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Biological Weapons: Toward a Threat Reduction Strategy

by Brad Roberts and Michael Moodie

Overview

A decade ago, the U.S. military and its allies had a close call with biological weapons (BW) in the war to expel Iraq from Kuwait. Iraqi BW could have inflicted horrific casualties on coalition forces, but the war stopped short of the contingency for which Iraq had prepared, predeployed, and preauthorized the use of such weapons: a march on Baghdad to remove the regime. A decade later, the United States is again poised for war against Iraq—this time for the explicit purpose of regime removal. Moreover, it is engaged in a war on terrorism against adversaries who evidently are strongly interested in BW. But the close call of a decade ago, and the concern it generated among senior Gulf War military leaders, do not appear to have translated into substantial improvements to the operational capability of current U.S. military forces to project power and prevail against BW-armed adversaries. Despite the efforts of many committed individuals, large vulnerabilities in the U.S. BW defense posture remain. Technology remains in the pipeline and not on the battlefield. Operational concepts seem founded on the assumption that an adversary would not dare use these weapons or, if he did, that U.S. forces could simply operate around them, as if they were chemical weapons.

The present scare seems to have generated even broader high-level concern than did the potential exposure to Iraqi BW 10 years ago. How can this concern be translated into an action agenda that will succeed at reducing present and future threats? How should we understand the risks of BW while the Al Qaeda leadership and anthrax mailer remain at large—and as the prospect of another war against Saddam Husayn looms on the horizon? Our focus here is on the threat of biological weapons to military forces and operations; where appropriate, we sketch out some connections to the BW homeland security challenge.

Why So Little Progress?

The chronic gap between requirements and preparedness apparently is rooted in a set of myths, widely held among U.S. defense planners, about biological weapons (BW).

Myth One: States Lack Interest in Biological Weapons

Conventional wisdom holds that biological weapons historically have been of hardly any interest to nations. Defense planners commonly hold that because BW have never been used, they should focus their time, energy, and resources on more evident problems. What is wrong with this view?

The record of BW use appears to be fairly slim, although allegations of use are in fact quite numerous. Most incidents remain subjects of dispute, not least because the evidence to prove that such weapons have been used is extremely unlikely to fall into the hands of investigators. These difficult-to-prove allegations include the Yellow Rain attacks by the Soviet Union in the 1970s and 1980s. Also, many in Asia believe that the United States used biological weapons in the 1950s in Korea and China—allegations that are unproven and for which considerable contrary evidence exists.

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However slim the record of actual use, the record of interest in and work on biological warfare by states is significant. In World War II, all major powers undertook BW preparations. Those who were defeated were compelled to abandon their BW ambitions, but the victors continued their efforts. During the Cold War, East and West pursued BW techniques. In the 1960s, Britain and France, and then the United States, unilaterally renounced biological warfare and destroyed stockpiles of weapons. The U.S. arsenal at the time consisted of weaponized anthrax and a substantial quantity of nonlethal agents, primarily for the attack of agricultural targets in the Soviet Union and China. The Nixon administration abandoned offensive BW in part to sustain the momentum of détente and asked the Soviet Union to follow suit. The bilateral U.S.-Soviet agreement fostered the multilateral Biological and Toxin Weapons Convention, which entered into force in 1975. Even before the outbreak of anthrax in Sverdlovsk in 1979, however, American experts were convinced that the Soviet Union was violating its treaty undertakings, a view that the outbreak only reinforced.

The past decade has witnessed numerous alarming revelations about the scale, scope, content, and sophistication of BW programs in a number of countries. The first is Iraq, which was compelled to admit (after 4 years of denial) to the United Nations (UN) that it had weaponized three different agents in both missiles and bombs. The nature of Iraqi revelations and the subsequent ejection of UN inspectors have fueled speculation that the admissions were incomplete and that there may be much more to the Iraqi program than is currently known. To date, Saddam Husayn has foregone over $100 billion in oil revenue to protect this BW program.

Another country that has raised BW concerns is South Africa. As hearings of the Truth and Reconciliation Commission revealed, during apartheid the state pursued a covert chemical and biological warfare program with rather novel applications. Chemical and biological weapon techniques were exploited in the hope of altering demographic birth and death rates. Allegedly South Africa also provided BW to those opposing independence movements in neighboring states.

