Bioterrorism

A Journalist's Guide to Covering Bioterrorism
Second Edition

Radio and Television News Directors Foundation
News Content and Issues Project
Published with the generous support of Carnegie Corporation of New York

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Second Edition

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Foreword

Journalists usually are uninvolved observers, reporting on events as they unfold. But as we know all too well—after the September 11 attacks on New York and Washington—when anthrax hit, journalists and news organizations themselves became part of the story.

Being in harm's way is nothing new to the news people who cover wars, natural disasters or other emergencies. Veteran journalists know how to deliver such stories without causing undue alarm, but covering bioterrorism presents a unique set of challenges. Public perceptions may, and likely will, play a deciding role. As it was on September 11 and in the days immediately following, media performance will be critical. If the public panics, responses by government and health authorities may be affected.

For example, if a bioterror attack led authorities to impose isolation or quarantine policies and something about the reporting led people to disregard the policies, containing the infection could become more difficult, leading to further deaths. Or, if a frightened public overwhelms hospital and public health facilities, chaos could ensue. Obviously, the opposite also is true: Helpful information, disseminated quickly and effectively, will go a long way toward preventing major disruptions.

This is a new kind of problem—for the United States and for the world, for the first-response emergency personnel and for the journalists reporting on them. Thankfully, no one yet has a wealth of experience in responding to bioterror attacks. Unfortunately, that could change. The better prepared we all are to play our respective parts during the heat and confusion of an emergency, the better we will be able to do our jobs. And that's why RTNDF has prepared this handbook—as one way to help journalists prepare for covering bioterrorism.

There is a massive difference between a crisis and a catastrophe, and in the case of bioterror attack, the effects of media coverage on public perception could be the deciding factor between the two. Although we hope none of us ever will need to know the kind of detailed information provided here, we have gathered facts, background information and resources and have presented them in what we hope is an easy-to-use format. Please read this guide now, before you need it, and keep it handy. Should a bioterror attack occur, your viewers and listeners will need critical information, delivered quickly, accurately and in the proper context. We hope this guide serves as one of the many tools you use to deliver the news to a public in need.

Special thanks to Carnegie Corporation of New York for providing the funding that enabled RTNDF to prepare this essential publication and to update it in response to strong demand.

Barbara Cochran
President, Radio-Television News Directors Association and
Radio and Television News Directors Foundation
April 2004

Why This Guide Is Needed

The very nature of an attack using biological weapons can present a unique set of difficulties and challenges for reporters, editors and producers as they struggle during a rapidly unfolding event to present the facts as clearly, objectively and dispassionately as possible.

For example, during the anthrax attacks in October 2001, some journalists suddenly found themselves in the middle of the story. They had become specific targets and potential victims of the very attacks they were reporting on when an anthrax-laced letter was found at the headquarters of NBC News in New York City and an assistant to anchorman Tom Brokaw tested positive for the disease. Employees at both ABC News and CBS News also were possible targets and potential victims although the actual contaminating letters were never found in either location. More broadly, it appeared the media in general were being targeted. The initial attack was in a letter addressed to American Media headquarters in Florida, publishers of a variety of supermarket tabloids, and another anthrax-laced letter was received at the New York Post. The attack had become personal, and maintaining an impartial demeanor on camera became unusually difficult.

In general, the slow and gradual unfolding of a biological attack can leave a long interval when there is uncertainty about many of the crucial facts: the exact location or extent of the initial release; the type of biological agent used; its level of volatility, virulence and stability over time; or the likelihood of additional releases that could take place, or might already have taken place but have not yet produced symptoms. Uninformed public speculation during this period of maximum uncertainty, or a vacuum of information caused by the withholding of information by misguided officials, can make the situation much worse—for example, creating public panic that may be the true objective of the attacker. Conversely, a quick release of the straight, basic facts, restrained reporting and the use of knowledgeable and balanced sources can play an important role in controlling needless public fears, disseminating important information about protective measures, and encouraging rational responses.

There is ongoing debate about exactly how much information to release, when and in what form — a debate that intensified in the wake of the 2001 attacks. Thomas Glass, an epidemiologist and sociologist at Johns Hopkins University, published a study in December 2001 saying that during the anthrax attacks, officials were so intent on averting panic that they withheld some information from the public and distorted other information. The result, he said, was actually the reverse: People are more likely to panic as a result of lack of information. Numerous studies of emergency responses have shown that when told the truth about a disaster (natural or human-induced), people tend to remain calm and organize themselves to help those who have been affected. Among the lessons to be learned, according to several specialists in risk communication, is that a knowledgeable, official source should have been made available to the press as a regular daily event, and more information should have been provided about measures citizens could take to protect themselves.

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Some government officials have discussed the possibility of adding a new category to certain published research, calling it "sensitive but unclassified."

Lee Clark, a sociologist at Rutgers University, has done research that emphasizes this point. He has found that while public officials and analysts typically cite the risk of panic as a reason for controlling or withholding information, the fact is that panic—defined as group action that is irrational and does not serve people's interests—is extremely rare in crisis situations. It is far more common for people to go to extraordinary lengths to help one another and work together to deal with the problems they face.

And yet, fearing the possibility of letting out facts that might prove helpful to the terrorists by revealing vulnerabilities they might not have considered, some have advocated the reverse policy of further restricting the flow of information. Some government officials have discussed the possibility of adding a new category to certain published research, calling it "sensitive but unclassified." In an editorial in the journal Science (11/8/02, p. 1135), the presidents of the U.S. National Academy of Sciences and the British Royal Society wrote that this idea would "generate deep uncertainties" among scientists. Such a measure "makes the best scientists reluctant to work in the affected area, stifles creativity in fields where it is most needed for defensive purposes, and consequently weakens national and international security." Still, they point out this does not mean that everything should be published. "Researchers in the biological sciences need to take responsibility for helping to prevent the potential misuse of their work," they wrote.

In the United States, and indeed in the rest of the world, there has been little experience in responding to bioterror attacks—either by "first response" paramedics, police and emergency room personnel, or public health officials and the media—increasing the difficulty for all involved in getting reliable information or knowing how best to proceed. The unfolding of such an attack will not be like witnessing an explosion. There may not be any footage of an attack to replay or a specific scene to shoot. Lacking a defined "crime scene" and likely having little time to prepare, news teams may find it very difficult to locate knowledgeable sources for specific, detailed and realistic information. Initially, even the nature of the biological agent may be unknown, adding to the difficulty of providing useful information. Whatever on-air sources can be found on very short notice—including perhaps local doctors, police or fire officers, or academic experts—may find themselves trying to explain specific diseases and distribution mechanisms about which they have had little training or exposure. At worst, the risk is that their varying, possibly conflicting, perspectives could add to the public's confusion and fear. At best, clear accurate information and level-headed reporting on a bioterror event can significantly and constructively affect public perception—possibly even keeping a crisis from becoming a catastrophe.

This book is an attempt to provide some guidance for those who may suddenly find themselves faced with the need to make quick decisions and provide information in the event of a possible bioterror attack in the United States or elsewhere today. We have attempted to give concise and up-to-date, basic background information on some biological agents believed to pose the greatest threat. The goal is to help working journalists increase the quality of their reporting and analysis concerning a bioterror event.

