1 Arms Dynamics, the Changing Threat Environment, and the Chemical and Biological Weapons Prohibition Regimes

Introduction

The development and application of military technology over time has taken many different forms. In the area of chemical and biological weapons (CBW), this has manifested itself in the deliberate spread of disease in premodern siege warfare (Wheelis 1999a, 10–16) and the large-scale deployment of chemical warfare agents during World War I enabled partially by the industrial revolution (Robinson 1998; SIPRI 1971a; Martinetz 1995). With the advent of the information age and the dawning of the "biotech century," questions about the relationship between military or dual-use technologies, and the political motives of state and substate actors, arise anew. These questions are especially pertinent because of wider changes in the nature of warfare (discussed in chapter 2 below), the ongoing revolution in the life sciences that opens up to malign interference regulatory systems—such as the nervous and immune systems—in the human body (see Kelle, Nixdorff, and Dando 2006 and chapters 3 and 4 below), and the renewed emphasis on biodefense activities in response to the perceived rise in the threat emanating from potential bioterrorist attacks (see chapter 5 below).

However, these risks are in principle dealt with by the prohibition regimes that were set up in the late 1960s/early 1970s (for biological weapons [BW]) and late 1980s/early 1990s (for chemical weapons [CW]) in order to address the threat stemming from these weapons. The multilateral regimes thus created and revolving around the 1972 Biological and Toxin Weapons Convention

(BWC) and the 1993 Chemical Weapons Convention (CWC),[1] respectively, were unambiguously products of their time. Both Conventions reflected (1) an international consensus on the prohibition of, inter alia, the development, production, and use of CBW; (2) the depth of the provisions contained in the two legal instruments—quite shallow in case of the BWC and considerably more intrusive in the CWC; and (3) the requirements for an international organization to oversee implementation of the treaty provisions by states' parties—none in the BWC and a 500-staff strong Organisation for the Prohibition of Chemical Weapons (OPCW) for the CWC. The underlying consensus on these issues was in turn informed by the state of the art in military technologies, the historical experience of state programs, and the use of CBW over the course of the twentieth century and resultant assessment of the usefulness of continuing to pursue or prohibit biological and chemical weapons, respectively. It is thus useful to reconsider the reasoning on arms dynamics and arms control approaches prevalent at the time as well as their application to CBW.

Following Buzan and Herring (1998) we reject a simple dichotomy of arms racing and non-arms racing and instead apply their concept of a continuum of an arms dynamic (ibid., 79). They use the latter term "to refer to the entire set of pressures that make actors (usually states) both acquire armed forces and change the quantity and quality of the armed forces they already possess" (ibid.). Buzan and Herring continue to explain that "arms racing is reserved for the most extreme manifestations of the arms dynamic, when actors are going flat out or almost flat out in major competitive investments in military capability" (ibid., 80). "Maintenance" of the military status quo in this logic is located at the other end of the spectrum of the arms dynamic. In between the two, the concept of an "arms competition" is located. None of these are immutable states of affairs. Rather, individual policies and relationships between actors can move across this spectrum through arms build-ups or arms build-downs.

Applied to the CBW issue area during the first half of the Cold War for BW and practically all of the Cold War's duration for CW, the numerous BW and CW state-level programs attest to the presence of an arms competition between East and West in this area too. In the biological field, such programs

1. The text of the BWC is available at http://www.opbw.org/convention/documents/btwctext.pdf (accessed 9 October 2011); and the text of the CWC is at http://www.opbw.org/int_inst/sec_docs/CWC-TEXT.pdf (accessed 9 October 2011).

in the United States, the United Kingdom, and other countries up until the late 1960s (van Courtland Moon 2006; Balmer 2006; Lepick 2006; Hart 2006; Pearson 2006) were terminated when under U.S. and Soviet leadership the BWC was negotiated. This multilaterally agreed-upon arms build-down became possible due to several factors: the advent of the nuclear age with a concomitant interest and partial successes in (nuclear) arms control during the 1960s, the Soviet Union's willingness to separate BW and CW negotiations, the limited tactical utility of BW from the perspective of the Nixon administration in the United States, the emergence of a nongovernmental champion of discussions on the prohibition of CBW (in the form of the Pugwash movement), and difficulties in implementing those provisions of the Brussels Treaty of 1954 that prohibited Germany from acquiring inter alia BW (Tucker 2002; Guillemin 2005; Chevrier 2006).