But the revelations about the Soviet/Russian program were the most alarming. In 1992, Russian president Boris Yeltsin confirmed the existence of a long-running illicit BW program. The Soviets apparently had at least four distinct BW development programs. Biopreparat, described in vivid detail by its former deputy director, Ken Alibek, sought to exploit genetic engineering techniques to field weapons that would rain on Western cities after nuclear war to slow national recovery (the purpose of the bioengineering was to reduce the susceptibility of the ensuing diseases to antibiotic treatment). By way of comparison for scale of effort, Biopreparat alone employed more people than the U.S. nuclear weapons complex.

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Also over the last decade, senior intelligence officials have regularly testified in Congressional hearings that biological weapons development programs can be found in all of the states deemed rogues by Washington, including Iraq, Iran, and North Korea. Those officials also regularly express concerns about biological warfare activities in other countries, including China, where the evidence is more ambiguous whether interest and potential translate into extant capability. Further, intelligence officials are careful to point out that, given the extreme difficulty of identifying covert BW research and development (R&D) and storage facilities, the number of states with a BW capability may well be larger.

The prevailing American view that history proves that states are not much interested in BW is sharply at odds with these realities. Perhaps it is simply that America's own abandonment of BW, in combination with the central place of nuclear weapons in our national security strategy, have given us a view of biological weapons that others do not share.

Myth Two: Biological Weapons Have No Military Utility

A second myth is that biological weapons simply do not have much military utility. To be sure, they are *different* from other weapons—but they are far from *useless*.

As tactical weapons, biological weapons are not especially useful; they are not immediate in their effects, and they are vulnerable to meteorological factors that may carry them away or kill them in the air. This has not prevented countries such as Iraq, however, from developing battlefield munitions for BW delivery. This view overlooks the simple fact that biological weapons include toxins—chemical substances produced by living organisms—that, like chemical weapons, are significant in their battlefield utility if delivered in large quantities.

As strategic weapons, biological weapons offer potentially high utility; delivered effectively, they are roughly comparable to nuclear weapons in their mass destruction potential. For states desiring strategic capabilities but not willing or able to acquire nuclear weapons, biological weapons may seem a viable substitute. A country possessing nuclear weapons might find biological weapons redundant, which is part of the reason that the United States abandoned them. Yet almost all those states identified as rogues are deemed to be pursuing both biological and nuclear weapons. The debate in the United States about whether a nuclear or biological weapon is more powerful misses the point that, for a rogue state capable of acquiring at most a handful of fission-style nuclear weapons, the killing power of the available BW arsenal would far outstrip that of the available nuclear arsenal.

How might U.S. adversaries think about the military utility of biological weapons in asymmetric conflicts against the United States? In a major theater war, a U.S. adversary will have framed a number of strategic objectives, which will vary with the phase of conflict. Early in war, that adversary may seek to achieve a local fait accompli and then dissuade coalition formation or deter an existing coalition from acting. Failing this, that adversary might seek to cripple U.S. power projection and defeat coalition military actions. If unsuccessful in the effort, that adversary might try to prevent a battlefield defeat from becoming strategic defeat (in other words, to

secure regime survival in the endgame). If Saddam Husayn's behavior over the last decade is any guide, a postwar phase will also include objectives to exact revenge against enemies and prevent a consolidation of regional forces detrimental to regime interests.

In service of these objectives, a regional power would have multiple tools: conventional weapons, conventionally tipped ballistic missiles, and perhaps nuclear, biological, and chemical weapons. The aggressor may see biological weapons as more certain than chemical and conventional weapons in achieving the desired result and as less risky to threaten and use than nuclear weapons. Hence the argument of many experts that biological weapons may be the weapon of choice of U.S. adversaries in asymmetric warfare. Especially for an adversary that hopes to cause economic crisis in America, cripple American society, or collapse American power and will, biological weapons may seem particularly appealing, given the possibility of using them covertly and escaping before their ruinous effects take hold.

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Technological advances may be enhancing the utility of biological weapons as an asymmetric adversary may perceive them. As the Biopreparat experience suggests, modern technologies can be exploited to improve the specificity, viability, durability, producibility, and storability of biological weapons. Moreover, a revolution is under way in the associated science and technology for biological warfare. If modern molecular biology (for example, genetic engineering) has been exploited for warfare purposes, it is not yet publicly known. But one cannot ignore the fact that, historically, BW programs have always sought to exploit the best science available at the time.

