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Biological warfare: an emerging threat in the 21st century

Why is biophysicist Steven Block so concerned about smallpox?

After all, more than 20 years have passed since the World Health Organization (WHO) announced the eradication of this highly contagious and incurable disease.

"Simply put, smallpox represents a direct threat to the entire world," says Block, a professor of biological sciences and applied physics at Stanford.

He points out that, although the disease has been eliminated in the wild, frozen stocks of smallpox virus are still maintained by the governments of the United States and Russia.

If rogue politicians or terrorists were to get hold of the remaining supplies, "the consequences could be disastrous," he warns.

But Block is haunted by more than the threat of a smallpox attack.

He points to some two dozen conventional biological agents -- including anthrax, Ebola and typhus -- plus an unknown number of genetically engineered organisms that terrorists could unleash on an unsuspecting public.

"We're tempted to say that nobody in their right mind would ever use these things," he says, "but not everybody is in their right mind!"

Block paints a disturbing picture of the international bioterrorist threat in an article published in the Jan./Feb. issue of *American Scientist* magazine.

His expertise in biological warfare stems from his work with JASON, an organization of primarily academic scientists who dedicate a portion of their time to solving national security problems. Members of JASON often serve as consultants to the Defense Department and other U.S. agencies

"In my opinion," he writes, "the terrorist threat is very real, and it's about to get worse."

Block argues that the United States and other developed countries should be doing more to prevent the spread of biological weaponry, which he calls "a serious threat to peace in the twenty-first century."

He saves his harshest criticism for his fellow biologists, most of whom have remained silent on the issue.

"Where are the biological scientists willing to go on the record about bioweapons?" he asks.

Anthrax

Biological weapons are "the poor man's atom bomb," writes Block in *American Scientist*.

He argues that bioweapons offer terrorist groups and "rogue states" (such as Iraq and North Korea) an affordable way to counter the overwhelming military superiority of the United States and other nuclear powers.

The agent of choice for most biological warfare programs, writes Block, is anthrax. Anthrax bacteria produce extremely lethal spores, and breathing in large numbers can lead to inhalation anthrax -- a disease that usually is fatal unless treated with large doses of a penicillin-type antibiotic immediately after exposure.

Anthrax spores are easy to produce and can remain viable for more than 100 years if kept dry and out of direct sunlight.

Their long shelf life makes them "well suited to weaponization in a device that can deliver a widespread aerosol," Block notes.

Anthrax also is relatively easy and safe to handle.

"Airborne spores remain infectious until they fall to the ground, where most become inactivated by sunlight," Block writes.

"Anthrax is not very communicable," he adds, "thereby reducing the risk that it will spread beyond the intended target. Moreover, a well-established vaccine exists that can prevent the onset of the disease, allowing it to be used safely by the aggressor."

"Black biology"

If anthrax, smallpox and other "conventional" biological agents aren't frightening enough, Block also raises the specter of "black biology" -- a shadowy science in which microorganisms are genetically engineered for the sole purpose of creating novel weapons of terror.

"The idea that anybody can brew this stuff in their garage vastly overstates the case," he says, "but any technology that can be used to insert genes into DNA can be used for either good or bad."

Block points out that genetic maps of deadly viruses, bacteria and other microorganisms already are widely available in the public domain. Last summer, for example, a leading scientific journal published the entire genetic code for the cholera pathogen. And legitimate researchers are now in the process of mapping the genomes of more than 100 other microbes -- including the bacteria that cause anthrax, the plague and typhoid.

Any scientist bent on destruction could use this information to attempt to clone extremely virulent strains of bacteria and viruses, Block contends.

He also points out that there are plenty of underpaid microbiologists in the world who might be eager to work for unscrupulous clients -- producing incurable "designer diseases," such as penicillin-resistant anthrax, or "stealth viruses" that infect the host but remain silent until activated by some external trigger, such as exposure to a normally harmless chemical.

History lessons

Biological warfare is as old as civilization, observes Block, but it was international revulsion over the widespread use of poisonous mustard gas during World War I that finally led to a 1925 treaty banning bioweapons during future wars.

"Disappointingly," Block writes, "neither the U.S. nor Japan ratified the treaty before the advent of World War II, when anthrax and other bioweapons were secretly being developed by both countries -- as well as by Germany, the U.S.S.R [now Russia] and Great Britain."

During the Second World War, the Japanese military killed thousands of Chinese prisoners by subjecting them to experimental doses of anthrax, cholera, plague and other pathogens. Evidence also exists of a deliberate tularemia -- or rabbit fever -- attack by Soviet forces against German troops in 1942, although some experts say the incident never occurred.

After World War II, the United States and the Soviet Union launched full-scale bioweapons programs, which included the development of aerosol sprays capable of delivering bacterial and viral agents by plane or ballistic missile.

"Both sides also stockpiled plenty of anthrax," adds Block.