The guide provides detailed information about the six biological agents the U.S. Centers for Disease Control and Prevention (CDC) has identified as the most likely to be used as biological weapons, in addition to brief descriptions of many other agents that, though considered less likely, have also been developed as weapons or may be in the future. This guide also contains a detailed glossary to help journalists navigate the complicated array of scientific terms, jargon and obscure acronyms they may encounter in covering a biological attack. Finally, we have also included a list of resources: government, military and academic Internet sites that can be trusted to give reliable information; agencies and associations that can provide referrals to local experts; and a few useful books and CD-ROMs to turn to for more detailed information.

What is Bioterrorism?

The State Department defines terrorism as "premeditated, politically motivated violence perpetrated against noncombatant targets by subnational groups or clandestine agents, usually intended to influence an audience."

The attacks against the United States on September 11, 2001, brought this definition into question. The scale of the attacks suggested more of a global, ideological motivation than a solely political motivation. In the 1970s, terrorists typically shied away from atrocious crimes that would scare away potential supporters. Today, terrorists increasingly aim for mass casualties, panic and death. In the years since that attack, while there have been no further mass incidents on U.S. soil, other large-scale terrorist attacks have taken place in Indonesia (on the island of Bali in October 2002), Iraq (especially after the war was declared over by U.S. officials), and Spain (in Madrid in March 2004). The advent of mass-casualty terrorism—and the reports of some terrorist organizations' pursuit of unconventional chemical, biological, radiological and nuclear weapons—indicates that the world is seeing a new type of terrorism altogether. According to a book by Jessica Stern, a former U.N. Security Council staff member, incidents of terrorism increased fivefold since the 1970s (even before the attacks of 2001), and the number of people killed per attack had doubled. This new terrorism could use anything from salmonella and smallpox to dirty bombs and hijacked airplanes as weapons of mass destruction.

Terrorism is not just about inflicting harm or damage; it is about instilling fear. Even hoaxes and threats can terrorize large populations, causing social and economic harm even when no real danger exists. Various government agencies, federal and local, will be responsible for keeping the media informed. The public will in many cases rely on the media for basic information about the event, including the nature of the biological agent and its effects and characteristics, measures that can or are being taken by public health officials or local health workers, and advice on steps that citizens can take to protect themselves and recognize signs of disease in themselves or in their communities.

Journalists should remain aware that the quality of coverage, in addition to the quality of decision making at all levels, could make or break the response to a bioterror attack. For example, overly vague descriptions of likely symptoms or exaggerated accounts of possible outcomes could lead to hospitals being overwhelmed with the "worried well" (those who are asymptomatic or have mild symptoms not indicative of infection but who seek medical treatment out of concern). In large numbers, the worried well can severely hamper or even disable a hospital's or public health system's ability to treat those actually exposed or infected.

One of the biggest problems for journalists trying to cover a bioterrorism incident concerns the uniquely stealthy nature of a bioterror attack, which could remain undiscovered for days or even weeks until health workers start to notice unusual infections or unusually high numbers of similar illnesses. Any attacks involving chemical, nuclear, radiological and other weapons of mass destruction are likely to require a conventional "lights and sirens" response, providing an obvious focal point

This new terrorism could use anything from salmonella and smallpox to dirty bombs and hijacked airplanes as weapons of mass destruction.

The differences between nuclear or chemical attacks and biological attacks can be compared to the difference between air strikes and sabotage missions.

for media coverage and opportunities for interviews with myriad experts about chemicals, radiation, building collapse or other relevant and relatively well understood topics. Bioterror will be different. Biological weapons could be just as destructive as chemical and nuclear weapons, but they are all the more frightening because they strike silently, invisibly, and may not even be discovered until long after the attack, giving the attackers plenty of time to flee far from the scene.

These circumstances will raise particular issues for journalists. Without a discernible scene or "ground zero," there will be no heroic fire, police or emergency medical personnel rushing to a precise location. Without reassuring, visible response efforts at the scene of the attack, an information vacuum could cause the public's level of fear to rise. As news organizations seek answers from experts and government officials, inexperience, limited knowledge or a reluctance to share information on the part of some of these sources could create further confusion and possibly even panic.

Bioterrorism can range from putting waste matter into food in a small-town restaurant to the aerosolized release (dispersing an agent in a particulate form) of a contagious virus over a large city, or even the spreading of plant or animal diseases in farming areas to disrupt the nation's food supply. The perpetrator can be anyone from a disgruntled employee to a hostile foreign nation or transnational terrorist group. The type of biological agent used, the means of dissemination, and the effectiveness of the response, as well as unpredictable variables such as rainfall and wind, will determine how many people are affected over how wide an area, and how severe their symptoms are. Theoretically, the number of potential biological agents is almost limitless, but certain agents naturally have a combination of properties (such as hardiness, transmissibility and virulence) that make them most effective as weapons. Several of these have been developed and tested for use as biological weapons, and these are the ones considered most likely to be used in a terrorist attack.

Much of the information the United States now has on such agents comes from research conducted by the U.S. military before President Richard Nixon halted the U.S. offensive biowarfare program in 1969, and from research of the former Soviet Union's massive biowarfare program, Biopreparat, which lasted into the 1990s. This research has led authorities to pinpoint a handful of agents believed to possess the combination of lethality and ease of dissemination that make them the likeliest agents for a bioterror attack. A later chapter discusses these agents in greater detail, focusing on the six now believed by the Centers for Disease Control and Prevention to pose the greatest threat, as well as brief descriptions of some of the other possible, though considered less likely, biological agents.

Biological vs. Chemical and Nuclear Weapons

The differences between nuclear or chemical attacks and biological attacks can be compared to the difference between air strikes and sabotage missions. While both are methods of attack, they are based on different technologies, unfold differently and have vastly different effects. Aside from usually being detectable by smell and sometimes by sight (as in the greenish-yellow color of chlorine gas), chemical agents work by creating relatively immediate physical effects in those exposed—usually via the skin, respiratory system, digestive system and/or neurological system. Decontamination usually attenuates the symptoms, and while high levels of exposure may have fatal or lingering effects, the attack is over as soon as the chemical no longer is being disseminated. The immediate and finite aspects of chemical weapons make them comparable to an air strike; the attack has a noticeable beginning, it inflicts damage and ends quickly, and it allows damage assessment and consequence management to begin almost immediately. Nuclear weapons, even more so than chemical, produce a dramatically obvious initial blast that causes immediate damage in a clearly defined area. Unlike chemical weapons, however, nuclear contamination can also leave a lasting legacy of latent, invisible cancers and mutations that may take decades to develop.

In the case of biological weapons, the crisis is measured in weeks and months, not minutes and hours. Even the fact that an act of biological terrorism had taken place could, and probably would, escape detection for days or weeks because detection currently depends on public health systems' ability to recognize unusual infections or upsurges in reported symptoms—symptoms that initially might resemble nothing more serious than the flu. In this sense, a biological attack is more like an undercover sabotage mission—the destructive blow is not immediately apparent and only time will reveal the attack's nature and extent.

Whereas chemical or nuclear weapons attacks would be followed by a large, immediate response by federal response teams and/or local fire departments and emergency medical services, biological attacks would produce a delayed response requiring difficult coordination among local hospitals, state and local public health departments, and the federal public health system. Moreover, the appropriate response depends not only on noticing that an attack has occurred but also on determining the specific agent used and its method of dissemination. A spike in flu-like symptoms in an East Coast city may well indicate an upsurge in flu cases, but it also could be the first sign of anthrax or smallpox, both of which require that vastly different response measures be taken as quickly as possible. In other cases, as in some recent real and hoax incidents, there may be obvious signs of an agent, such as mysterious powder found in an envelope containing a cryptic or threatening message. In such cases, the response is often more similar to the response to a chemical attack, with a roped-off crime scene and hazardous-material (hazmat) teams responding in full protective gear and breathing apparatus. If the attack is thus visibly localized, that may allay people's fears about its uncontrolled spread.

