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Coping with Biological Terrorism

Robert H. Kupperman and
David M. Smith

To say that the United States is at a crossroads is simply to reiterate a truism that has become stale with repetition. But it has become increasingly less difficult to imagine a world in which the United States has lost its military capabilities to respond to new and unconventional threats from the next generation of international mavericks who will—make no mistake—follow in the footsteps of Qadhafi, Saddam Hussein, and Hafiz al-Asad. Americans are clearly in a different ball game, one that they ill understand.

On the security front, the United States is virtually unprepared to meet the kinds of threats most likely to occur. The greatest risk is that the nation will rest on the laurels of its Persian Gulf success. This is certainly not intended to detract from an extraordinary job of coordination, cooperation, and execution. Yet, in the final analysis, Desert Storm was a blip on the screen of regional conflict—an arena in which the United States has been slow to respond. In reality, the United States is not adequately prepared to cope with most kinds of attacks below the level of massive conventional warfare.

Terrorism—Saddam Hussein's second front—is one variation of potential threats. Throughout Desert Shield, and for much of Desert Storm, the specter of terrorism loomed large. Yet the threatened fusillade of terrorist events did not materialize. This is fortunate because the allies knew that Iraq planned devastating blows. It had the power to unleash the terrorists and it possessed the weapons, some of which were capable of inflicting mass destruction upon the members of the coalition.

Nevertheless, there were still nearly 200 attacks worldwide by terrorists sympathetic to Saddam. Most of them proved to be minor pinpricks, precisely because intelligence was shared

in abundance. Today, U.S. defenses have been relaxed, difficulties in intelligence sharing have reemerged, and a note of apathy has crept back into counterterrorism activities. That makes the United States a vulnerable target.

Ironically, the threat may be much higher now than it was at the time of the war, given that it may take only months to plan, coordinate, and execute an effective terrorist attack. And the potential for impact is much greater. In the midst of war, terrorism is merely a sideshow. It is during the lulls that terrorism achieves center stage—precisely the effect the terrorists are after.

Terrorism is a high-leverage, low-risk form of warfare that has attracted many of the world's rogue leaders. President Ronald Reagan may have declared that terrorists "can run but they can't hide," but his statement proved in retrospect to be little more than hollow rhetoric. Syrian- and Iranian-sponsored terrorists blew a Pan Am jumbo jet and over 250 people out of the sky with total impunity (so far), also contributing, by the way, to the demise of Pan Am as a viable business. Pan Am 103 was attacked because it was an American symbol. There are many such symbols, dangerously vulnerable to attack, both around the globe and within the continental United States.

Clandestine attacks using chemical, biological, and radiological agents pose a significant risk and they may prove quite difficult to deter. These agents are inexpensive, readily obtainable, and largely unstoppable, except possibly by those nations that have prepared for such attacks by means of intelligence, detection, protective clothing, decontamination, vaccines, and emergency management. Clearly, the United States has not.

Some 20 nations are actively developing capabilities for using these agents. Responsible observers should ask themselves, To what end? Equally disturbing is the fact that these tools are filtering down to small nihilist groups operating abroad and in the United States. In 1988, a Japanese Red Army terrorist was caught on the New Jersey Turnpike with several bombs (although not of a chemical or biological nature). Recently, in Paris, a Red Army Faction (RAF) safe house (an apartment equipped with a primitive laboratory) was raided and found to have in it quantities of botulinal toxin,

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Games of regional power politics have outlasted the cold war, but technology is changing their reach and scope, with the result that new, real dangers are emerging. Small nations, even subnational terrorist groups, have the ability to inflict mass destruction upon their enemies. The means of delivery and the weapons have become ubiquitous. When Americans are faced with crisis, their tendency to panic and then to denial and apathy is their greatest danger. The aftermath of the Persian Gulf debacle is a case in point. Will the United States learn the right lessons? Or will it soon forget the more ominous clandestine threats?

Among all the terrible threats posed by Saddam Hussein during the Persian Gulf War, biological attack was by far the worst. Hundreds of thousands, conceivably millions, of people could have died in a well-executed urban attack. Had Saddam Hussein been slightly more clever, the United States and its coalition partners might have lost the war, their triumph wrenched from the jaws of victory by bolder tactics, including the use of biological agents against urban targets worldwide. The requisite technology, laboratory facilities, and aerosolization devices were already within the grasp of the weakest countries. The sad truth is that the United States, the world's sole surviving superpower, is still unprepared to cope with such a contingency.

The purpose of this paper is, first, to explore the physical threats posed by terrorists armed with live agents or toxins and, second, to evaluate the possible counters to these weapons, research and development (R&D) opportunities, emergency management, civil defense, and public education before and after a biological attack.