Myth Three: The Problem Is Too Hard to Solve

A third myth that has cluttered the landscape for the military planner is the view that the BW problem is simply too hard to solve. In the face of an almost limitless number of vulnerabilities, the apocalyptic use of biological weapons would indeed appear too difficult to solve by the traditional means of protection and defense, hence the heavy reliance on deterrence in the overall U.S. posture. But if the threat of the future is not so much apocalyptic as asymmetric, then the issue is what to do other than rely on deterrence to reduce threats and manage risks.

As the flurry of activity since September 11 suggests, a great deal can be done. Vaccines, masks, physical protection of facilities, and forensic capabilities, among many other factors, have been shown to play a part in protection. (The elements of a more robust biodefense strategy are elaborated in the second half of this paper.) From a military planner's perspective, the key question is whether capabilities can be created that would enable U.S. forces to project and prevail against a bold adversary willing to run large risks and able to employ sophisticated BW capabilities for theater-strategic purposes. In our assessment, such a capability is within U.S. reach. But it will not be attained if the rather lethargic pace of evolutionary improvements evident over the last decade is maintained. Something more revolutionary is necessary.

Myth Four? Terrorists Want Weapons of Mass Destruction

Until September 11, terrorists had rarely engaged in massively destructive attacks and had made almost no use of weapons of mass destruction (WMD). Today, most Americans are convinced that terrorists have both the will to use WMD and the technical sophistication to do so in a way that reaps their full mass casualty potential. We are skeptical on both points, at least regarding nonstate actors across the board.

The technical argument is an important one. In the BW domain, a terrorist seeking mass casualties must be capable of more than simply growing materials that sicken people. That material must be kept alive; the strain must be lethal to humans; the agent has to be disseminated in an aerosol with proper particle size. The attacker must have some understanding of the technical parameters of the target and of meteorological factors. The attacker must also have confidence in the possibility of escape after the attack. This is not a small skill set. Moreover, if state BW programs are any guide, the development of such skills requires extensive trial and error—not always the forté of terrorist organizations.

The argument about terrorist motivation is also important. Terrorists generally have not killed as many as they have been capable of killing. This restraint seems to derive from an understanding of mass casualty attacks as both unnecessary and counterproductive. They are unnecessary because terrorists, by and large, have succeeded by conventional means. Also, they are counterproductive because they might alienate key constituencies, whether among the public, state sponsors, or the terrorist leadership group. In Brian Jenkins' famous words, terrorists want a lot of people watching, not a lot of people dead. Others have argued that the lack of mass casualty terrorism and effective exploitation of BW has been more a matter of accident and good fortune than capability or intent. Adherents of this view, including former Secretary of Defense William Cohen, argue that "it's not a matter of if but when."

The attacks of September 11 would seem to settle the debate about whether terrorists have both the motivation and sophistication to exploit weapons of mass destruction for their full lethal effect. After all, those were terrorist attacks of unprecedented sophistication that seemed clearly aimed at achieving mass casualties—had the World Trade Center towers collapsed as the 1993 bombers had intended, perhaps as many as 150,000 would have died. Moreover, Osama bin Laden's constituency would appear to be not the "Arab street" or some other political entity but his god. And terrorists answerable only to their deity have proven historically to be among the most lethal.

But this debate cannot be considered settled. Bin Laden and his followers could have killed many more on September 11 if killing as many as possible had been their primary objective. They now face

the core dilemma of asymmetric warfare: how to escalate without creating new interests for the stronger power and thus the incentive to exploit its power potential more fully. Asymmetric adversaries want their stronger enemies fearful, not fully engaged—militarily or otherwise. They seek to win by preventing the stronger partner from exploiting its full potential. To kill millions in America with biological or other weapons would only commit the United States—and much of the rest of the international community—to the annihilation of the perpetrators.

The Threat: From Apocalyptic to Asymmetric

So what then is the BW threat? Let us think in both the short and long term. In the unfolding war on international terrorism, the short-term BW threat from Al Qaeda depends on its objectives in the next phase. Does it envision the collapse of the American economy, society, and power, and if so, does it believe that it can inflict biological attacks on America and still achieve its own goals? Does it perceive certain risks to its objectives of *killing too many*? These questions provoke much speculation but no clear answers.

In this short-term assessment, the BW threat from state adversaries is also an unresolved question. Almost all the states with which the United States might find itself at war are suspected of possessing biological weapons. Iraq, for example, may see no alternative but to exploit such weapons in asymmetric strategies as a way to escape conflict with a conventionally superior United States. Rogue state leaders may believe that U.S. military power will be spread thin in such an evolving and unfolding war—and thus see an incentive to strike while the United States is overextended.

