against cystic fibrosis.[7] Another example is a new vaccine production method called "reverse genetics" which might enable public-health authorities to respond more rapidly to changing influenza threats. Through genetic engineering, the influenza virus's genome is converted from RNA to DNA, manipulated to remove the genes thought to cause pathogenicity, and converted back to RNA for vaccine production.[22]

From a security perspective, the kind of genetic engineering of most concern is that which makes pathogenic microorganisms more dangerous to humans. On the one hand, the production of an "enhanced" pathogen can serve a genuinely peaceful purpose. A scientist might, for example, set out deliberately to generate a bacterium resistant to a certain class of antibiotics to determine whether it *could* become resistant to that class — at least by the mechanism or mechanisms envisioned. Such information could help guide clinical infectious-disease management in humans, animals, and even plants. On the other hand, genetic engineering might enable a pathogen to defeat the defenses erected by the human immune

system and supplemented by existing medical technologies. In a 1997 publication entitled "Proliferation: Threat and Response," the U.S. Department of Defense suggested that genetic engineering might be employed to produce the following novel agents: otherwise benign microorganisms genetically altered to produce a toxin, venom, or bioregulator; microorganisms resistant to antibiotics, standard vaccines, and therapeutics; microorganisms with enhanced aerosol and environmental stability; and microorganisms immunologically altered to defeat standard identification, detection, and diagnostic methods.[23, 24]

To take one example, monkeypox virus, which is endemic in parts of tropical Africa, is not as virulent as smallpox virus, which is — we assume — closely guarded. But the two have a similar genetic makeup, so similar that protection against the former may be achieved by vaccination against the latter. In theory, the monkeypox virus could be modified to increase its lethality, possibly by splicing in a human gene that regulates immunity, and to decrease its vulnerability to antibodies raised by existing smallpox vaccines.

To address so-called "emerging threats," the U.S. government is sponsoring research into modified biological agents that it believes might be used deliberately. For example, the Department of Defense Chemical and Biological Defense Program (CBDP) is presently engaged in "[s]tudies to elucidate the toxicity and mechanism of action of non-traditional agents, and to determine the effectiveness of current medical countermeasures."[25] Under the category of "Genetically Engineered Threats," the goal of CBDP research is "to assemble and integrate databases of protein domains responsible for lethality, delivery into human cells, evasion of the immune system, and therapeutic resistance."[25] According to the program's 2005 report to Congress, "[t]he direct payoff from the Emerging Threats capability investment is the prevention and/or mitigation of illness or injury following exposure to new, emerging and genetically modified CBW agents."[25] To a more skeptical observer, however, the United States is also acquiring knowledge that could drive an offensive BW program using genetically engineered pathogens to evade medical and pharmaceutical defenses.

The declared policy of the U.S. Department of Defense has clearly changed since 1989 when David Huxsoll, commander of USAMRIID, commented: "It would be absurd for us to create disease-causing organisms just to test therapies we develop."[26] U.S. researchers used to conduct tests in cooperation with the host governments of countries where naturally occurring infectious diseases of BW concern were already claiming victims. Perceived security imperatives and a pre-existing threat to human health clearly overlapped. Similarly, the biological agent Project Jefferson genetically modified to be vaccine-resistant was already described in the open scientific literature. "Enhancing" a pathogen in an unprecedented way is another matter.