Presently, no national "early warning system" exists for biological agents. However, detection on a local level has advanced greatly in the past decade to include systems that analyze data from ambulance calls, hospital admissions and even drug store purchases. Some cities and states are much more advanced than others in this regard.

Hand-held machines meant to "sniff" the air and detect certain agents are under development in a number of research laboratories, but so far they have not met expectations for accuracy and dependability; both false negatives and false positives can have dangerous consequences. Larger detection machines are currently under development, but no systems have yet proved themselves suitable for widespread national deployment. Some may be close, however. One system, developed by scientists at the California Institute of Technology and NASA's Jet Propulsion Laboratory, could continuously monitor the air to detect spores—either as a tracer of various biological weapons, or in some cases such as anthrax, the agent itself. Such systems could function as a kind of bioweapons "smoke alarm," the scientists say, especially in large public spaces such as airports and train stations, stadiums and concert halls. Until such detection systems are fully developed, tested and deployed, the nation must rely on the vigilance of the public health community and the news media to notice when something is amiss and thereafter on the federal laboratory response network to quickly hone in on the identified biological agent.

From a practical standpoint, chemical weapons are often easier and cheaper to produce and easier to deploy than biological weapons. Chemical weapons often are closely analogous to industrial-use chemicals (e.g., the nerve agents Sarin and Tabun are closely related to industrial pesticides). Therefore, terrorists can steal industrial chemicals to use as weapons, and due to the commercial use of these chemicals, the technology to manufacture them is relatively widely circulated and relatively easily copied. By contrast, the technology, materials and expertise required to develop nuclear weapons are by far the most expensive and difficult of all the so called "weapons of mass destruction." For example, one U.S. government study concluded that nuclear weapons would cost $1,500 per person killed, while

From a practical standpoint, chemical weapons are often easier and cheaper to produce and easier to deploy than biological weapons.

anthrax could cause deaths at a cost of just a penny each. The contrast is so great that biological weapons have been referred to as the "poor man's nuclear weapon."

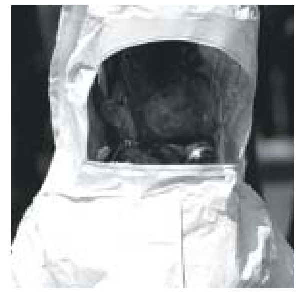
The technology required to grow biological agents is much more advanced than that required to mix chemicals, and in most cases a much higher level of expertise is needed as well—although it is possible that new techniques developed for biological research or pharmaceutical production could change that. Dissemination of a biological agent involves not just getting the agent into water, food or the air; it involves a painstaking, complex process of refining the agent to the right size and form to infect humans while maintaining both stability and virulence. Biological weapons also in some cases carry a greater risk to those producing them—accidental infection or contamination are both likelier and, because the contamination may not be immediately apparent and could lead to secondary infections among those who come in contact with the infected person, potentially deadlier than in the case of chemical weapons. Stories of accidental infection and dissemination from the Soviet biowarfare labs in the 1970s and '80s still are emerging.

Biological weapons' potential for delivering widespread human damage even from a small-scale release, however, may outweigh their expense and danger if the intent is to cause maximum harm at minimum cost. Some studies estimate that anthrax spores, correctly prepared, could be 1,000 times more lethal and could infect an area 1,000 times larger than the same weight of Sarin, one of the more potent chemical nerve agents. In addition to potentially extreme physical harm, the most widespread damage caused by a biological agent may well be psychological. In some cases, there will be no clearly defined specific area to fear and avoid, so instead people may develop a generalized fear of public places, going outdoors, opening the mail or even breathing. A well-defined contaminated area, as is likely in a chemical or even nuclear attack, is much easier to comprehend and accept than a dangerous biological agent at large in the air.

While a chemical weapon may have a devastating impact, the human toll will be finite and calculable within hours, even minutes, of an attack. Many may die or be permanently affected by the chemical, and some areas may require lengthy and costly decontamination. In theory, the impact of a biological attack could be far greater, because of the potential for person-to-person spread of the infection after the initial attack (though this is not the case for agents such as anthrax or botulism). The physical toll will not be known until every person possibly exposed has passed the time limit for developing symptoms, and this uncertainty can add greatly to the attack's psychological toll.

When Biological Weapons Have Been Used

Biological warfare and bioterrorism have been rare in the history of the world, but the technology involved and the potential methods of attack have advanced rapidly in recent years. Whereas the first "biological" attacks, in medieval times, involved hurling dead and rotting corpses over city walls, the attacks through the U.S. mail in 2001 involved anthrax so refined that merely opening an envelope dispersed particles that could infect people nearby and contaminate entire buildings.



In the first documented cases of biological warfare in the 1340s, Europeans catapulted dead bodies into besieged cities and castles in the hope of causing unlivable conditions and spreading infections such as plague. By the 1420s, they had added animal manure to increase infections caused by the rotting cadavers. One of the more notorious reports is that a British commander, Lord Geoffrey Amherst, in 1763 ordered that smallpox-contaminated blankets be distributed among American Indian tribes to cause an epidemic, thus helping British forces to advance through Indian territory. Whether such a plan was carried out or succeeded has not been conclusively substantiated; however, American Indian populations did suffer many epidemics of smallpox in the eighteenth and nineteenth centuries.

By World War I, the biological sciences had greatly advanced, and the Germans tried to inject livestock in a number of allied countries with anthrax and glanders (a disease that mostly affects horses but, like anthrax, has also been developed as a biological weapon against humans). The effects of this secret campaign were minimal. By World War II, many countries were on their way to sophisticated biological weapons programs. Japan's Unit 731, the most infamous and experienced army unit, used agents such as anthrax, cholera and plague on the Chinese people, beginning in occupied Manchuria before the war. Members of Unit 731 exposed hundreds of thousands of civilians to various agents by methods such as contaminating food and drinking water and dropping bags of plague-infected fleas over cities from airplanes. After the war, the leaders of Unit 731 agreed to give United States Forces the collection of data they had accrued from their experiments in exchange for immunity from prosecution for war crimes. In lawsuits for reparations, China has said that as many as 50,000 deaths from plague can be attributed to the Japanese attacks, since plague had been unknown in the area before then. Officially, Japan has not acknowledged the attacks.

Despite the increasing sophistication of biological warfare programs in the United States, Great Britain, the Soviet Union and other countries, there have been few instances of any nation ever actually waging biological warfare. Since the Japanese attacks in World War II, the best known cases were the reported use of biological weapons in the 1980s and 1990s by Iraq in attacks against Iran, where intelligence reports indicated evidence of both

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anthrax and mycotoxins (toxic chemicals produced by fungi). The weapons also may have been used against Iraq's Kurdish population. The Soviet program—undoubtedly the largest development effort on biological weapons ever carried out by any nation—made some infamous mistakes, such as an accidental release of anthrax in the city of Sverdlovsk in 1979, but it conducted no deliberate attacks.