Success in negotiations on BW came at the expense of putting a build-down in the CW area on the back burner. Completion of negotiations for the CWC took another two decades until this treaty was opened for signature in January 1993. This does not come as a complete surprise given the degree to which already in the latter stages of World War I CW "were being integrated into the prevailing doctrine, organisation and day-to-day routines of armed forces. They were now . . . caught up in that process of 'assimilation' which is discernible in the history of most technologies, civil as well as military" (Robinson 1989, 112). Robinson points out that despite the nonuse of CW during World War II, three major technological changes—the discovery of nerve gases, the advent of aerobiology, and the discovery of antiplant CW agents—resulted in significant institutional consequences insofar as they led to the survival of "chemical warfare bureaux . . . within military bureaucracies" (ibid., 116). These, in turn, "have shaped the situation of chemical warfare in the 1980s" (ibid.). This situation was characterized by a renewed interest in CW as a deterrent of offensive CW use by the Soviet Union and its allies. In the context of the general arms build-up under the Reagan administration in the first half of the 1980s, plans to develop and produce binary chemical weapons were revived in the United States (Adams 1990, 152ff.). In addition to the binary CW program, in 1986 "the Pentagon requested a further $12 million to begin research on 'novel lethal and incapacitating compounds,' and was reported to be developing 'a master plan for future development of retaliatory systems' to incorporate greater range, accuracy and stand-off capabilities" (ibid., 165).

This not only provides another illustration of the assimilated character of CW in United States (and other) military doctrines but also puts a finger on the issue of research for defensive purposes. Considering the BWC, Adams rightly points out that this treaty does not prohibit research into biological warfare agents (ibid.) and that, according to the U.S. defense establishment, testing of BW agents "must involve not only agents known to exist in the current Soviet stockpile, but also those which might be produced in the future" (ibid. 1990, 165). Moving on to more recent debates, it appears that the logic of the argument put forward by proponents of a strong biodefense effort has not changed much—apart from the shift in the nature of the opponent and the much greater urgency with which biodefense and biopreparedness policies are being pursued in the United States and elsewhere.

Evolution of the Threat Spectrum

Along this line of reasoning, recent warnings have made it clear that we could well face an increasing range of different biological agents being used for hostile terrorist and warfare purposes in the coming decades. George Poste (2000), for example, has emphasized the need to think "beyond bugs." More generally, Mathew Meselson has argued convincingly that as the century progresses, more and more of life's fundamental processes will become open to both benign and malign manipulation:

> During the century ahead, as our ability to modify fundamental life processes continues its rapid advance, we will be able not only to devise additional ways to destroy life but will also become able to manipulate it—including the processes of cognition, development, reproduction, and inheritance. . . . Therein could lie unprecedented opportunities for violence, coercion, repression, or subjugation. . . . We appear to be approaching a crossroads—a time that will test whether biotechnology, like all major predecessor technologies, will come to be intensively exploited for hostile purposes or whether instead our species will find the collective wisdom to take a different course. (Meselson 2000, 16)

A report provided by three U.S. defense analysts (Petro, Plasse, and McNulty 2003) sets a framework for thinking about future trends in this context. These authors consider the evolution of biological warfare agents in three phases (see fig. 1.1). The first phase includes what is referred to as "traditional biological weapons agents." They are the naturally occurring organisms or their toxic products, which have intrinsic properties that determine their suitability for biological warfare, such as infectivity, lethality, time to effect, and environmental stability. Petro and coauthors contend that although the threat posed by traditional agents has been increasing since the early twentieth century, it will eventually level off because of (1) the development of medical countermeasures such as antibiotics, antiviral drugs, antitoxins, and vaccines; and (2) the fact that there is only a limited number of these agents that meet the requirements to be suitable for biological warfare.