The wildcard in this assessment is the opportunist, for whom biological weapons may have a special attraction. The ability to produce and use them surreptitiously makes them appealing to those waging prolonged covert warfare. This is especially so if the perpetrator seeks a form of strategic misdirection—to lead others to the conclusion that the attack was perpetrated by some entity that the actual perpetrator would like to see punished. There are many potential opportunists in the current conflict, those who would see a spasm of American military reprisal as somehow in their interest, or those who would like to alter the course of the current conflict by drawing in new actors.

In the longer term, what is the threat beyond the current conflict? The current state of U.S. knowledge tells us that:

- almost any potential U.S. military adversary either has biological weapons or has a program to get them
- biological weapons are of rising interest to nonstate actors
- terrorists are mimics, meaning that hoaxes and limited lethality anthrax attacks are quite likely to be replicated
- technology is changing rapidly and also diffusing, offering more and more state and nonstate actors the means to exploit biological processes for military ends.

What we do not know is how the current conflict will shape long-term possibilities. If we have seen the last of biological weapons in the current conflict, it seems reasonable to hope that future adversary interest in exploiting such means in war against the United States will remain limited. But if such weapons are used to good effect by Al Qaeda, its supporters, or others, then some could draw the conclusion that such weapons have high utility—thus foreshadowing their broader proliferation and use. In other words, if such weapons are used to coerce or defeat U.S. military forces, the Nation will have an overriding interest in demonstrating to one and all, state and nonstate alike, that the use of such weapons cannot be tolerated and will invoke the sternest possible reply, not just from the United States, but the international community as a whole. This is a high stakes game.

From Threat- to Capabilities-based Planning

This problem fits well into the framework of capabilities-based planning recently elaborated in the Quadrennial Defense Review (QDR) 2001. In our view, the case is strong that biological weapons are in the hands of adversaries developing asymmetric strategies to counter U.S. military power. But we cannot make a specific assessment of where, when, how, and why biological weapons will be used—or by whom. This lack of specificity has been one of the primary obstacles to more effective defense planning. The services have not known how to translate uncertainty about the precise capabilities and motives of potential U.S. adversaries into operationally clear pictures of consequences and requirements.

Describing a world in which specific U.S. adversaries cannot be confidently predicted, the QDR calls for a shift in planning focus from threats to capabilities—from the Cold War picture of an adversary's order of battle to a focus on the kinds of capabilities that the U.S. military should be able to field against any adversary. Risk-based approaches can also be instructive, as they draw on projections of the likelihood of certain types of attacks and their potential operational consequences to frame a comprehensive "threat envelope."

The Response: A Threat Reduction Strategy

How can we best ensure that our resources are used more effectively in the coming decade to reduce the BW threat? What are the essential ingredients of a BW threat-reduction strategy?

Any strategy must begin with a clear objective. In the long term, the goal should be to create a threat environment in which the number of adversaries prepared to wage biological warfare is few rather than many and their capabilities to do so are limited rather than robust. This requires inhibiting the emergence of new threats driven by the biotechnology revolution. The short-term goal over the next 5 years should be to reduce existing vulnerabilities by redressing capability shortfalls and eliminating foreign state and nonstate capabilities whenever possible.

Any strategy must also have a comprehensive picture of the applicable policy tools and the means to exploit them for synergistic effect. The BW domain has multiple tools of long-term threat reduction: military preparedness, intelligence support, counterterrorism, Cooperative Threat Reduction, diplomacy, and export controls. In the short term, the essential tools are in the military domain, which is the focus of the remainder of this paper. The essential components of military capability can be summarized by the following schematic:

Strategic Response to the BW Challenge

Deterrence ➡ Prevention ➡ Defense ➡ Consequence Management

Deterrence

People in the defense community generally know what deterrence means and hope that it operates to prevent the use of biological weapons. But as the record of the last decade suggests, actually translating deterrence concepts into the new operational setting and bringing into being the capabilities suited to that new setting have proven difficult.

In the Cold War, deterrence played a central role in preventing a U.S.-Soviet nuclear exchange as well as conventional conflict in Europe. Today, the demands on deterrence are more complicated. The United States faces not one but many potential adversaries armed with WMD, both state and nonstate, each with its own value structure and strategic personality. The goal of deterrence is not only preventing war or the use of BW in war but also preventing the acquisition of biological weapons and their transfer to others. BW deterrence is actually a multilayered problem: the challenge of deterring first use differs from the challenges of deterring follow-on use and last-resort use.