In addition, both Rhodesia and South Africa did extensive work on developing or acquiring biological weapons during the last years of their respective white-minority governments, and are believed to have made at least some use of these weapons against their own black-majority populations. In Rhodesia, according to Peter Stiff, a former police officer there who has written books on the subject, perhaps as many as "a couple of thousand" black citizens were killed with biological weapons.

In the latter half of the 20th century, the only event confirmed as a successful act of bioterrorism—that is, a use of biological weapons by individuals rather than a nation—was the one carried out by the followers of Baghwan Shree Rajneesh, who deliberately contaminated Oregon salad bars with salmonella bacteria in 1984 in an attempt to manipulate local election results. Although nobody died, about 1,000 people became ill. Another suspicious event occurred in 1996, when 12 laboratory workers at a large Dallas medical center became ill with *Shigella dysenteriea* (shi-GELL-a dis-in-TER-i-a), which can cause severe diarrhea, after eating contaminated pastries left in a break room. The source of the bacterial strain used was found to be within the medical center itself, suggesting deliberate contamination by a disgruntled employee, but the culprit was never identified.

One case that raised initial suspicions of bioterrorism, but was later ruled out, occurred in New Hampshire in 1999 when a woman came down with what appeared to be brucellosis, a rare disease considered to be a possible biological weapon. Lab flasks containing unknown liquids, belonging to a foreign ex-boyfriend, added to the suspicions. But later tests proved that the patient, who died of an unspecified disease, did not have brucellosis, and the flasks did not contain biological agents.

Some other attempts at bioterrorism are known to have failed. Before the Aum Shinrikyo cult resorted to spraying the nerve gas Sarin in the Tokyo subway in 1995, the group had tried numerous times to release anthrax and botulinum toxin. The attempts failed probably because the cult's scientists could not refine the agents into a viable form capable of remaining infectious long enough. This

Highlights of Biological Warfare and Terrorism

1340s
Europeans throw rotting and plague-infected cadavers over city and castle walls.

1763
British allegedly send blankets contaminated with smallpox to Delaware indians.

World War I
Germans attempt to infect allied livestock with anthrax and glanders.

failure is encouraging because it attests to the relative difficulty of producing and disseminating a biological agent in a way that actually harms people, despite the group's strong scientific base, ample funds and obvious determination to cause widespread damage.

As difficult as it may be to carry out a biological attack, the anthrax attacks through the U.S. mail in October 2001 demonstrated that, with access to a highly refined agent, a damaging bioterror attack can be delivered with only an envelope and a stamp. The anthrax attacks were the first terrorist biological attacks to garner immediate worldwide attention. While the investigation continues and many questions remain, it is known that the anthrax used was highly refined, highly lethal and probably originated in a sophisticated laboratory, most likely a U.S. government lab. This attack brought a number of issues to the forefront of the nation's consciousness: The United States' (and the world's) vulnerability and lack of preparedness; the relative ease with which a single person or a small group might wreak havoc on a national level; and, most important, shortcomings in how the government, the medical community and the media informed the public about the attacks and their aftermath.

Those factors, combined with the media's inexperience in covering biological attacks, inflamed the situation beyond the fact that five lives were lost. (This is less than one-twentieth the number of people who die in U.S. car accidents every day.) The public fears and confusion following the attacks—about how widespread the infection could become, how reliably it could be diagnosed, and the likelihood of fatality from different forms of infection—affected the nation's sense of security for months. However, it also helped to demonstrate that even with a sophisticated, highly-purified and weaponized biological agent, reasonable precautions such as the rapid sealing and decontamination of affected buildings, along with a bit of luck, can greatly limit the number of fatalities. (One example of good luck in that case: One of the anthrax letters was found to have become wet somewhere along the way, causing the anthrax spores to form clumps and greatly reducing the amount that dispersed in aerosol form when the envelope was opened).

Another failed attempt was the ricin attack on a U.S. Senate office building in January 2004. Although powder found in an envelope mailed to a Senator's office was confirmed through testing as being highly toxic ricin, and additional ricin was also found in other offices, quick action to seal and decontaminate the building prevented any casualties from that incident. Once again, this demonstrates just how difficult it is for an attacker to produce

The anthrax attacks were the first terrorist biological attacks to garner immediate worldwide attention.

Japan's Unit 731 experiments with biological weapons on hundreds of thousands of Chinese people.

World War II

Aum Shinrikyo fails in attempts to release anthrax and botulinum toxin in Tokyo.

1993-1995

Five die, eleven infected by anthrax attacks carried out through the United States mail.

2001

injuries or deaths by means of a biological weapon. But another recent event has underscored the uncertainties that can accompany a possible biological attack. When the new disease now known as SARS (Severe Acute Respiratory Syndrome) was first detected early in 2003, there were some initial fears that it might be a biological toxin being deliberately spread through the world's population. It took several weeks of study to determine its natural origins and pattern of spread, apparently from initial infections in Southeast Asia, and to identify the virus responsible. But it is entirely possible that some future attack could unfold in a similar way, leaving people—including doctors and public-health officials—uncertain for an extended period about whether they were facing a natural epidemic or a deliberate act of terrorism.

Overall, there has been no increase in the number of actual attempts to use biological weapons since the initial anthrax attacks in October 2001, but there was a huge increase in the number of hoaxes, including numerous incidents in which letters were said to contain anthrax but were actually found by testing to contain innocuous materials such as talc. In 2001 there were 600 such hoaxes, according to a survey by the Center for Nonproliferation Studies in Monterey, Calif., but only seven cases where actual infectious agents were found. The vast majority of the hoaxes (550 of them) involved attempts to intimidate abortion clinics. In 2002, the latest year for which figures were available, there were 70 hoaxes, and no real agents were found.

How a Biological Attack Might Unfold

The method used to carry out a biological attack will play a large part in how many people are infected and with what type of infection (e.g., pulmonary anthrax vs. cutaneous anthrax, discussed further in a later chapter).

Dissemination methods could range from using humans as "biological bombs" by sending infected, contagious individuals into crowded, confined places, to dropping fleas from airplanes. However, the scenarios discussed below are presently considered more likely than others due to their relative ease and effectiveness.

Aerosol Dissemination

Aerosol dissemination is considered by many analysts to be the likeliest route for dispersing most of the biological agents considered threatening today. Given the idealized case of "correct" technology, agent, environment and target, such an attack could infect hundreds of thousands, or even millions, of people. For example, a U.S. Congressional Office of Technology Assessment study concluded that 220 pounds (100 kilograms) of anthrax, thoroughly distributed in aerosol form over a large city, could kill as many as three million people.

This method involves dispersing an agent in a particulate form sized to effectively travel through the air, lodge in human lungs, and cause infection. Aerosols could be distributed by planes or trucks equipped with sprayers, by stationary sprayers in high places such as the roofs of buildings, or by sprayers in confined spaces such as buildings or subway systems. Aerosols also can be generated when specially refined powders overcome normal adhesive forces; a glass container filled with such a refined powder, broken on subway tracks, would generate a "secondary" aerosol by stirring up the powder into the air. The powdered anthrax sent through the mail worked this way; the action of opening the envelope stirred up the powder into a secondary aerosol.

Agents disseminated outdoors would have to be hardy so as not to degrade too quickly due to sunlight, heat, cold or wind. An open-air attack would be most devastating if it occurred during a meteorological condition known as inversion, the familiar condition often responsible for smoggy summertime days when a layer of colder air acts as a cap, holding down a layer of warmer air at ground level, and thus preventing the vertical dissipation of pollutants—or an aerosolized biological agent.

