

Combined Microbiology Training in Support of New and Emerging Biowarfighting Capabilities

By Captain Dana Perkins, Ph.D., and Major Shane Wilde

Biological warfare—coined “public health in reverse” because it involves the deliberate use of living microorganisms or their toxins to incapacitate or kill people¹—has never been used on a large scale. In fact, it is currently banned under the Biological and Toxin Weapons Convention (BTWC), which was entered into force 26 March 1975. However, some countries are still believed to be pursuing biological and toxin weapons (BTW) capabilities.² Moreover, history indicates that even the inadvertent spread of infectious diseases during wartime may erode fighting capability and result in more casualties than actual combat.³ The threat to our Forces is, therefore, clear and imminent.

Asymmetric Biological and Toxin Threat

One of the founding sponsors of the BTWC, the former Soviet Union (FSU), continued to secretly develop an offensive BTW capability throughout the 1970s and 1980s. The project involved tens of thousands of scientists who were mainly employed by one of about forty civilian research and development facilities in the Biopreparat complex (established in 1973), but also by military institutions. It wasn't until 1992, after the collapse of the Soviet Union, that former Russian President Boris

Yeltsin officially acknowledged violations of the BTWC and banned further offensive biological weapons (BW) work in Russia.

According to a 2004 testimony before Congress,⁴ the U.S. government continues to be concerned about Russian compliance with the BTWC and about the solvency of certain Russian laboratories funded via the Department of Defense (DOD) Cooperative Threat Reduction Program. This is because the infrastructure of the FSU BTW program is largely intact and may be capable of supporting future mobilization for the production and delivery of weaponized biological agents. Moreover, results of “sensitive” research on the genetic engineering of BW agents have been published as recently as 1992.^{5,6} The use of these agents against humans could lead to unusual symptoms, thereby obscuring diagnoses and delaying therapy.

While terrorists continue to favor proven conventional tactics such as bombings and shootings, the possibility of chemical, biological, radiological, and nuclear (CBRN) attacks cannot be disregarded. Worldwide terrorist organizations and nonstate actors have expressed an interest in CBRN agents. In 2005, at the first International Criminal Police Organization (INTERPOL) global conference on preventing bioterrorism, French Interior Minister Dominique de Villepin stated that “Several al-Qaida cells have been trained in Afghanistan, where they have learned to use biological agents including anthrax, ricin, and botulinum toxins. Later, after the fall of the Taliban regime, those groups continued their experiments in the Pankisi Gorge, on [*sic*] the territory of Georgia, bordering Chechnya.”⁷ Moreover, on 31 March 2005, the Commission on Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction concluded that “Al-Qa’ida’s [*sic*] biological program was further along, particularly with regard to Agent X than pre-war [*sic*] intelligence indicated. The program was extensive, well-organized, and operated for two years before 9/11, but intelligence insights into the program were limited.”⁸



Hands-on bacteriology training at MAMC

An 11 August 2005 posting to an al-Qaida message board indicated that “the use of nuclear, dirty bombs, chemical and biological weapons by martyrs is justified as part of holy war strategy [*sic*].” On 28 September 2006, the leader of al-Qaida in Iraq, Abu Ayyub Al-Masri, released the following call to scientists: “We are in dire need of you. The field of jihad can satisfy your scientific ambitions [*sic*] and the large American bases [in Iraq] are good places to test your unconventional weapons, whether biological or dirty, as they call them.” Recent insurgent attacks in Iraq, including those involving exploding trucks filled with chlorine canisters, may illustrate responses to this call. They may also reflect the escalation and further development of classic suicide bombing techniques.⁹

Counterproliferation

The main goal of the Cooperative Threat Reduction Biological Weapon Proliferation Prevention Program (BWPP) is to facilitate a partnership between FSU states working toward the successful global elimination of BW and the prevention of bioterrorism. The Cooperative Biological Research (CBR) Program of the BWPP specifically aims to engage FSU BW scientists, preempt the “brain drain” of these scientists to rogue states and terrorist groups, gain U.S. access to scientific expertise to enhance preparedness against biological threats, and reduce the threat through direct U.S./FSU cooperation on biological research. Memoranda of understanding were signed between the agency implementing the CBR program (Defense Threat Reduction Agency [DTRA]) and the Department of the Army so that military experts from organizations such as the U.S. Army Medical Research Institute of Infectious Diseases could provide support for CBR efforts. Some of the experiences and lessons learned from this partnership are available to Chemical and medical Soldiers and may enhance BW awareness and overall preparedness.

110th Chemical Battalion

The 110th Chemical Battalion (Technical Escort [TE]) is one of five subordinate chemical battalions within the 48th Chemical Brigade, which is assigned to the 20th Support Command (Chemical, Biological, Radiological, Nuclear, and High-Yield Explosives [CBRNE]).