Creating a "threat" not known to exist anywhere but in a loyal scientist's imagination is hard to describe as necessary and difficult to reconcile with the BWC. In the United States, though, several novel pathogens have come into existence only because scientists have created them. In 2003, a team of government-sponsored scientists at Saint Louis University repeated a previously published Australian experiment modifying mousepox virus;[27] they intended to develop a pharmacological countermeasure against the modified agent and, working in mice, demonstrated therapeutic efficacy using a combination of antiviral drugs. As mousepox virus was closely related to smallpox virus, this result led to the hypothesis that smallpox virus itself, even if engineered to defeat traditional vaccines, might be controlled in a similar fashion.[28] Later, however, the scientists went further, applying the Australian mousepox virulence-enhancement technique to cowpox virus which, unlike mousepox, infects humans. The rationale was reportedly "[t]o better understand how easy or difficult it would be to apply the same kind of genetic engineering to the human smallpox virus and make it more lethal."[29] Although such work has been justified as "necessary to explore what bioterrorists might do," many scientists have sharply questioned both the utility and the wisdom of enhancing the virulence of pathogens outside a strictly basic-science context.[30, 31]

A major problem with creating previously hypothetical pathogens for threat-assessment purposes is the difficulty of correctly predicting technological innovations by, or simply the technological choices of, bioweaponeers. There is a danger, Jonathan Tucker argues, of falling into the trap of "mirror-imaging" — that is, proceeding on the belief that an adversary would approach a technical problem in exactly the same way as the person doing the analysis.[32] Faced with so many

possible modifications, predesigning specific defenses against single-gene variations makes little sense. Knowing what kind of organismal variation or product a determined adversary would try to make would require extraordinarily accurate intelligence. In such a situation, research could be dictated *ad infinitum* by the overactive imaginations of defense planners.[29] The United States would then be engaged in a BW arms race with itself.

Another problem is that the mere existence of novel agents potentially increases homeland infectious-disease security risks, whether measured in biosafety or biosecurity terms. The accidental leak of a "super virus" from a laboratory could trigger an epidemic or the fear of one, and the risk that novel pathogens and the know-how that created them could be stolen and misused for malicious purposes would be expensive to minimize. Contemplating the way fear of BW attack has already prompted the manipulation of dangerous agents, Tucker has warned of a "self-fulfilling prophecy," in which risky new technologies could leak out to enemies of the very country that created them.[32]

Finally, the significance of genetically modifying pathogens must be judged in terms of international law. The 2005 CBDP report to the U.S. Congress stated that "[w]ork conducted in this area [Emerging Threats and Special Projects] will be guided by all applicable agreements, conventions and treaties and is performed to provide defensive capability only."[25] However, the creation of novel BW agents must presumptively contravene Article I of the BWC, under which member states undertake "never in any circumstances to develop. . .biological agents. . .of types and in quantities that have no justification for prophylactic, protective, or other peaceful purposes." As Susan Wright has argued, "[i]f there is no evidence of a threat posed by, say, a genetically engineered strain of cowpox that attacks the immune system, then there is no reasonable justification for developing such an organism. Arguably, to do so crosses the line between defense and offense."[29]

Issues of legality aside, the creation of a new agent with BW potential might have significance in terms of international power relations. Other countries, suspicious of U.S. intentions, might feel compelled to reproduce "made-in-America" pathogens in order to develop countermeasures. For this reason, Tucker advocates a statement by the U.S. president "renouncing the prospective development of genetically modified microorganisms with increased pathogenicity for threat-assessment purposes and urging all countries to follow suit."[32] Such a statement could have a normative impact comparable to President Richard Nixon's 1969 declaration that the United States would henceforth eschew biological warfare. That declaration did not, of course, make the BWC unnecessary, nor did it prevent the subsequently illegal funding of offensive BW programs in the Soviet Union and several other countries.

A less provocative approach to biodefense against new BW threats would be for researchers to focus on developing broad-spectrum therapeutic and preventive measures that are not agent-specific; this approach, however, differs from research-as-usual in little more than emphasis. More ambitious would be to build an infrastructure for rapidly detecting and countering new biological threats, malicious or otherwise.[32] In 2003, the severe acute respiratory syndrome (SARS) was recognized as distinct from known illnesses, was understood microbiologically, and was made diagnosable by kit test, all in short order.[33]

Yet, for the BW-control community, the SARS lesson was a complex one. The response to SARS was slowed initially by suppression of information, as response to a BW incident might be, but did catch up. Still, the SARS organism had not been designed to evade surveillance. Its dissemination had not been disguised or made unnaturally sudden or multifocally simultaneous. And while international cooperation, after a slow start, had been quick to coalesce, with transparency coming even to the country, China, where cover-up had first been tried, people died and economic interests were damaged in many countries. For biodefense, SARS emergence was a natural experiment. But for biological warfare it was just as surely proof-of-concept.

