

THE SPECTER OF BIOTERRORISM

IN SEPTEMBER 1999, the federal Centers for Disease Control and Prevention allocated some \$40 million to state and local health departments across the country to expand and upgrade their ability to detect and respond to biological and chemical agents, and to provide a public health response to terrorist acts in the United States. Beyond the public health monies, the federal government allocated an additional \$133 million for bioterrorism preparedness. It seems fitting that the *CD Summary* kick off this, the final year of the second millennium, by delving into the current concern about the potential for bioterrorist attacks.

HISTORICAL NOTES

Bioterrorism has been defined as the threat or use of biological agents by individuals or groups motivated by political, religious, ecological, or other ideological objectives.¹ An analysis of agents potentially useful for these purposes is illuminated by a look at the record of their uses for military purposes.

The first such use known occurred in Kaffa (now Feodosiya, Ukraine), a Genoese Black Sea port city on the Crimean peninsula.² When an outbreak of bubonic plague among the besieging Tatar forces threatened to rob them of their victory, they catapulted the cadavers of dead plague victims into Kaffa. (Although plague subsequently broke out in Kaffa and traveled to Europe with the city's refugees, helping the second plague pandemic along, whether the

catapulters were culpable remains a matter of conjecture; we know that the vector fleas tend to leave their hosts soon after death.)² During the French and Indian War (1756-63), British soldiers presented hostile American Indian tribes with blankets from the smallpox hospital at Fort Pitt. The smallpox epidemic that occurred among tribes in the Ohio River valley may have been transmitted by blankets-as-fomites, but then again, we now know that smallpox is more efficiently transmitted by droplets than by fomites, and there were many other opportunities for the Indians to meet the variola virus.²

During the first world war, Germany infected animals in neutral countries trading with Allied nations. Romanian sheep and Argentinian livestock destined for export to Allied countries were infected with *Bacillus anthracis* and *Burkholderia mallei* (which cause anthrax and glanders, respectively). They also attempted to contaminate animal feeds and to infect horses in the U.S. intended for export.²

From 1932-1945, Japan's now infamous Unit 731 conducted extensive experiments with a variety of microbes.² At least 10,000 prisoners died from experimental infections, or were executed following them. Experimental biological attacks were inflicted upon at least 11 cities in occupied Manchuria. Water and foods were contaminated with *B. anthracis*, *Vibrio cholerae*, *Shigella* spp., *Salmonella* spp., and *Y. pestis*. Fleas were allowed to feed on plague-infected rats, harvested, and released over Chinese cities in quantities of up to 15 million per attack; epidemic plague was attributed to such attacks (although rigorous confirmatory data are unavailable). Some of the biological attacks proved difficult to control; one attack led to approximately 10,000 illnesses and 1,700 deaths in Japanese troops, mostly

from cholera.

In 1942, the United States began to develop an offensive biological weapons program. In ensuing years, the US military weaponized *B. anthracis*, botulinum toxin, *Francisella tularensis*, *Brucella suis*, *Coxiella burnetii*, staphylococcal enterotoxin B, Venezuelan equine encephalitis virus, and several anti-crop agents. Biological agents were calculated to be a cost-effective means of producing mass casualties (see table).² Nevertheless, given the conventional, nuclear, and chemical arsenal available to US forces, biological weapons were ultimately deemed unnecessary. They were unproven from a military standpoint, and potentially hazardous to US troops. And the US had a strategic interest in preventing the development by other nations of such low-cost weapons of mass destruction. For pragmatic reasons such as these, President Nixon renounced the military use of biological agents in 1969. The US subsequently destroyed existing biowarfare stockpiles and signed the 1972 Biological Weapons Convention treaty.²

Although signatories of the same treaty, the Soviet Union and Iraq have had extensive bioweapons programs uncovered in recent years. In the Russian city of Sverdlovsk (now Ekaterinburg) an accidental release of *B. anthracis* spores from a Soviet bioweapons facility resulted in at least 77 human cases of inhalational anthrax, 66 of which were fatal, occurring over a period of 39 days. Rarely, anthrax can be contracted through the gastrointestinal route, and this outbreak was initially attributed by the Soviets to consumption of contaminated beef sold on the black market. Experts scoffed, and in May 1992, Russian President Boris Yeltsin admitted that "military developments" caused the outbreak.³ The Soviet program is now known to have built the capacity to produce hundreds of tons of biological