However, an attack's "success," in the terrorists' eyes, need not be measured only in terms of casualties. Even if terrorists used a relatively inappropriate aerosol, such as one that degraded quickly due to exposure to sunlight, even a handful of actual victims might lead to nationwide panic and fear, as exemplified in the wake of the anthrax attacks though the U.S. mail.

Human Carrier

Novels and movies often have portrayed an infected person wandering about, purposely infecting others with bacteria or a virus. This

Aerosol dissemination is considered by many analysts to be the likeliest route for dispersing most of the biological agents considered threatening today.

Mass water supplies are less vulnerable than individual water supplies; municipal water supplies are more difficult to access and contaminate than widely believed.

method has at least one clear advantage: The agent need not be highly refined because the terrorists need to infect only one individual directly. Moreover, this method is relatively inexpensive and requires no difficult equipment to disseminate the agent. If a highly contagious agent were chosen, and the infected individual able to expose a significant number of people without attracting attention, the attack could lead to widespread illness, and even wider panic.

However, the human-as-biological-bomb method is not practical in many ways. First, it would work only with contagious agents, and the agents considered likeliest for a biological attack would make their victims so ill, and so quickly, that by the time they were contagious (for example, with smallpox) in many cases they wouldn't be able to get out of bed, much less wander a mall or subway station. Even if they could wander around a populated place, in most cases they would be visibly ill, have a rash and most likely attract attention, sparking an early response effort. While this method would be inexpensive and low-tech (except, of course, for the difficulty of obtaining the necessary infectious agent in the first place), it also would require someone willing to become infected (or able to be duped), as well as a certain amount of luck, to infect others without being noticed.

Oral Ingestion

The final scenario that is considered a likely threat involves deliberate contamination of food or water supplies. Mass water supplies are less vulnerable than individual water supplies; municipal water supplies are more difficult to access and contaminate than widely believed. The dilution caused by the large volume of water in a public supply, diffusion far from the initial point of contamination, and chlorination that can kill most human disease-causing organisms, make the infliction of mass casualties by this method highly unlikely. However, because even a few infections, as noted earlier, could produce serious social, psychological or economic harm, contamination of an individual building's or small area's water supply may be a likelier threat. Even on a smaller scale, the agent must be able to overcome factors such as dilution and chlorination.

Deliberate mass contamination of food may be less difficult to accomplish than mass contamination of water. Food can be contaminated at any step in processing—from manufacturing to packaging to distribution and sales. While this method of distribution would most likely not infect as many people as a worst-case aerosol release would, a handful of infections in an isolated area could cause nationwide fear of infection, mass recall of products, and a significant effect on the economy. Again, the agent and method of contamination would have to avoid degradation by chemicals or temperature extremes involved in processing or distribution.

Other scenarios for distribution are possible, such as dermal (skin) exposure (botulinum toxin and anthrax could be spread this way) and insect-borne transmission of an illness, but due to technical difficulties and lower possibilities of success, they are less likely to cause widespread illness than the methods described above.

How a Bioterrorism Event Might Unfold

Every event is likely to be different. As discussed already, the sheer number of factors involved in a possible bioterror attack gives any "master scenario" limited usefulness. The different methods of distribution, the array of agents, and other factors such as environment, population density and population vulnerability yield a near infinite range of possible scenarios. To illustrate some of the basic stages of such a possible attack, however, a general scenario is described below.

Unless the dissemination of the agent is noticeable or the perpetrators issue some kind of warning (which they might do, for example, to maximize the public's initial fears), a biological attack probably will go undetected until sometime after the first victims begin to show symptoms. The incubation periods of infections vary greatly but generally range from a few days to two weeks. The old, the immuno-compromised and the very young will be the first to fall ill. Most biological infections first manifest with symptoms similar to those of the flu such as aches, fever, nausea and fatigue, making a correct first diagnosis unlikely.

Health care professionals will suspect something out of the ordinary either when they notice an unusually large number of similar diagnoses or when the illness progresses in certain individuals in ways inconsistent with common illnesses. The vigilance of health care professionals will be a critical factor in the early detection of a bioterror attack. Whether the attack involves food poisoning or an aerosol release of smallpox, doctors, nurses and emergency medical personnel will form the first line of awareness. Early detection has the potential to greatly mitigate the effects of an attack—whether by allowing for the isolation of the source of infection, as in the case of deliberate food poisoning, or by allowing vaccinations to begin, as in the case of a smallpox outbreak.

Detection of an unusual occurrence or group of symptoms will start several different chains of response. Epidemiologists will attempt to trace the path of infections toward a single person or location, laboratory scientists will work to identify the specific agent, health care workers will care for the ill, and government health officials will decide how best to contain the infection and mitigate its effects.

Once the outbreak is reported to the public, how various media outlets handle the reporting of the unfolding story can make a big difference in the course of the outbreak and the success of efforts to contain and treat it. News organizations, striving to get the most accurate and helpful information possible out to the public in a way that may contribute toward keeping people alive, certainly can play a crucial role in helping to mitigate the effects of an attack. And one major factor in helping that process is to know ahead of time whom to call for informed and reliable comment.

Another useful service the media can provide during such an attack—as many did during the 2001 anthrax attacks—is to quickly check out and dispel rumors and expose profiteers who may seize on public fears to sell "snake oil" remedies. For example, rumors circulated in 2001 that mail suspected of being contaminated with anthrax could be sterilized and rendered harmless by passing a hot iron over it—something most public-health experts considered a useless precaution. And some people tried to take advantage of public fears by selling useless devices, such as portable ultraviolet lights supposedly capable of sterilizing surfaces or objects in a few seconds, or gas masks that most specialists say are virtually worthless for biological attacks. On the other hand, media can call people's attention to simple and often inexpensive measures they can take to protect themselves against some kinds of infectious diseases, such as frequent handwashing and the use of simple paper or cloth surgical-type masks when going to crowded areas.

The progression of a bioterror scenario depends largely on the type of agent used (for example, short-acting toxin vs. contagious virus) and the method of dissemination (such as local food contamination vs. aerosol release over a large city). The breadth and severity of infection will determine the steps taken on local, state and federal levels. The response might require no more than treating a handful of infected individuals, but at worst it could involve months of antibiotic treatments, decisions about how widespread vaccination rounds should be, isolation policies or even quarantines.

Given the myriad possibilities for a biological attack, preparation never will be complete because new threats emerge, technology develops and the population and its vulnerabilities change. Hypothetical scenarios may help us to examine possibilities and test certain aspects of response plans, but they also can be dangerous if relied on to encompass all possible events.

Whether the next terror attack against the United States involves chemical, biological or nuclear weapons, conventional weapons like bombs or guns, or once-unthinkable weapons such as commercial airliners, we have learned that uncharted areas of terrorism might remain for which no scenario can prepare us.

Most biological infections first manifest with symptoms similar to those of the flu such as aches, fever, nausea and fatigue, making a correct first diagnosis unlikely.

Possible Bioweapons

The idea of using biological agents as weapons both fascinates and terrifies the public and nothing grabs attention more than the names of agents themselves: anthrax, smallpox, Ebola. Despite their fascination, the public knows little about the specifics of biological agents.

Good coverage of bioterror in general must be informed, and a clear, sophisticated, straightforward discussion of the specific agents is especially critical.