There are various additional challenges. Nuclear threats seem relevant to the deterrence of some uses of BW—those of an apocalyptic or massively destructive character. But as a deterrent of BW uses of substantially less lethal effect, the credibility of nuclear threats is greatly debated. The perception of those threats by others makes their deterrent effect a success or failure. Effective deterrence also requires clear communication strategies; the wide range of actors whose decisions the United States would seek to influence complicates the formulation of a single credible deterrence message. Deterrence also requires that its target seeks to avoid the costs of punishment; U.S. commanders need to be aware that in asymmetric conflicts, adversaries may be baiting them into uses of force that might be seen on the world stage as excessive, thus discrediting the United States politically.

U.S. friends and allies wonder what risks Washington will be willing to run to defend its interests in a confrontation with a WMD-armed regional adversary

For these reasons, deterrence cannot play the same central role in managing the asymmetric BW threat that it played in managing the apocalyptic Soviet threat. This does not make it irrelevant, just different. Deterrence by threat of punishment can be expected to play some continuing role. To the extent the United States brings into being the kinds of conventional military capabilities that allow it to achieve strategic effects without nuclear attacks, such threats ought to gain in credibility. But deterrence by denial of the adversary ability to achieve the intended operational and strategic effect of using WMD must play a more important role than before. Deterrence by denial requires some of the robust capabilities described below.

An unchanged element of the deterrence problem is the challenge of extending deterrence so that friends and allies share in credible protection. Today, many U.S. friends and allies are in regions that are also home to BW proliferation. The questions about credibility that dogged extended deterrence during the Cold War still fester today. U.S. friends and allies wonder what risks Washington will be willing to run to defend its interests in a confrontation with a WMD-armed regional adversary who is willing and able to project punishment into the American sanctuary. People in Washington wonder how long those friends and allies will support U.S. war objectives if the burden of punishment they are asked to bear is disproportionate to that of the United States. What do U.S. friends and allies consider essential to credible deterrence? Shared ballistic missile protection may help answer some of these questions, but the debate about BW as an anticoalition weapon probably has only just begun.

Prevention

When deterrence strategies prove unreliable in dissuading a U.S. adversary from preparing or conducting BW attacks on its forces or interests, the focus of U.S. efforts must shift to prevention. Here, too, there are no easy solutions.

In its most blunt form, prevention equates with preemption. Effective counterforce is a complex mission. It requires the ability to locate weapons storage and production facilities, to characterize those targets in ways that permit effective attack, to deliver munitions through hardened protection, and to predict and minimize the collateral damage such attacks might generate in the release of toxic and infectious agents. Since the Persian Gulf War, headway has been made in developing these capabilities. But two important potential Achilles' heels remain.

One is the rush by BW adversaries to dig tunnels and place militarily sensitive capabilities in hard and deeply buried facilities. The effectiveness of the U.S. air campaigns in the Persian Gulf and subsequent military actions has only accelerated the effort to hide underground. Doubts are growing that conventional ordnance can reliably cripple or destroy some of these facilities. This fuels an interest in maintaining or creating an improved capability to deliver nuclear weapons against these targets—a matter of intense debate, given disputes over the deterrent efficacy of such capabilities and the proliferation consequences of such attacks.

The other potential weakness is targeting intelligence. A counterforce attack capability depends above all on knowing the location of the target. But reliable and timely information about the location of production, storage, and deployment sites is difficult to come by through national technical means. There is, therefore, a strong need to improve BW-related intelligence, especially human intelligence. Equally important is better BW-related analysis that relies on a deeper scientific base within the intelligence community than currently exists.

Improving intelligence will also bolster efforts to preempt BW use by terrorists. Together with law enforcement, intelligence remains the key means for penetrating terrorist organizations and stopping them before they act. In the face of the global transnational terrorist challenge, reinvigorated law enforcement and intelligence efforts must involve a substantial international dimension.

But such cooperation often touches on highly sensitive areas, making governments—including the United States—reluctant to share information with their counterparts, even in the North Atlantic Treaty Organization. In the short term, the September 11 attacks appear to have generated a new willingness to cooperate internationally. A successful long-term BW threat reduction strategy requires that this cooperation be sustained when and if the Al Qaeda threat recedes.