Estimated Casualties from a Hypothetical Biological Attack*

Agent	Downwind reach (km)	Dead	Incapacitated
Rift Valley fever	1	400	35,000
Tick-borne encephalitis	1	9,500	35,000
Typhus	5	19,000	85,000
Brucellosis	10	500	125,000
Q fever	>20	150	125,000
Tularemia	>20	30,000	125,000
Anthrax	>20	95,000	125,000

* release of 50 kg of agent by aircraft along a 2-km line upwind of a city of 500,000.²



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agents, including those of plague, tularemia, glanders, anthrax, smallpox, and Venezuelan equine encephalitis. Intercontinental ballistic missiles containing *Y. pestis* were available for launch.⁴ Our ignorance of what happened after the collapse of the Soviet Union to most of the $\geq 50,000$ personnel working in the Soviet program and to the stocks of seed cultures of biological weapons agents is hardly cause for comfort.^{4,5}

Before the 1991 war with Iraq, it was widely suspected that Iraq had developed a sizeable bioweapons program. Following the cease-fire that ended the war, United Nations inspectors confirmed that Iraq had weaponized *Bacillus anthracis*, botulinum toxin, ricin, and aflatoxin, and investigated the potential biowarfare use of *Clostridium perfringens*, wheat cover smut*, Congo-Crimean hemorrhagic fever virus, yellow fever virus, enterovirus 17, rotavirus, camelpox virus, and tricothecene mycotoxins. Iraq was ordered to destroy all biological warfare agents in 1991, but UN inspectors could not confirm that this took place.⁶

ATTRACTION FOR TERRORISTS

Although the military utility of biologic agents remains questionable, potential terrorist uses are easier to fathom. First of all, biological agents are relatively easy to come by. If you have access to a microbiology laboratory, you can recover microbes from patient specimens. Almost any pathogen can be purchased inexpensively from various microbe repositories, which

exist to provide grist for legitimate scientific experimentation. Finally, those *really* short on cash might recover bacteria like *Clostridium botulinum* and *B. anthracis* from a scoopful of soil in their backyards.

Once acquired, microbes are easy to transport through airports or through the mail in containers that neither trip metal detectors nor cause concern if visualized by security personnel. Once in the hands of terrorists with a minimum of microbiology training, a few bacteria can be multiplied to enormous numbers through the miracle of exponential growth. Unlike chemical weapons, biological agents dispersed in clouds are essentially invisible and odorless, so that the first sign of an attack may be illness. Finally, the incubation periods afforded by biological agents allow putative bioterrorists time for a leisurely trip across the globe before their pestilential work is detected.

CAUSES OF CURRENT CONCERN

Events over the past few years have served to heighten concern about potential terrorist attacks in general and bioterrorist attacks in particular. Six persons were killed and $>1,000$ wounded in the February 1993 bombing of the World Trade Center. Perpetrators of the April 1995 bombing of the Alfred P. Murrah federal building in Oklahoma City killed 168 persons and wounded hundreds more. Might potential terrorist try biological agents? Well, some already have. The Japanese Aum Shinrikyo cult obtained notoriety when its members released sarin nerve gas in the Tokyo subway system in March 1995, killing

11 and sickening more than 5,000 persons; perhaps less well known is the fact that cult members also experimented with several microbes, including *B. anthracis*, *Coxiella burnetii*, botulinum toxin and perhaps Ebola virus, and attempted several times to transmit anthrax and botulism.¹

What is the likelihood that bioterrorists will strike closer to home? What agents might they use? How can we prepare for such horrors? Stay tuned. In a future issue, we will discuss potential agents of bioterrorism, clinical scenarios that might bespeak a bioterrorist attack, public health efforts to deal with the threat, and resources for medical response.

REFERENCES

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Have a Nice Day!

*not suitable for further discussion in this family-oriented newsletter