The mission of the 110th Chemical Battalion is to conduct weapons of mass destruction–elimination operations in support of the combatant commander and to support local, state, and federal agencies at CBRNE incidents within the Homeland. The Soldiers of the battalion mitigate the effects of chemical and biological weapons through detection, monitoring,



Soldiers conducting decontamination

presumptive analysis, render-safe operations, packing and transportation, and limited decontamination operations.

An emerging unconventional biological threat and the requirement for a full CBRNE spectrum response pose new challenges for individual and unit training. As U.S. Forces face a potential CBRNE threat across the full spectrum of combat operations, a broad range of military operations from homeland security support to war and stability operations may be necessary. Combined TE unit/Army Medical Department training, if expanded and standardized, could enhance the capabilities of Chemical and medical Soldiers to fight and win in a CBRNE environment. The 110th Chemical Battalion and the Madigan Army Medical Center (MAMC) recently participated in such joint cooperative training.

Clinical Microbiology and Molecular Diagnostics Training

From December 2006 to April 2007, twenty-four 110th Chemical Battalion Soldiers with military occupational specialties of 74A and 74D were trained on basic clinical microbiology at MAMC, Fort Lewis, Washington. The training objectives included understanding the principles of pathogen isolation, understanding processes involved in identifying a pathogen in a clinical specimen, learning good laboratory practices, and observing and discussing laboratory procedures with medical laboratory technicians (MLTs). Opportunities for hands-on practice of agar-streaking techniques and antibiotic susceptibility testing were also provided.

In addition to basic clinical microbiology training, Soldiers were trained in basic concepts of molecular diagnostics, with an emphasis on biological-agent detection and an overview of detection technologies, including capabilities and program development of the Ruggedized Advanced Pathogen Identification Device (RAPID) and

the Joint Biological Agent Identification and Diagnostic System. The training objectives included understanding the quality control requirements of polymerase chain reaction data, learning good molecular diagnostics laboratory practices, and assessing and mitigating the risk of cross contamination. Trainees also had the opportunity for hands-on practice of parallel deoxyribonucleic acid (DNA) extraction of *Legionella pneumophila* on Dacron swabs (to simulate environmental sampling) with a Roche MagNa Pure instrument (currently in use at MAMC and in the RAPID system used by TE units in the field) and parallel polymerase chain reaction testing using a Roche LightCycler instrument and RAPID.

Following the clinical microbiology and molecular diagnostics training, Soldiers were asked to complete an evaluation which included the following questions:

1. Was the training provided relevant to your current duties and/or mission? Was the time allotted to training appropriate in length? All respondents except one noted that the training was useful and relevant. The comments indicated that the training would help Soldiers improve prioritization, gain a better scientific background, understand basic laboratory instrumentation, understand the difference between clinical and weapons laboratories, and apply the fundamental aspects of MLT work to daily tasks. One of the participants felt that more time at the setup bench would have been useful.
2. Were the briefings provided useful and informative in content? All Soldiers answered affirmatively. Comments indicated that additional information about obtaining clinical samples from deceased



TE Soldier conducting presumptive identification of an unknown liquid

individuals who were suspected to have died as a result of chemical and biological weapons would have been useful.

3. Were the laboratory trainers knowledgeable and helpful? All Soldiers answered affirmatively.
4. Would you like to attend more training sessions at MAMC? All Soldiers answered affirmatively. Comments indicated that MAMC microbiology training could contribute to integrated contingency response training (through joint bioterrorism preparedness drills); customized training on specific techniques or equipment used by clandestine and government-sponsored biowarfare and terrorist laboratories; instruction on the weaponization of certain parasites, viruses, and bacteria; field testing of clinical samples; and training in chemistry and hematology laboratories.

BW Threat Awareness Training

Captain Dana Perkins, Ph.D. (a MAMC-assigned officer with Military Occupational Specialty 71A), assisted with the presentation of a week-long training program to contractors and Soldiers of the 110th Chemical Battalion on the production and use of biological agents. The training was conducted by ImmunoSolutions, Incorporated—a company specializing in biological incident training for first responder units. The program involved a series of briefings on several topics: the history of biowarfare, microbiology of biological agents, aerobic and anaerobic bioprocesses, detection overview, bioprocessing and optimization, bioprocess equipment and uses, specific systems for specific agents, dissemination, bioterrorism and biocrimes, agroterrorism, bioterrorism case studies, and lessons learned from Iraq. It also addressed laboratory techniques and procedures; featured hands-on activities (including work with nonpathogenic bacterial simulants) to teach the essentials of retrieval, culture, fermentation, and downstream processing of microorganisms; and included a multiday team project that involved using off-the-shelf items to build a complete bacterial fermentation system in a makeshift laboratory.

In addition, Captain Perkins briefed 110th Chemical Battalion Soldiers on the use of viruses as biowarfare/bioterrorism agents. Topics covered included the definitions of biowarfare/bioterrorism, historical examples of biowarfare/bioterrorism attempts and incidents involving viruses, sensitive research, terrorist types and potential bioterrorism attacks, al-Qaida interest in biological agents, “fingerprints” of potential BW programs, threat assessments and criteria for prioritizing

preparedness efforts, public health consequences of a biowarfare/bioterrorism threat or event, and infection control measures.