In the longer term, a more comprehensive threat reduction strategy would complement these counterforce and intelligence tools of prevention with additional tools. They include, for example, export controls (which can inhibit access to the necessary technologies and materials that are essentially dual-use in nature) and international efforts aimed at promoting domestic criminalization of activities inconsistent with international treaty undertakings (that is, it should not be legal for individuals to produce biological weapons when it is illegal for states to do so).

Defense

For most members of the U.S. military, BW defense equates simply with passive defense—a good protective mask. This is far too simple a view of the requirements of effective defense.

Passive defenses are certainly central. The mission-oriented protective posture (MOPP) gear designed for combat in a chemically contaminated environment provides protection to military personnel against BW agents as well. The burdensome effects of MOPP (such as heat prostration) are excessive, however, given that defense against most BW threats can be provided with a far lighter mask and little or no body protection. Beyond individual protection gear, there is also collective protection—inflatable command posts or field hospitals as well as citadels in some naval vessels, for example. In the last decade, progress has been made in equipping the services with improved passive defenses, though doubts remain about the actual ability of U.S. forces to sustain combat operations even with such defenses.

Passive defenses depend on sensors to warn personnel that an attack is under way or has occurred. Such sensors are well developed for chemical warfare but remain in their infancy in the biological domain. Chemical sensors allow a military unit to have some advance warning of an attack and to prepare accordingly; in contrast, biological sensors provide notice of an attack in progress so that treatment protocols can be initiated. There is no capacity as yet to provide advance warning. Chemical sensors are widely deployed with U.S. combat forces; biological sensors are deployed in tiny numbers. Chemical sensors can warn of a broad range of likely and possible agents; biological sensors cover only a handful. With an eye toward gaining improved BW sensor capability, both military and civilian entities have spent a lot of R&D money. But these efforts have not yet produced a substantial change in U.S. capability, or even a clear picture of when and how new capabilities will actually reach the field. In the absence of such a sensor system, the real ability to detect a BW attack lodges in the military medical system, where the first signs of an attack will manifest as unfamiliar symptoms in the physician's office.

Active defenses also play a role in the BW defense posture. These encompass the means to attack delivery systems so that biological weapons do not actually reach their targets. The air defense capabilities of U.S. forces remain strong. Ballistic missile defense capabilities remain weak, and, despite the national consensus to push for deployment of improved theater missile defenses after the Persian Gulf War, little has changed in the operational capabilities of U.S. power projection forces. Cruise missiles—which are proliferating widely—make ideal delivery vehicles for biological agents, but as yet little attention has been given to defending against them. Even if active defenses cannot eliminate all incoming delivery vehicles, they make a significant contribution to management of the BW threat by thinning the arriving threat, thus enabling passive defenses to operate at lower performance levels, reducing the footprint of attacked areas, and easing the burden on the military medical system.

Another component of the defense tool kit is medical protection. The most effective form of medical defense is vaccination, which can practically eliminate the threat posed by specific threat agents. Vaccination against anthrax initially occurred in the Persian Gulf War. Suspended after the war, anthrax vaccination of the broader force resumed after a hard-fought debate about the benefits and risks of broad inoculation. Doubts about the wisdom of inoculation were fueled both by concerns about the safety of the vaccine itself and the emergence of Gulf War syndrome, as well as allegations of a Pentagon coverup of the exposure of U.S. forces in the war to low-level chemical weapons contamination. The vaccination program was then suspended after production problems occurred. If this unhappy story about one commercially proven vaccine is any harbinger, the effort to develop additional vaccines to cover the full range of known and potential threat agents may take decades.

A final component of defense relates to the force protection mission: the protection of U.S. military bases, operations, and personnel from attack by unconventional, covert means. Especially since the attacks on Khobar Towers in Saudi Arabia and the USS *Cole* in Yemen, the U.S. military has been seized with the need to provide effective force protection in noncombat situations. Force protection against BW attack has remained, however, a relatively low priority.

Many of these capabilities have applications in the civilian realm as well, especially medical therapeutics and sensors. But here, too, the challenges are only beginning to come into focus. Should a national vaccine program against smallpox be established? What amount of vaccine and other medicines should be maintained in the National Pharmaceutical Stockpile? What access will the military have to that stockpile, if any? How much of a surge production capability for vaccines should be maintained in the commercial base, and what, if anything, should the military pay to maintain that production base?