Threats

The use of biological agents as weapons dates back to antiquity. Over 2,000 years ago, Greeks and Romans used the corpses of victims of infectious diseases to contaminate their

adversaries' wells. Since then, biological agents have been used repeatedly, for example, during the Crimean War, the British–American Indian conflicts, the Civil War, the Boer War, and probably in Southeast Asia. Advances in biological weaponry have paralleled military developments of conventional and even nuclear arms, especially when the progress in genetic engineering is considered. Fortunately, because of the moral abhorrence felt by the West over the use of these insidious weapons, they were not used during either World War I or World War II. Even with these beliefs, however, had World War II not ended when it did, biological weapons would undoubtedly have been used. Five thousand anthrax-laden cluster bombs were in production in the United States, destined for Berlin. When the war ended, production ceased and the bombs were destroyed.

Advances in medical care, health research, agriculture, pharmacology, and biotechnology, especially recombinant DNA technology, while dramatically enhancing human lives, have also introduced new tools for warfare. The same equipment and technologies used to save lives can be readily directed toward the production and effective use of biological weapons. Because of these advances, biotechnology equipment and expertise have been widely disseminated throughout industrialized and many Third World nations. Moreover, U.S., European, and Asian universities graduate literally thousands of scientists and engineers each year with the technical acumen needed to produce and effectively use biological weapons.

Although cutting-edge biotechnology research requires an infrastructure of sophisticated equipment and laboratories, many of the more effective biological agents can be produced in sufficient quantities for terrorist use by relatively primitive means. Virtually any infectious microorganism or metabolic product of an organism that elicits incapacitating or lethal effects in plants, animals, or humans has potential utility as a biological weapon. Even today, the most effective and easy-to-use agents occur naturally in the environment and are not man-made (i.e., genetically engineered).

Biological agents (live pathogens and toxins) are commonplace—and some of them are all too effective. Because they are

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Anthrax (*Bacillus anthracis*), botulinal toxin, and the plant toxin ricin are prototypical biologicals. Seed cultures of anthrax are readily obtained; they are found in the soil of cattle country or at times in sheep's wool. *B. anthracis* is endemic to large areas of the world, including Iraq.

Anthrax is grown aerobically, a luxuriant product of fermentation, much the way beer is brewed. But the similarity ends here, for when inhaled anthrax spores kill with virtual certainty. The mean lethal inhalatory dosage is 10^{-8} gm, or, in principle, were the spores distributed appropriately, one gram would be enough to kill more than one-third of the population of the United States. Fortunately, such an attack is not feasible. But a single, simpler attack, executed by individuals of limited technical competence, could kill hundreds of thousands. This was demonstrated by the United States Army when, in the 1950s, it dispersed live, nonpathogenic agents in the New York City subway system in order to test the utility and ease of execution of an anthrax attack.

B. anthracis (anthrax) is endemic and enzootic in many parts of the world; some strains are highly virulent and can cause death within 24 hours after being inhaled or ingested. Death results from pneumonia, systemic infection (septicemia), and subsequent organ failure. As noted earlier, it is quite easy to culture in a laboratory. Preparing it for dissemination as spores requires some expertise, but the terrorist can practice disseminating bacillus species that are not pathogenic to humans. For example, *B. thuringiensis,* which is used to control caterpillars, can be used safely to simulate anthrax.

Botulinal toxin is an exotoxin that causes paralysis by blocking the transmission of nerve impulses at neuromuscular or neuroglandular junctions, resulting in congestion and hemorrhage in all the organs and especially in the central nervous system. Death usually occurs within 24 to 48 hours.

Botulinal toxin is produced by *Botulinum clostridium,* a bacterium found virtually everywhere. When food, such as canned salmon, is improperly handled, botulinal poisoning may occur. The Type-A toxin, when crystallized, has a mean

lethal ingestive dose of a microgram, making it the most lethal substance known. Unfortunately, it is also easily produced and is readily dispensable.

Ricin is obtained from the castor bean. The toxin is insidious. When inhaled, less than a milligram causes death, often within hours. All that is needed is the castor bean and an adventuresome terrorist willing to extract the toxin from it. The solvent extraction of the protein albuminoid toxin is a well-documented, trivial, two-step procedure.

Ricin is a cytotoxin with a predilection for the hemovascular system. Death usually occurs from pulmonary edema and circulatory collapse. For quite some time, ricin was the suspected culprit in Legionnaires' disease. It was the agent in the Bulgarian umbrella killings. During World War II and the 1950s, ricin was stockpiled by the ton.

Anthrax, *Botulinum clostridium,* and ricin were among Saddam Hussein's selected instruments. Most of Iraq's clandestine biological facilities may still exist, despite the efforts to eliminate them. Syria, Iran, Libya, North Korea, and Cuba have also chosen these agents.