Good coverage of bioterror in general must be informed, and a clear, sophisticated, straightforward discussion of the specific agents is especially critical. To dispel misinformation and clearly delineate the main issues surrounding bioterrorism, this chapter covers important facts about the six agents the Centers for Disease Control and Prevention calls Category A agents—those deemed to pose the highest threat—as well as others, listed in categories B and C, that it has identified as lesser but possible risks. This chapter also covers additional agents that have been identified by the World Health Organization, the U.S. military and other sources, as well as some that have in fact been developed and perhaps even used as weapons (Iraq's development and alleged use of aflatoxin weapons falls into this category).

Anthrax

Short Description

Bacillus anthracis (ba-SILL-us an-THRA-siss) is a rod-shaped bacterium that infects humans through the respiratory system, the skin or the digestive system. As bacteria go, anthrax is hardy (it can remain in a dormant spore form for decades before becoming active again), widely available (it is researched at more than 2,000 laboratories in the United States alone), and, depending on the method of infection, highly lethal. Anthrax is not easy to disseminate. Sophisticated processes—collectively known as the weaponization of anthrax—are needed to refine the bacterium to reduce it to its most infective size and to decrease electrostatic clumping, enabling it to travel long distances in the air and be inhaled. Once weaponized, anthrax is easily disseminated, as demonstrated by the attacks of October 2001, and by the Sverdlovsk accident in 1979, which resulted in human fatalities as far as four kilometers away from the release site. However, anthrax is not contagious; only those directly exposed can develop infection.

Infection and Treatment

Although all forms of anthrax are caused by the same bacteria, the effects are very different depending on how the organism enters the body. Inhalational or pulmonary anthrax, which affects the respiratory system, is the most lethal form of exposure to the disease and is therefore currently believed to be the form most likely used in a terrorist attack. Once inhaled, the tiny anthrax spores (one to five microns in size, less than one-twentieth the diameter of a human hair), enter the lungs' alveoli, or air sacs, where blood is oxygenated. Authorities originally believed that at least 10,000 spores were needed to infect a human being, but the October 2001 attacks suggest that much smaller amounts—perhaps just a few thousand—might be enough to cause infection. From the lungs, the infection spreads to the lymph nodes in the chest, and within hours or days, the bacteria begin producing large amounts of a deadly toxin.

Anthrax infection progresses in two phases, the first of which brings flu-like symptoms including fever, nausea, vomiting, aches and fatigue. As with most other biological agents, these symptoms are nonspecific and often resemble the flu so that the initial diagnosis is likely to be incorrect. Health care workers will have to be extremely vigilant to notice a sharp rise in similar cases or in slightly unusual symptoms. The first symptoms usually appear in one to seven days after exposure but in some cases can appear more than a month later. A short recovery-like period sometimes follows the first phase, but the infection progresses to its final phase within two to four days of the onset of symptoms. The second set of symptoms is characterized by respiratory distress and failure, shock and sometimes death. Untreated inhalational anthrax has a fatality rate of approximately 90 percent. Aggressive long-term treatment with antibiotics may reduce the fatality rate to 30 percent.

Antibiotic treatment is most successful if begun before the toxin is released, which can occur anywhere from hours to days after exposure. An anthrax vaccine exists, but it is not a treatment option; it is effective only if the first of six inoculations is given at least four weeks before exposure. The vaccine is presently given only to those considered to be at a heightened risk of exposure, including lab workers and certain members of the armed forces. It consists of three injections given two weeks apart, followed by three more injections at six, 12 and 18 months. Annual booster injections are recommended to maintain immunity.

Alternate Forms of Exposure

Anthrax also can infect humans through the skin (the cutaneous form) or through the digestive system (the intestinal form). Cutaneous anthrax infections occur when open wounds or cuts come in contact with the anthrax bacterium. The resulting infection appears one to seven days after exposure and is characterized by sores that progress to black scabs. Systemic infections may develop from these sores, but cutaneous anthrax is eminently treatable with antibiotics.

Naturally occurring gastrointestinal anthrax results from ingestion of meat contaminated with anthrax bacteria; symptoms usually occur within two to five days and include stomach pain, diarrhea, fever and septicemia (bacteria in the blood). Untreated, gastrointestinal anthrax will kill about 50 percent of patients, but antibiotic treatment can greatly reduce this fatality rate.

Prevalence

Anthrax is widely available. The bacterium occurs naturally in domestic livestock and certain wildlife, and is currently legally studied at more than 2,000 facilities in the United States alone. The sheer number of people with access to these facilities greatly increases the likelihood that access privileges could be abused for sinister purposes, either by carrying out an attack themselves or by selling anthrax. The sophistication and specific strain of the anthrax used in the attacks through the U.S. mail in 2001 suggest that it originated in a laboratory. Until relatively recently, strains of anthrax were available through the mail for research. It is not known if any such samples were shipped to people with illegal or terrorist intents. However, records recently scrutinized by Congress show that the U.S. government allowed the CDC and a biological sample company to export strains of anthrax and other deadly biological agents to Iraqi sites during the 1980s.

Summary

While cutaneous and gastrointestinal anthrax produce severe symptoms and can be fatal, neither approaches the lethality of inhalational anthrax as a bioweapon. Inhalational anthrax is a dangerous weapon due to its stability in the environment, its widespread availability, and its high lethality. Its usefulness to terrorists is compromised only by the degree of skill and equipment needed to make it a viable weapon and by the fact that it is not contagious.

The first symptoms of anthrax usually appear in one to seven days after exposure but in some cases can appear more than a month later.

Botulinum toxin could be employed as a bioweapon via aerosol dissemination or the intentional contamination of food or drinks.

Botulinum Toxin

Short Description

Botulinum toxin is produced by the bacterium *Clostridium botulinum* (clos-TRI-dee-um bah-tchoo-LINE-um) and is the most poisonous substance known to man. The toxin produces a descending paralysis known as botulism, which is most often traced to the consumption of improperly canned or undercooked food tainted with the bacterium. Botulinum toxin could be employed as a bioweapon via aerosol dissemination or the intentional contamination of food or drinks. The latter is considered the likeliest method for a bioterror attack because it is the easiest to carry out, requires the least amount of bioengineering, and maintains the toxicity of the agent. Botulism is not contagious; only those who ingest or inhale the toxin become ill.

Infection

Botulinum toxin can cause disease in humans via four different routes, only two of which are relevant to bioterror: ingestion and inhalation. If botulinum toxin is ingested through contaminated food or drink, it affects nerve transmission, resulting in muscle paralysis. In the case of food-borne botulism, the first symptoms of this paralysis usually appear within 12 to 36 hours after ingestion and include double vision, drooping eyelids, dry mouth and difficulty swallowing and talking. Paralysis then spreads from the face and neck in a descending fashion to the rest of the body, eventually paralyzing respiratory muscles and often leading to death from respiratory failure. About 60 percent of those with untreated ingestional botulism will die.

Botulinum toxin also can be inhaled, but this second possible method of bioterror attack is considered less likely because it would be more difficult to carry out and could be less effective. Botulinum toxin is unstable in the environment, and a high degree of technical expertise would be necessary to render it suitable for aerosol release.

Treatment

A commercially available antitoxin can halt the spread of paralysis caused by botulinum toxin, but it must be administered soon after the onset of symptoms. It would not reverse paralysis that already has occurred. Further treatment such as respiratory support may be required to sustain life, depending on the degree of paralysis. Paralysis will generally diminish with time.