Transparency and "defensive" BW proliferation

An offensive BW program could easily be disguised as defensive by playing on the dual-use nature of pathogens. One deception might involve the development and production of vaccines, the most common form of which contains an inactivated component of a selected pathogen. Producing doses for thousands of individuals necessarily involves growing a pathogen in large quantities.[4] But the technologies and equipment

required to do so could readily be turned to the mass production of BW agents for offensive purposes. Illustrative was Biopreparat, established by the Soviet Union in 1973, shortly after signing the BWC. To the outside world, this was a state-owned pharmaceutical complex developing vaccines for general use. In fact, Biopreparat was a military-funded program for developing new types of BW.[34] Concealment of illegal production was simplified by technical overlap with legitimate research and development. Conceivably, a BW facility could be located in a city and yet be virtually indistinguishable from other buildings even in a high-resolution satellite image.

In the area of scientific endeavor to address disease-based security threats, a key challenge for the United States is to pursue defenses in ways that do not endanger the norm against deliberately causing disease, as that norm is embodied in the BWC. In written testimony to the U.S. Senate Committee on Foreign Relations in 2001, Nobel laureate Joshua Lederberg argued:

> We have to be careful to behave ourselves fully consistently with abhorrence at the idea of using disease as a weapon. . .A particular dilemma is how to study the BW threats in detail, how to develop vaccines and other countermeasures, without attracting such accusations [of breaching the BWC]. I believe the executive and legislative branches could develop models of entrusted transparency for oversight of such necessary studies, both for assurance to global publics, and to be certain there are no careless projects oblivious to the reputational or physical harm they could inflict on our polity.[35]

The importance of transparency was recognized in 1986 at the Second BWC Review Conference when member states agreed to specific confidence-building measures (CBMs). These were extended and elaborated in 1991 at the Third BWC Review Conference. The CBMs include: exchange of data on research centers and high-containment laboratories; exchange of data on and descriptions of national biological defense programs and associated facilities; declarations on vaccine production facilities; exchange of information on unusual infectious disease outbreaks; encouragement of publication of experimental results and promotion of the use of knowledge; active promotion of scientific contacts through international conferences, symposia, seminars, and other forums for exchange; and declaration of legislation, regulations and other BWC implementation measures.[36]

On the whole, the annual CBM returns of BWC member states have been few in number and of poor quality. For some countries, non-participation in the CBM process might be the result of technical difficulties, insufficient personnel, and limited resources. Other countries, however, might simply be avoiding transparency. In the case of the United States, neither Clear Vision nor Bacchus nor Jefferson was mentioned in CBM declarations before being revealed by journalists in 2001.[37]

If carried out inside a designated "rogue state," projects similar to these would undoubtedly have been viewed by the United States and other Western countries as violating the BWC. Global reactions to Convention-stretching but ostensibly defensive American activities have correspondingly been suspicious. As the British Medical Association acknowledged in 2004, "some countries may not view the West as benign in general and some biotechnology work being carried out in the West as necessarily above suspicion."[38] Worth noting also is the possibility that the former Soviet Union maintained its BW program after signing the BWC in 1972 because it believed the United States intended to do likewise, notwithstanding President Nixon's 1969 renunciation announcement. In his 1999 memoir *Biohazard*, Soviet defector Ken Alibek reflected:

> We didn't believe a word of Nixon's announcement. Even though the massive U.S. biological munitions stockpile was ordered to be destroyed, and some twenty-two hundred researchers and technicians lost their jobs, we thought the Americans were only wrapping a thicker cloak around their activities.[39]

The difficulty of determining BWC compliance lies in the extent to which it comes down to perceptions of a given state's intent. And because intent is difficult to gauge reliably, states naturally err on the side of caution by focusing on the capabilities of potential adversaries. According to a number of authors, allaying BW suspicions therefore requires as much transparency as is consistent with national-security interests.[40, 41, 42, 43] These interests, of course, can always be redefined on short notice to hide whatever governments want to hide, making transparency, short of challenge inspec-

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tions, a famously tricky concept. At the 2002 resumed session of the Fifth BWC Review Conference, a group of NGOs recommended that the results of biodefense activities might need to be kept confidential, but that secrecy concerning the types and locations of such activities should be disavowed.[19] Similarly, Tucker advocates publicly describing defensive BW programs in general terms while omitting technical details. This, he argues, would help to build confidence in U.S. compliance with the BWC without making it easier for adversaries to circumvent planned defenses.[32]

A recent indication that the United States might be moving towards greater transparency is the publication online of its 2004 return on BWC CBMs.[44] However, the U.S. is still better remembered for joining with some other countries to reject in 2001 a proposed device for achieving greater transparency, a "verification" protocol for the BWC that would have featured: (1) declarations by member states of existing BW stockpiles and potentially BW-capable facilities; (2) routine and unannounced visits to declared or suspected BW-relevant sites; and (3) investigations of suspicious disease outbreaks.

Beyond the legal issue of BWC compliance, transparency is also important for strategic reasons. Since the end of the Cold War, and beginning with the Clinton administration, the United States has shifted its focus away from the problem of state-run BW programs and towards concerns about biological attacks perpetrated by individuals and sub-state groups. However, intentional proliferation from orderly states and unintentional proliferation from disorderly states are both still important concerns today. BW proliferation might appear also in defensive guise; the very existence of the U.S. biodefense program might induce other countries to imitation, for at least three reasons.

Firstly, in the eyes of a suspicious adversary, the development of pharmacological defenses might constitute an attempt to acquire protection for a nation's own military forces against a biological agent that the nation intends to use in a BW "first strike." Prior to the 1991 Gulf War, for example, one of the reported reasons why the U.S. military became concerned about the use of *B. anthracis* was the discovery that Iraqi soldiers captured in a covert prewar operation had anti-anthrax serum immunoglobulin titers.[45] Secondly, any close association between defensive BW work and existing military programs could create nervousness in an outside observer. For example, the conduct of classified Biosafety Level Three (BSL-3) biodefense research at the Lawrence Livermore and Los Alamos National Laboratories might cause other countries to be concerned about offensive American intent because these facilities have historically been used for nuclear-weapons development.[46] Thirdly, the risk of BW proliferation could be exacerbated by U.S. threat-assessment projects. In particular, rival nations might be concerned that American exploration of novel BW threats could generate scientific breakthroughs that would put them at a strategic disadvantage.[32] The result could be a BW arms race or, more enduringly and more ambiguously, a biotechnological race with arms implications.

Conclusion

In conducting defensive work on pathogens, so as to reduce the vulnerability of Americans to a biological attack, the United States needs urgently to become more sensitive to how that work may be perceived by others. A particular danger is that current and planned threat-assessment projects could be seen as breaches of the prohibitions contained in Article I of the BWC. And that danger appears more vividly in light of the possibility that the United States has already violated the Convention through similar projects in the past. At stake is the credibility of the United States as an adherent to the rule of international law and as a sincere opponent of deliberately causing disease. Absent credible transparency, the development of offensive capabilities for defensive purposes risks undermining the international norm against BW. This in turn paradoxically risks accelerating BW proliferation. Five years on from the anthrax deaths of 2001, the United States must ensure its countermeasures are not counterproductive.

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