The second phase in the evolution of biological agents encompasses genetically modified traditional agents. The first successful genetic engineering experiment, in which plasmid genes from one bacterium (*Staphylococcus aureus*) were transferred to and expressed in another unrelated bacterium (*Escherichia coli*), was carried out shortly after the conclusion of the BWC in 1972 (Chang and Cohen 1974). It was quite apparent a few years later that this new development was perceived as a potential threat to biological weapons control (Wade 1980; Budianski 1982). Petro and coauthors argue that, like traditional agents, the threat posed by genetically modified traditional agents will also eventually plateau because "only a finite number of properties and genetic modifications can be used to enhance a traditional agent without altering it beyond recognition" (Petro, Plasse, and McNulty 2003, 162).

The third phase involves what has been called "advanced biological warfare (ABW) agents" by these authors. The hallmark of the developments in science and technology over the past three decades is the explosive nature of the accumulation of knowledge concerning molecular mechanisms and functions of biological systems. While this knowledge is essential for countering disease more effectively and promoting public health security in general, it can at the same time be malignly misused for waging biological warfare. Indeed, as the process described by Meselson continues through the century, an ever-increasing number of targets will become available for which specific ABW agents may be designed in a systems approach to creating novel biochemical weapons that would be able to attack vitally important bodily functions such as respiration, blood pressure, heart rate, body temperature, mood, and consciousness as well as innate and adaptive immune responses. Petro, Plasse, and McNulty have noted that this "capability-based threat posed by ABW agents will continue to expand indefinitely in parallel with advances in biotechnology" (Petro, Plasse, and McNulty 2003, 162). This is

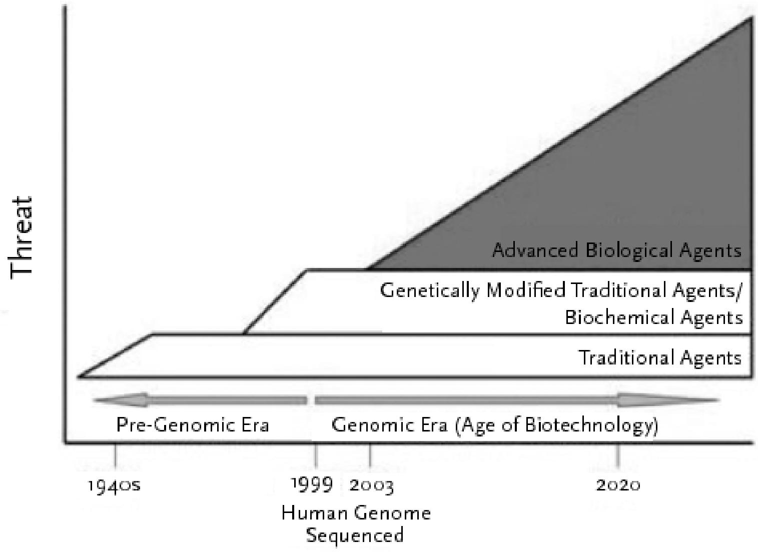

FIGURE 1.1. Timeline describing the three phases of the evolution of potential biological warfare agents and their impact on the biological weapons threat level. SOURCE: Petro, Plasse, and McNulty 2003, modified.

compounded by rapid advances in vector and aerosol technologies designed to deliver an ABW agent to specific targets in a way that will be effective (see chapter 3). Thus, defense will be confronted with the problem of a diffuse and fundamentally unknowable range of agents with the potential of targeting individuals in ways not normally associated with traditional biological weapons. It is important to realize that such ABW agents that can manipulate life processes have the properties of both biological and chemical substances (bioactive chemicals), and they are thus relevant for both chemical and biological weapons control.