As a former DTRA contractor/desk officer in the BWPP/CBR program, Captain Perkins attended a series of officer professional development lectures at the 110th Chemical Battalion and presented a briefing on U.S. government nonproliferation programs that focused on the redirection of former bioweaponers in Russia, Libya, and Iraq toward public health-oriented research programs. Dr. Alexander Chepurnov (a scientist at the Michigan Nanotechnology Institute for Medicine and Biological Sciences, Ann Arbor, Michigan)¹⁰ presented a lecture on Ebola and Marburg diseases, epidemiology, vaccine development, work at the State Research Center of Virology and Biotechnology “Vector” (with a pictorial demonstration of personal protective equipment use), and the Ebola laboratory accident case¹¹ clinical course and management.

Sharing of Chemical Expertise

Major Shane Wilde, 110th Chemical Battalion operations and training officer (S3), was a guest speaker for chemical warfare and terrorism briefings conducted for medical residents, laboratory personnel, MLT students, and other MAMC staff. Major Wilde discussed chemical detection and decontamination, while Captain Perkins provided an overview of clinical symptoms of and medical countermeasures for chemical agents and a history and assessment of the current threat of chemical terrorism (with an emphasis on al-Qaida and scientific communities in Islamic countries).

Captian Perkins attended the 110th Chemical Battalion exercise on site assessment and exploitation of a “clandestine” chemical production facility and has received training on TE procedures for personal protective equipment use, the operation of field detection devices, sample collection, and decontamination.

Conclusions

Executing CBRN defense requires the overall integration of multiservice doctrine and intraservice coordination of activities as outlined in Field Manual (FM) 3-11. It is the authors’ opinion that further integration and combined TE unit/Army Medical Department training will enhance the ability of the Army to defend against and mitigate the effects of CBRN incidents.

As Lieutenant Colonel Mark Lee, commander of the 110th Chemical Battalion, stated, “The unique set of microbiology skills and biowarfare threat assessment

provided to our Soldiers as a result of MAMC involvement are [*sic*] an illustrative example of Army transformation toward a responsive, deployable, agile, and versatile force able to adapt its training and future operations to an everchanging threat climate in order to remain relevant.”

Endnotes:

¹*Technologies Underlying Weapons of Mass Destruction*, U.S. Congress, Office of Technology Assessment, Government Printing Office, Washington, D.C., December 1993.

²“Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 July Through 31 December 2003,” Central Intelligence Agency.

³J.P. Hegggers, “Microbial Invasion—The Major Ally of War (Natural Biological Warfare),” *Military Medicine*, Volume 143, Number 6, June 1978, pp. 390–394.

⁴Testimony of Lisa Bronson, Deputy Under Secretary of Defense for Technology Security Policy and Counterproliferation, before the Senate Committee on Armed Services, Subcommittee on Emerging Threats and Capabilities, 10 March 2004.

⁵V.M. Borzenkov et al., “The Additive Synthesis of a Regulatory Peptide in Vivo: The Administration of a Vaccinal *Francisella tularensis* Strain That Produces Beta-Endorphin,” *Biull Eksp Biol Med*, August 1993.

⁶V.M. Borzenkov et al., “Study of Nonpathogenic Strains of *Francisella*, *Brucella*, and *Yersinia* as Producers of Recombinant Beta-Endorphin,” *Biull Eksp Biol Med*, June 1994.

⁷“Preventing Bioterrorism: The 1st INTERPOL Global Conference,” Lyon, France, 28 February–1 March 2005.

⁸“The Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction,” Report to the President of the United States, 31 March 2005.

⁹Audrey Kurth Cronin, “Terrorists and Suicide Attacks,” Congressional Research Service Report for Congress, 28 August 2003.

¹⁰Dr. Chepurnov was formerly the chief of Biosafety Level 4 Highly Dangerous Viruses at the State Research Center of Virology and Biotechnology “Vector,” Novosibirsk, Russia.

¹¹In May 2004, Antonina Presnyakova, a scientist working with the Ebola virus, accidentally injected herself with the deadly virus and died two weeks later.

References:

FM 3-11, *Multiservice Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical Defense Operations*, 10 March 2003.

ImmunoSolutions, Incorporated, Web site <<http://www.immunosolutions.com>>, accessed on 10 April 2008.

Captain Perkins served in Operation Enduring Freedom 20 April 2006–5 September 2007. She was appointed chief of the Clinical Immunology and Molecular Diagnostics Laboratory at MAMC and also served as a CBRN instructor with I Corps.

Major Wilde, formerly the 110th Chemical Battalion S3, is currently attending Command and General Staff College. He holds a bachelor's degree in political science from the University of Oregon.