Although there are more sophisticated agents, the three listed above are superb model agents because of their high toxicities and relative ease of production. Once terrorists have made sufficient quantities of their agent of choice, they have to develop a delivery system, which, not surprisingly, presents no difficulties because commercial units for aerosolizing liquid and solid materials are readily available.

The most effective means of delivering toxic agents to large populations is via aerosol clouds, with the toxic particles or droplets being highly respirable. Respirable particles have mean aerodynamic diameters of 1 to 3 microns. (Aerodynamic diameter results from the particle's physical size, shape, and density.) Respirable particles are readily inhaled and deposited in the peripheral portions of the lungs, where they are readily absorbed if soluble in biological fluids. Many chemicals are absorbed and distributed systemically almost as fast as when they are injected intravenously. They also remain suspended in air for extremely long periods. A rule of thumb is that respirable particles settle at only 2 to 3 centimeters per hour.

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Wind and sunlight are the principal means of inactivating biological agents once they have been dispersed.

Even if less than optimal aerosol delivery systems that generate particles larger than respirable sizes are used, it is probable that these particles would remain suspended in the atmosphere for a long enough period to infect large numbers of people.

Obtaining starting cultures for anthrax and *Botulinum clostridium* is easily accomplished because these microorganisms are found in most areas of the world and are widely studied. Although distribution of these organisms is now monitored by the U.S. Federal Bureau of Investigation and the law enforcement agencies of other governments, culture samples can be obtained under the guise of use in legitimate medical research. Once reference samples are obtained, they can be put into production for terrorist activities. If a terrorist group decides not to use reference samples, it can readily isolate and grow the organisms from areas where they are endemic or enzootic.

Aerosol dispersal technology is easy to obtain from open literature and commercial sources, and equipment to aerosolize biological agents is available as virtually off-the-shelf systems produced for legitimate industrial, medical, and agricultural applications. With access to a standard machine shop, it would not be difficult to fabricate aerosol generators and integrate components to produce reliable systems for dispersing microorganisms or toxins.

Illustrative Scenarios

Although the circumstances under which biological agents can be employed as terrorist weapons seem limitless, we offer three scenarios to illustrate the effectiveness of such weapons:

1. The date is late spring 1993 and internal violence in the former USSR has erupted into virtual civil war. Hopes for peace in the Middle East have been dashed. Iraq, now emboldened by Russian and Ukrainian hard-liners, retains ruthless elements of the Abu Nidal organization to commit a monstrous act against Israel and the United States and leave

no signature. New York City is the target, the financial center of the world and home to millions of Jewish-Americans. Saddam Hussein will get even; the United States will never be the same. The plot is doable and plausibly desirable. A fishing vessel sails around Manhattan Island, starting at the entrance to the East River. To avoid suspicion, the vessel has the external trappings of a commercial boat normally present in these waters. At a speed of three knots up the river, an airborne cloud of mono-dispersed respirable anthrax spores, suspended in a suitable medium (e.g., propylene glycol or an inert powder), would be released from the nozzles of an aerosol generator. The release point would be 35 feet above the waterline and the anthrax spores would be released at a rate of 2 kilograms per hour (2×10^{11} lethal dosages per hour). A grayish, overcast day is chosen, so that the advantages of a stable atmosphere are obtained. By conservative estimate, more than 400,000 people die within 48 hours. Manhattan and its surroundings are contaminated and may have to be evacuated. After the attack, the fishing vessel heads to the open sea, where it is destroyed. The United States must respond, but against whom and how?

2. In late 1993, Germany's RAF terrorist group strikes with a vengeance in the United States. Ten milligrams of botulinal toxin (10^5 lethal doses) are injected into bulk milk in a commercial processing plant, after it has been pasteurized. Each carton of milk or subsequent portion of a dairy product like ice cream contains thousands of fatal doses. The target plant is a supplier to a vender serving the Senate dining room. When the toxin takes effect, the victims experience crippling nausea, vomiting, cramps, double vision, and muscular paralysis. Casualties number 2,000 to 4,000 with at least 50 percent of them dying.

3. The Animal Liberation Front places a small nitrogen-pressurized aerosol generator in an air vent of the ballroom of a major Washington, D.C., hotel housing the annual meeting of the American Academy of Arts and Sciences. Five kilograms of ricin are dispersed over three hours. Two thousand people are exposed. Within hours after the dinner, 11 people collapse. By morning, 170 people are critically ill or dead. A medical emer-

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gency is declared and panic ensues. Federal and local health and law enforcement personnel are mobilized. That morning, the aerosol device is discovered. Within hours, ricin is reported to be the agent. An act of biological terrorism has been documented, an ugly vignette reminiscent of the Legionnaires' disease outbreak of some 15 years ago.