A vaccine exists but is presently used only for laboratory workers and troops deployed to high-risk areas. The vaccine is in short supply and is very painful to receive. It also is not effective against all forms of the toxin. These factors, plus the current usage of botulinum toxin to treat certain medical conditions, make mass vaccination impractical and unlikely.

Alternate Forms

Botulism can occur in humans in two additional forms not relevant to bioterror. Infantile botulism occurs when children less than one year old ingest large amounts of the spore form of the *Clostridium botulinum* (not harmful to older children and adults). Wound-type botulism is extremely rare and occurs when an open wound comes into contact with *Clostridium botulinum*. Wound-type botulism progresses similarly to the ingestional form.

Prevalence

Clostridium botulinum occurs naturally in soil, and thus it is widely available. While this is a good source of toxin suitable for contaminating food or drink, the toxin must be highly refined to function efficiently as an aerosol. The Japanese cult Aum Shinrikyo failed to produce an effective aerosol form of botulinum toxin despite significant funding and scientific expertise. The Soviets devoted significant attention to developing botulinum toxin as a bioweapon, and the stores of toxin and the scientists who produced them are unaccounted for.

Summary

The high toxicity of botulinum toxin, its wide availability and the probable need for long-term medical care for infected persons make it an effective bioweapon. The progressive paralysis of botulism is a particularly dramatic symptom that would make noninflammatory media coverage even more difficult; this paralysis joins the disfiguring blisters of smallpox as symptoms that pose a particular risk of causing a disproportionate amount of fear in those watching television media coverage or reading written accounts.

Plague

Short Description

Plague is the disease caused by infection with the rod-shaped bacterium *Yersinia pestis* (yur-SIN-ee-a PESS-tiss). Plague does not receive as much public attention as anthrax or smallpox, but its lethality, contagiousness and infectivity make it one of the most deadly and potentially effective bioweapons. Pneumonic plague (deemed the most likely form of plague to be used in a bioterror attack) has a lethality rate of almost 100 percent if left untreated and approximately 50 percent if treated—high enough to make overcoming the difficulty of acquisition, refinement and dissemination well worth a terrorist's while.

Infection

Plague is naturally transmitted to humans either by inhalation or by the bite of a flea that has previously bitten a rodent infected with the bacterium. In the case of a bioterror attack, the bacterium might be released in an aerosolized form into the air. Refining the bacteria to an effective, airborne form that can cause pneumonic plague requires a high degree of technical expertise. Moreover, plague is not extremely stable; it degrades in sunlight or heat but can remain viable for up to a year in the soil.

Plague infection in humans can take three forms: pneumonic, bubonic and septicemic. As previously mentioned, pneumonic plague is thought to pose the greatest risk for a bioterror attack because it infects people more easily than the other forms and also is the only form that is contagious. Pneumonic plague results from the inhalation of the bacteria into the lungs or from the spread of infection of the septicemic form. Once inhaled into the lungs, symptoms usually appear after two to four days and include a cough-producing bloody mucus, fatigue, fever, diarrhea, nausea and vomiting. The infection can pass from an infected individual to others by coughing. A full pulmonary infection follows the initial symptoms, and death can follow within a day or two if the infection is not treated early and aggressively.

Treatment

Successful treatment of pneumonic plague requires antibiotics within 24 hours of exposure. The immediacy of the need for treatment would make a large-scale response effort especially difficult to coordinate; while individuals exposed to smallpox must be vaccinated within four days of exposure, those with plague have only hours to receive treatment. No accepted plague vaccine exists today. However, a vaccine developed at Porton Down defense research laboratory in England has passed initial safety tests and as of February 2004 was expected to be made available for widespread use within one to two years.

Alternate Forms of Infection

The bubonic form of plague occurs when an infected flea bites an individual. Instead of infecting the lungs, as in the pneumonic form, bubonic plague infects the lymphatic system. The first symptoms, including weakness, fever and chills, generally appear two to eight days after exposure. These initial symptoms are followed two to four days later with the characteristic and painful swelling of the lymph nodes (called buboes). Untreated, death can follow within a few days. Bubonic plague is not contagious.

Septicemic plague can occur when the plague infection enters the bloodstream, leading to internal

Smallpox contagiousness begins only with the appearance of a rash, generally two to three days after the onset of the initial symptoms.

hemorrhaging and, without prompt treatment, rapid death. Septicemic plague is not contagious.

Prevalence

About 1,500 plague infections occur naturally each year in the world. While most of these infections are of the bubonic type, outbreaks of pneumonic plague could become epidemics and breed public panic. Laboratories around the world study plague bacteria, and while these samples are protected, there are no assurances that these safeguards are 100 percent effective. Plague was among the biowarfare agents most intensely studied and most massively produced by the Soviet biowarfare program. Hundreds of tons of the bacterium were produced, and similar to fears concerning smallpox, the fate of these stockpiles remains unknown, as do the present locations of many of the scientists who worked on developing plague as a weapon.

Summary

While some biowarfare agents garner more media and public attention than they warrant (e.g., smallpox and Ebola), plague has received perhaps less attention than it is due. With its high infectivity, high contagiousness and high fatality rates, plague's serious threat status as a bioweapon is diminished only by its instability in the environment and the degree of technical sophistication required to refine it and disseminate it effectively.

Smallpox

Short Description

Smallpox, or *Variola* (va-ree-OH-la), is among the few contagious bioterror agents, and its symptoms are particularly severe and permanently disfiguring. Through recorded history, it has killed hundreds of millions of people. These factors make it a particularly fearsome agent and therefore prone to inaccurate or exaggerated perceptions. However, smallpox may not be as effective a bioweapon as many believe. First of all, it is not as contagious as some reports have suggested, requiring direct face-to-face contact and falling somewhere between tuberculosis and chickenpox in the spectrum of contagiousness. Smallpox is lethal in approximately 30 percent of cases, and a concerted, decades-long program based on simple public health measures, containment and targeted vaccination resulted in its control and eventual eradication. The last naturally occurring case was in Somalia in 1977. As described in Richard Preston's 2002 book "The Demon in the Freezer," smallpox is the potential biological weapon that many specialists fear most.

Infection

The variola virus that causes smallpox belongs to the orthopox virus family. Infection is caused by the inhalation of small fluid droplets, called aerosols, or by direct contact with lesions or contaminated objects. Smallpox has an incubation period of seven to 17 days, with the first symptoms usually appearing 12 to 14 days after exposure. The first symptoms include high fever, backache, headache, fatigue and physical collapse. These symptoms, particularly extreme physical exhaustion and prostration, serve to reduce the virus's transmission rate. There is a common misunderstanding that people infected with smallpox will be mobile in the population while they are contagious. In fact, by the time infected people become contagious, they have usually been experiencing severe physical exhaustion and aches for several days and are unlikely to be out of bed, much less going to work, running errands or visiting heavily populated areas.

Contagiousness begins only with the appearance of a rash, generally two to three days after the onset of the initial symptoms. The rash starts as small pink dots in the mouth and throat and spreads to the face and arms, then to the trunk and legs. The dots progress to form lesions, filling with pus and becoming painful. Within eight or nine days of the onset of the rash, scabs begin to form over the lesions, eventually falling off approximately 14 days after the first onset of symptoms. Victims remain contagious until all the scabs have fallen off, and the scabs usually leave disfiguring scars.