Consequence Management

When deterrence, prevention, and defense fail, the focus necessarily shifts to the challenges of coping with the consequences of a biological attack. If military operations are under way, the overriding goal must be to sustain campaign operations and accomplish mission objectives on ground, at sea, or in the air. Over the last decade, recognition has grown of the need for improved consequence management

capabilities. But the focus generally has been on managing the consequences of a chemical attack, leaving the biological attack as a lesser-included challenge. It is not. The challenges of managing a biological attack are entirely different from those of a chemical attack.

Effective BW consequence management requires first and foremost a capability to identify and diagnose an attack rapidly. This is a medical problem posing multiple requirements. Health experts across the theater must be able to share information on military health demographics in real-time or near-real-time. Physicians must be trained to identify diseases that would not normally be expected in theater. The medical system must deliver the early therapeutics that can make a difference in saving lives, such as antibiotics in large quantities, as well as vaccines. In the case of contagious diseases, some capacity must exist for isolating victims. Preparations must also be made for long-term care of the disabled and disposal of remains that meets both sanitary and socioreligious requirements. The military personnel system also must be geared to replace casualties on an individual or unit basis so that operations can be maintained.

the key to an effective civilian response to a biological attack is a robust public health system

In the last decade, some progress has been made in coming to terms with these challenges. But external studies continue to suggest that the military medical system is poorly prepared for anything but the most limited possible adversary uses of biological weapons. Large-scale use could well cripple existing capabilities—and the overall fight—if the military medical system collapses.

Again, there are civilian analogues and synergies to be reaped in the development of strengthened consequence management capabilities in the civilian and military realms. The key to an effective civilian response to a biological attack is a robust public health system. At issue for the military is its proper support to and integration with a homeland defense BW posture. In managing the consequences of a limited domestic BW attack, it has little role to play, except as a source of expertise on agents and treatment protocols. After all, the first responders to a terrorist BW attack are likely to be physicians and associated medical professionals in the private and public healthcare systems. In managing the consequences of a larger attack on society, the military may have law enforcement and mass treatment responsibilities in conjunction with a declaration of martial law by the President. Calibrating the scope and content of military support to the BW homeland defense mission is an entirely separate challenge from calibrating military support to other homeland defense missions, given the unique characteristics of BW and their consequences for national security.

Progress versus Success

This analysis suggests that some progress has been made. Some tailoring of deterrence strategies has occurred for the new problem of asymmetric warfare. Improved counterforce attack capabilities have begun to reach the forces. Fielding of new and improved passive and active defenses and limited progress on vaccines have improved the capacity to defend against BW attacks. Consequence management techniques have received increasing attention that is reflected in greater interest and funding.

But success still seems a long way off. To be sure, success may be in hand if an aggressor's use of BW is extremely limited and meant more to scare than harm. And success against an adversary willing to use BW to kill millions cannot be achieved through a strategy of protection and defense; we will have to continue to bet on deterrence. But what does success between these two extremes require—success in terms of meeting the challenges of an adversary willing to use biological weapons in large quantities in campaign-style attacks for military goals? Success against such an adversary requires more than the modest incremental improvements above.

In the consequence management realm, success requires a robust medical response capability scaled and equipped to meet the challenge of the larger threat.

In the defense realm, success requires broad-based medical protection against a spectrum of agents, sensors capable of rapid detection at a distance, and passive protection gear suited to the specific requirements of BW.

In the prevention realm, success requires counterforce attack assets capable of defeating the BW agent being attacked (so-called agent-defeat weapons) and improved human intelligence.

In the deterrence realm, success requires reducing reliance on nuclear threats for BW attacks when nuclear responses clearly would not be credible, through increasing reliance on conventional strategic capabilities and improved defenses.

The Role of Science and Technology

Science and technology (S&T) play a critical role in meeting these challenges. Indeed, the services and regional military commands have generally looked to the acquisition pipeline, believing that eventually the silver bullet will emerge that allows them to plan and prosecute wars against BW-armed adversaries as if the BW threat simply did not exist. They want a technical fix so that they can go about business as usual. The problem is that technology cannot provide this fix. It is essential to the solution, but it is not *the* solution.

The closest we might ever get to a silver bullet is in the world of vaccines. The anthrax vaccine is indeed a full remedy to the anthrax threat. In fact, a fully vaccinated force could likely suffer an anthrax attack without any noticeable impact on operations. Because anthrax is considered one of the premier BW agents, eliminating it as a threat would pay enormous dividends. But the known BW threat agents are numerous, and the number of *potential* threat agents is even larger. A plan has been put in place to deliver vaccines against an increasing number of threat agents. Even if vaccine development is fully successful, the process of gaining approval to produce and deliver such vaccines could take at least a decade or two. The current Food and Drug Administration approval process adds years to bringing a new vaccine to market; even a revised regulatory process would not eliminate the time required for sufficient health and safety reviews. Developing specific vaccines for every possible

BW agent is, therefore, an impossible job, hence the rising interest in broad-spectrum protection for which some technological promise exists. But whether such full-spectrum vaccine protection will ever be achieved against all known or plausible threat agents is unknown.