To meet the challenge posed by the third stage of development of such agents, Petro, Plasse, and McNulty argue that there is a need for "next generation" approaches to biodefense. In effect, their solution is to increase allocation of biodefense resources that would: (1) permit the evaluation of emerging biotechnologies that might foster ABW agent development, (2) provide for the establishment of a federally funded facility to consolidate and conduct research into biotechnology threat assessments, and (3) promote research into the development of next-generation systems for environmental detection of agents, medical diagnostics, therapeutics, and prophylactics.

These are of course legitimate activities that could contribute to countering present and future threats from biological weapons agents, but is this approach sound enough to really do the job? We do not believe so, for several reasons. In the first place, the solution is too narrow in scope, focusing entirely on biodefense to counter offensive BW programs and not taking into account the need for developing both CW and BW prohibition regimes further to meet these new challenges. These treaties represent the cornerstones of the prohibitions against CBW use. The measure of the effectiveness of an arms control regime to meet immediate and future challenges is embodied in a number of features such as the availability of verification measures and the adaptability of the regime structure to changing circumstances, such as the regime's capacity to adapt to science and technology change (Kelle, Nixdorff, and Dando 2006; Kelle, Nixdorff, and Dando 2008). The slow evolution of the CBW regimes in these respects, which we have outlined elsewhere (see also chapters 7 and 8 below), matched against the explosive developments in science and technology that are relevant for both regimes, underscores the need for further development of these regimes in order to prevent erosion of the norms against CBW.

Secondly, reliance on the development of effective defensive countermeasures is too much of a long-term approach to be useful for immediate and near-future needs. While the development of next-generation countermeasures, such as systems for environmental detection of agents, medical diagnostics, therapeutics, and prophylactics, is surely desirable, the timeline needed to achieve these goals, if they can be achieved at all, is simply too long for immediate or near-future use. This is made especially apparent by reviewing the status of where we are today with regard to the development of such countermeasures directed against traditional agents that belong to just the very first phase of biological agent evolution. In this regard, a recent assessment (Matheny, Mair, and Smith 2008) of U.S. biodefense countermeasures development concerning these agents is particularly revealing. In that report, the authors present a cost/success analysis for development of medical countermeasures that would satisfy the U.S. Department of Health and Human Services (HHS) requirements to protect citizens against biological weapons and bioterrorism, in particular the funds needed for the Biomedical Advanced Research and Development

Authority (BARDA) to see developments through the costly clinical trial process. The analysis involved eight classes of existing countermeasures candidates, including 12 small-molecule drugs, 15 vaccines, and 5 biological therapeutics. Twenty-one of these are in preclinical development, 10 are in phase I clinical trials, and one is in phase II trials. The authors estimated that a huge increase in funds—from the $723 million requested in FY 2009 (for 2009–2015) by President Barack Obama to $14 billion—would be necessary in order for HHS to respond to all of the traditional biological agents designated as material threats. This, however, would by no means guarantee successful production of the required countermeasures, given the high failure rate of biopharmaceutical development. Although others (Klotz and Pearson 2009) have estimated these costs to be somewhat less ($6.3 to $11.6 billion), the fact remains that "drug and vaccine development is a long, high-risk and expensive endeavour" (Matheny, Mair, and Smith 2009), and some voices have questioned whether the threat is great enough to pour these huge sums into the uncertain development of countermeasures directed against these agents (Leitenberg 2005; Enserink and Kaiser 2005; Kahn 2007). Given that the production of vaccines and therapeutics needed to protect against all traditional agents is so uncertain, it is illusory to believe that protective countermeasures of this sort could ever be achieved for the endless array of potential agents that will result from continuing advances in the life sciences.