In 1969, President Richard Nixon issued an executive order unilaterally and unconditionally ending America's bioweapons program, and all U.S. stockpiles were destroyed by 1972.

That same year, 160 nations signed a treaty banning all use of biological and chemical weapons. And 143 countries eventually ratified the treaty, including the United States, Russia, Iraq, Iran, Libya and North Korea. Fifty-two nations have not signed on, including Israel, Egypt and Somalia.

Failed treaty

Despite its noble intentions, says Block, the 1972 treaty lacks any significant provisions for enforcement or verification. As a result, a number of signatories to the treaty have maintained active bioweapons programs.

"I'm fairly confident that the U.S. has stopped producing biological weapons," he says, "but the Soviet Union carried out ultra-secret bioweapons work right up until it collapsed in 1990."

In 1979, 100 people and countless livestock died following the accidental release of anthrax spores from a bioweapons plant in the Russian city of Sverdlovsk -- one of 40 such facilities that operated in the former Soviet Union.

Russia's dismal economic situation raises the question of how out-of-work bioweapons scientists are managing to find gainful employment now, observes Block.

"Some experts contend that a low but significant level of bioresearch still exists today," he adds.

Block's ultimate nightmare is that terrorists could somehow get access to the smallpox viruses being kept on ice at the Russian State Research Center of Virology and Biotechnology -- a fear bolstered by the testimony of a former official in the Russian biowarfare program, who claimed that smallpox-based weapons were being manufactured there as recently as 1992.

Iraq also has violated the 1972 bioweapons treaty by mass-producing weapons-grade anthrax and conducting research on a wide variety of other biological agents -- including botulism, rotavirus and gangrene-inducing bacteria. Details of the Iraqi bioweaponry program only came to light in the aftermath of the 1991 Gulf War.

All told, Block estimates that about a dozen countries are believed to have active bioweapons programs.

Terrorist threat

Although Block is concerned about the bioweapons buildup in Iraq and other nations, he believes a greater threat comes from terrorist groups willing to risk an out-of-control epidemic and eager to suffer casualties for the good of "the cause."

A recent example was the 1995 sarin gas attack inside the Tokyo subway by the Japanese apocalyptic cult Aum Shinrikyo. The widely publicized assault, which killed 13 people and hospitalized thousands, had been preceded by a series of failed botulism and anthrax assaults near the Imperial Palace, a Tokyo airport and two U.S. military bases.

"Groups like Aum Shinrikyo are willing to use biological agents inefficiently just for the terror and propaganda value," Block contends.

"If anthrax were released haphazardly in a major U.S. city and produced only a handful of cases, the public fear and disruption that would ensue might alone bring about the intended effect," he adds.

Solutions

During fiscal year 2000, the Clinton administration allocated \$1.4 billion to combat both biological and chemical warfare -- a good beginning but not enough, according to Block, who believes more should be spent beefing up America's anti-terrorist intelligence effort and its emergency response capability.

Block also supports the development of hi-tech devices capable of instantaneously detecting lethal bacteria and viruses in the environment, and he encourages the production and stockpiling of new vaccines --a hot-button issue in Washington, D.C. these days.

The anthrax vaccine has stirred the most controversy. The U.S. military wants to inoculate all 2.4 million active and reserve troops, but no one knows if the current vaccine will provide immunity against inhalation anthrax the type commonly used in bioweapons. Questions of safety, along with a scandal involving the corporation that distributes the anthrax vaccine, have led to a sharp reduction in the military's vaccination effort.

As for smallpox, routine vaccinations in the United States ended in 1980, the year the virus was officially eradicated, so few Americans still have immunity today. The Centers for Disease Control will make 40 million new doses of the vaccine available beginning in 2004, but critics say that, in the event of a multi-city terrorist attack, hundreds of millions of doses will be needed to prevent the often fatal disease from spreading throughout the country.

On the diplomatic front, Block argues in favor of strengthening the 1972 bioweapons treaty -- "giving it some 'teeth,'" he says, by requiring reciprocal international inspections to assure treaty compliance.

"Embarrassingly," he notes, "the United States itself has steadfastly resisted certain attempts to establish provisions for inspections" -- in part to protect the interests of large American pharmaceutical and biotech companies against industrial espionage.

"As the world's remaining superpower," Block maintains, "the United States bears the unique responsibility to take the moral high ground in this process, assuming a leadership role in support of meaningful weapons treaties."

He also makes a strong plea to his fellow biologists to break their silence and take a stand against the proliferation of biological weapons.

"Some folks simply do not take the threat seriously," he observes, "but they should. Others worry about provoking a widespread public backlash against biotechnology in general that might have a chilling effect on their own legitimate biological research."

None of these excuses stands up to close scrutiny, Block contends, adding that the time to act is now before disaster strikes.

"We should not have to wait for the biological equivalent of Hiroshima to rally our defenses," he concludes.

By Mark Shwartz

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