Technological breakthroughs elsewhere in the medical S&T world can also pay important dividends. Medical diagnostics and other pharmaceutical treatments promise improved performance of the medical system. But the real problems confronting the military medical system appear not so much in the S&T realm as elsewhere. The monitoring of disease outbreaks appears as poorly developed on the military as on the civilian side. Medical training for biological warfare remains deficient, though improved over that of a decade ago. Service readiness for BW-specific contingencies appears uneven but generally low. There is little evidence that the service components or the regional commands have integrated the requirements of a severely taxed military medical system into their plans.

Technological breakthroughs on the nonmedical side can also be expected to pay important dividends. Sensors will gain in sensitivity and specificity. Nonnuclear agent-defeat weapons will be fielded. Improved capabilities to attack missiles, both ballistic and cruise, are beginning to reach the field, with dramatic improvements expected at the theater level. In these areas, however, as so often elsewhere in the S&T realm, the search for the perfect solution has sometimes been the enemy of finding an adequate solution. For example, the sensor technology that seems likely to reach fruition in a decade or so promises dramatic improvements in the ability of U.S. forces to detect BW attack. But for today's military commander, the key question is why some remedial capabilities have only barely begun to reach the field a decade after the Persian Gulf War. Moreover, here, as in the medical realm, the solutions are as much operational as technical. Having new capabilities in place will require new concepts of operations and the training to back them. Biosensors, for example, do not stand alone; they are part of a larger system that must be able to reach back to remote expertise, transport samples to laboratories for diagnosis, and enable the on-site commander to manage risks through informed decisionmaking. As yet, little attention apparently has been given to identifying the decisions that will have to be made or the information necessary to make them.

To secure the potential benefits of improved science and technology, a much stronger public-private partnership is needed. In the Cold War, U.S. defense industries played a critical role in developing national security technology. Until September 11, the biotechnology and pharmaceutical industries wanted as little as possible to do with preparations against biowarfare and bioterrorism. The Nation cannot afford them to be bystanders in an era of BW vulnerability. Opportunities abound to work together to meet both military and civilian needs.

Longer-Term Perspective

This agenda addresses what the United States can do now in the military realm to strengthen its capacity to deter, prevent, defend against, and manage the consequences of BW attacks. But planners and policymakers should recognize that this is a national strategy for what is an international problem. A national response alone is unlikely to produce sufficient dividends against a problem that is so complex and multifaceted, one that plagues virtually every region of the world. If, somehow, the *wrong* response is made and biological weapons come to be seen as useful and legitimate instruments of military power and political coercion, everyone will pay a price.

Approaching this problem in a more global perspective means first thinking about opportunities. Stronger international partnerships can pay dividends in the S&T realm, for example, given the advanced biotechnological capabilities of U.S. friends and allies. Some of those allies have also done their own planning for managing bioterrorism attacks, and sharing "lessons learned" would benefit all who participate.

In taking a global approach, however, a central question for Washington is how to build and lead a long-term global effort to reduce BW threats. The United States needs the help of allies in constraining adversary access to BW-relevant technologies, material, and expertise. It needs them to strengthen their own defenses against BW attack so that they can remain partnered with the United States when power must be projected. Their continued commitment to the norm against biological weapons is necessary, not least so that a U.S. decision in extremis to punish norm violators meets with broad international support instead of resounding criticism.

So long as Al Qaeda and its supporters continue to attempt terrorist attacks on the United States and other countries, the will to cooperate should remain sufficient to pay short-term dividends. But over the long term, will other countries support the web of military, political, and economic measures the United States promotes? A common international perception of the U.S. anti-BW agenda is that Washington emphasizes military preparedness at the expense of political and economic tools. It seems to be sending the message to "do it our way, or it won't happen." Washington, therefore, must do a better job convincing its partners that its anti-BW strategy encompasses all available policy instruments, each suited to a specific task. Both a national and an international agenda are essential to reducing the short- and long-term BW threat. We will close on success in the anti-BW effort only if we work diligently down both tracks.

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