Finally, the increased biodefense-related activities called for by Petro, Plasse, and McNulty (2003) may actually be viewed as part of the biological weapons proliferation problem itself. For example, the enormous increase in funding for biodefense in the United States after 9/11 and the anthrax attacks that followed (Pearson 2008; Franco and Kirk Sell 2011) has been cause for serious concern among prominent arms control analysts, the greatest concern being that the call for a decided increase in biodefense work with dangerous pathogens would greatly increase the risk of accidents or malign misuse (Ebright 2002; Kahn 2007). Indeed, this approach has been termed "highly problematic . . . because it could undermine the ban on offensive development enshrined in the Biological and Toxin Weapons Convention (BWC) and end up worsening the very dangers that the U.S. government seeks to reduce" (Tucker 2004).

Structure and Content of the Book

We share the concern that the markedly increased biodefense activities, particularly those of the United States, combined with wider changes in the life sciences and the nature of warfare could very well lead to a resurgent interest in chemical and biological weapons capabilities. This could lead to a destabilizing biochemical arms race among major powers and "rogue states" or—much further in the future—substate actors, such as terrorist groups, which will in all likelihood result in offense dominance for most of the twenty-first century. Framed in this way, our approach clearly departs from the currently dominating orthodoxy that puts the threat of bioterrorism at center stage. We reject this as misguided and not borne out by historical evidence of successful bioterrorist attacks. In addition, as demonstrated in subsequent chapters, the nature of the revolution in the life sciences is favoring early adoption of advanced biological warfare agents—to use the term coined by Petro, Plasse, and McNulty (2003)—by states and not by substate actors.

The following four chapters will be devoted to an analysis of the changing nature of warfare, the changing nature of the life sciences, and current large-scale biodefense programs, all with a view to their implications for new utilities of CBW. In doing so, our approach ties in with different bodies of academic and policy-oriented research on both the changes in the life sciences, with implications for the biothreat spectrum, and the changing nature of warfare. With respect to the former, the U.S. National Research Council has conducted two major studies on *Biotechnology Research in an Age of Terrorism* (the so-called Fink Committee Report, National Research Council 2004a) and *Globalization, Biosecurity, and the Future of the Life Sciences* (the so-called Lemon-Relman Committee Report; National Research Council 2006).

In regard to the latter body of scholarship, our approach ties in with an emerging consensus about the changing nature of warfare. Münkler (2005) and Kaldor (2007), for example, have convincingly made this argument. General Rupert Smith (2008) has since substantiated these points with his concept of "wars amongst the peoples," derived from decades of involvement in military planning. Informed by this debate, Robinson (2008a) has highlighted the issue of new utilities for chemical weapons and identified the above-mentioned "wider changes in the nature of warfare" as one of the underlying reasons for possible resurgence in the interest of chemical weapons.

Although our analysis of the evolving threat scenario coincides with the one put forward by the above quoted three U.S. defense analysts (Petro, Plasse, and McNulty 2003), the measures we propose to prevent a biochemical arms race, or to contain its negative consequences should one occur, could not be more different. In contrast to their prescriptions for action, we regard the existing international regime structures revolving around the BWC and CWC as in principle capable of reform and strengthening. Hence, after having analyzed the changing biothreat spectrum and its underlying causes, in chapters 6 to 8 we will analyze these international regimes, their achievements and shortcomings, and the wider web of responses they are part of.

The concluding chapter of the book will return to the course of events suggested by Petro, Plasse, and McNulty (2003) concerning the offense-defense arms race in the biological arena, as this proves useful in focusing attention on those policy options that need to be conceptualized and should be implemented with a view to the 2011 BWC and 2013 CWC Review Conferences. On this basis, we will develop policy proposals that will (1) deal with both the CW and BW prohibition regimes individually and (2) address the perceived political-psychological gap between them. The chapter—and book—will conclude with a consideration of additional measures to strengthen the wider web of responses.