In the event of the anthrax attack described above, New York City, if not the entire United States, would "stop" for months, its infrastructure and health resources overwhelmed. Fear of contamination, which would cloister most New Yorkers initially, would give way to the pragmatics of survival (food and water). Martial law would likely follow because the city would be gridlocked, its people frantic. The rats, which already outnumber the human population, would be well on the way to a permanent victory. If the attack were extensive, large portions of the city might be abandoned, even condemned by whatever city government remains. New York City would be as deserted as Hamburg in 1943, but eerily the buildings would still be standing.

If only for purposes of revenge and national distraction, U.S. intelligence and law enforcement agencies would ferret out the culprits. Once the sponsoring state is found, the United States would face the ultimate dilemma of whether to attack a country that may well have nuclear weapons.

Resolving the Problem

Resolving the terrorist problem requires vigilance by the United States, something history shows to be difficult for this country and made even less possible by the trivializing effect of television. Even if the United States acts today, it may be unprepared for years to cope with the primary emergency, even as it retains the capacity to thwart a limited nuclear attack. The U.S. government will have been ensnared by inattention to the changing modes of warfare and an inflexibility brought on by decades of cold war.

To improve its protective posture, the United States should pursue an all-embracing concept that includes proactive intelligence collection, the will and the weaponry to destroy

the biological arsenal of a Saddam Hussein, the technological ability to destroy clouds of pathogens, countermeasures such as lasers or bleach-saturated "counterclouds," protective measures (civil defense and public education), and command post and field simulations intended to develop realistic recovery plans. The Federal Emergency Management Agency should lead this effort. The White House should prepare an emergency management protocol to safeguard U.S. national resources. The objective would be to have a plan in place to recover from a massively destructive biological attack on the United States without additional self-inflicted wounds.

A central element of this effort should be creation of a chemical and biological counterpart to the Nuclear Emergency Search Teams (NEST). NEST was formed in the mid-1970s to meet evolving command and control, technical, behavioral, law enforcement, search, disarmament, and decontamination needs, after a number of episodes demonstrated the need to assess nuclear weapon extortions, to locate improvised or stolen atomic weapons rapidly, and to deactivate them. Fortunately, the more than 100 nuclear extortions to date have all been hoaxes, and no atomic bombs have been found. Nevertheless, the team(s) has performed admirably both in Europe and in the United States. Numerous exercises involving "stolen" nuclear devices have been held, and a well-honed ability to assess and cope with nuclear threats has emerged.

No such capability exists for chemical and biological threats. We propose formation of a chemical/biological analog, CBEST. This is not another mere bureaucratic invention. Parallel to advances in detection and countermeasures, an interdisciplinary capability must be forged to cope with the threat and consequences of biological attack. Anything less would be irresponsible. It may take as much as a decade for Saddam Hussein to fabricate a nuclear weapon, but only a few months would be needed to deliver an anthrax cloud over a U.S., European, or Middle Eastern city. Staffing and equipping CBEST would be a relatively inexpensive and sane response to the proliferation of biological weapons to states known to sponsor terrorism and to those that might see ideological virtue in humbling the world's sole remaining superpower.

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The U.S. Department of Energy relied upon the national laboratories for help in framing the NEST concept and for bringing it to life. Now again the Los Alamos National Laboratory and its sister laboratories can develop the detection and countermeasure technologies needed to cope with biological warfare. Moreover, the laboratories can construct simulations that predict cloud movement, horizontal and vertical dilution, and residual virulence. Using meteorological data, active defenses, such as high-power ultraviolet (UV) lasers and "countercloud missiles," can be deployed, and passive measures, such as evacuation, might be prepared as well.

Conclusion

The use of biological agents as weapons of terrorism, insurgency, or war—no matter how repugnant—cannot be excluded. Indeed, its likelihood is probably increasing, as biological weapons proliferate and the stability of the cold war balance of power passes. The potential was demonstrated during the Persian Gulf episode, when there was every reason to fear SCUD attacks dispersing anthrax over Israel and killing tens of thousands. Nor is the United States immune from such attacks.

Reasonable preparedness measures should be taken now. Among these are technological innovations designed to detect and identify pathogens and toxins; active defenses (countercloud of disinfectants and high-power UV lasers); pharmacological defenses (vaccines, toxoids, monoclonal antibodies, and antibiotics); disinfectant aerosols built into air-conditioning systems of large buildings; and effective decontaminants following an attack. Less exotic forms of protection should be a priority as well. Development and testing of advanced protective garb for those engaged in cleanup should be undertaken. Low-technology approaches also deserve attention, such as taping door rims and using vacuum cleaners in homes to create a positive pressure relative to the outside, all as part of a comprehensive, intelligent civil defense program. Beyond technological development, an emergency operations, command and control, and training apparatus should be carefully designed and implemented. CBEST, the analog of the success-

ful NEST team, should be constructed and undergo exercises regularly.

Biological warfare is frightening. But pretending that the threat does not exist will only lead to needless injury, death, and public hysteria because reasonable protective measures will not have received sufficient attention.