Two other known manifestations of smallpox infection are historically rare but generally fatal: *Purpura variolosa,* or hemorrhagic-type smallpox, which involves a severe loss of blood into the skin and internal organs; and flat-type smallpox, characterized by slow-developing lesions that remain soft to the touch and never rise above the surface of the skin. These variations generally develop in 3 percent and 5 percent, respectively, of persons infected with *variola major. Variola minor,* a variation of the smallpox virus, is less severe than the typical *variola major* strain, killing approximately 1 percent of those infected.

Treatment

No definitive treatment exists for smallpox, but vaccination within four days of infection can prevent or mitigate the effects of the disease. The smallpox vaccine consists of live vaccinia virus and has the highest rate of adverse effects of any commonly used vaccine.

Experience with vaccination in the 1960s suggests that if the entire U.S. population were vaccinated, approximately 1,500 would suffer severe side effects and approximately 300 would die. These estimations do not take into account the fact that compared with the U.S. population in the 1960s, a much larger percentage of today's population is immuno-compromised and therefore more susceptible to complications from the vaccine.

Because the vaccine contains live vaccinia virus, it can cause disease, especially in persons with compromised immunity. It also can, on rare occasions, be transmitted from person to person. HIV/AIDS, past radiation or chemotherapy treatment, past transplant surgery and even a history of eczema all are conditions that increase the likelihood of severe side effects or death from the vaccine. A treatment called vaccinia immune globulin (VIG) can mitigate most severe reactions to vaccinia, and the antiviral medication Cidofovir may be effective in treating certain adverse reactions. Development of a safer vaccine is a high research priority, but the vaccinia vaccine remains the only available method to prevent infection. After the anthrax attacks in 2001, the U.S. government ordered production of enough smallpox vaccine to vaccinate the entire U.S. population, should the decision be made to do so. At this writing, such mass vaccination has not been ordered and a more targeted approach, aimed at front-line medical, law enforcement and emergency personnel is considered more prudent.

In fact, a study published in Science in November 2002 showed that as long as there are some members of the population who have immunity (from childhood vaccinations or from a targeted vaccination program aimed at first-line responders), a targeted approach focused on areas where cases have been reported is more effective than mass vaccination at curbing an outbreak.

Prevalence

Ironically, smallpox was supposed to be the one scourge the world did not have to worry about any more. In 1980, the World Health Organization declared smallpox eradicated, with the last naturally acquired case occurring in Somalia in 1977. After 1980, samples of the virus were supposed to be stored in only two locations: at the CDC facilities in Atlanta and at a Russian laboratory known as Vector, in the town of Koltsovo near Novosibirsk. However, the defection of high-level Soviet biowarfare scientists in the early 1990s brought the massive Soviet biowarfare program to light and revealed that it had produced and tested massive amounts of the virus—a stockpile of 20 tons of weaponized smallpox was maintained as late as the 1980s for immediate use by the Soviet military. The program's smallpox and other biowarfare agents have been unaccounted for—increasing concerns that nations that sponsor terrorism, or sophisticated transnational groups, such as al Qaeda, could have made attractive offers to former Soviet biowarfare scientists looking to escape desperate circumstances in the former USSR. Thus, there is no definitive information on the amount of smallpox at large in the world today. As of November 2002, intelligence reports indicated that four nations harbor unauthorized stocks of the virus: Iraq, North Korea, France and Russia (which also has one of the two

After the anthrax attacks in 2001, the U.S. government ordered production of enough smallpox vaccine to vaccinate the entire U.S. population

Tularemia infection can manifest in a variety of forms, depending on the route of infection and the virulence of the particular strain of the bacterium.

known authorized stocks).While Iraq no longer possesses such stocks, the other three nations are still believed to have supplies of the virus.

Summary

While smallpox is a fatal contagious disease that may presently be in terrorist hands, it is not as contagious as commonly feared, and terrorists with designs to use smallpox in a bioterror attack would encounter some serious obstacles, including accidental infection, difficulty in dissemination and blowback (the spread of infection to those originally disseminating a contagious agent).

Tularemia

Short Description

Tularemia, also known as rabbit fever and deer fly fever, is caused by the *Francisella tularensis* (fran-sis-SELL-ah too-la-REN-sis) bacterium. While neither is easy to disseminate nor particularly lethal, tularemia is one of the most infectious diseases known, making it a serious risk as a bioweapon. Whereas someone must inhale at least several thousand anthrax bacteria to become infected, inhalation of a single tularemia bacterium is sufficient to cause infection. Tularemia is unstable in the environment and particularly susceptible to heat, but it can remain stable for months in moist soil; advanced processes are necessary to stabilize the bacterium for effective dissemination. However, tularemia is not contagious and is eminently treatable with antibiotics, so even if many people became infected, a quick diagnosis and a rapid response could significantly mitigate the effects of an attack.

Infection and Treatment

Tularemia infection can manifest in a variety of forms, depending on the route of infection and the virulence of the particular strain of the bacterium. A bioterror attack would be most dangerous in the case of an aerosol release, causing severe pneumonia in those exposed. As with many other biological agents, a significant degree of technical expertise is required to cultivate the bacterium in a form allowing efficient dissemination. However, because of tularemia's extremely high infectivity, if it is refined and disseminated efficiently, a small amount of agent could infect a very large number of people.

The incubation period for inhalational tularemia is usually three to five days, but it can be as short as one day or as long as two weeks. Initial symptoms include sudden fever, chills, coughing, joint pain, headaches and general weakness. Clinicians will, in all likelihood, have a difficult time identifying tularemia if an attack occurs because these symptoms are common and not easily or immediately differentiated from those of influenza or even the common cold. The inhalational form of tularemia can progress quickly to full-blown pneumonia, with symptoms including shortness of breath, a cough producing bloody mucus, and chest pain. In the absence of treatment, the mortality of inhalational tularemia may be as high as 60 percent; prompt antibiotic treatment, however, reduces the fatality rate significantly.

Of those infected with tularemia through inhalation, a small percentage will develop typhoidal, or septicemic, tularemia instead of pneumonia. This infection is concentrated in the circulatory system instead of just in the respiratory system and may also lead to death if not treated with antibiotics. Typhoidal tularemia presents a diagnostic challenge because, unlike the pneumonic form, it is not detectable by x-ray, and it is characterized only by fever, extreme exhaustion and weight loss. The fatality rate of typhoidal tularemia may approach 35 percent in untreated cases.

A tularemia vaccine exists and was formerly administered only to individuals who work with the bacterium in laboratories, but it is no longer in use. The vaccine took about two weeks to provide protection and was not entirely effective against the inhaled form of tularemia; therefore, it is not considered to be worth using either before or after a biowarfare attack. Another vaccine that should provide better protection against the inhaled form of tularemia is under development.

Alternate Forms

The natural ulceroglandular form of tularemia infection is usually contracted through the bite of an infected tick or fly, or when infected meat comes into direct contact with abraded skin or an open wound. Ulceroglandular tularemia is characterized by the appearance of an ulcer at the infection site and the subsequent swelling of regional lymph nodes. Ulceroglandular tularemia has a lower fatality rate than pneumonic or typhoidal tularemia and is treatable with antibiotics. Tularemia infection can also occur when undercooked, infected meat is consumed.

Prevalence

Tularemia occurs naturally in rodents, but isolating and growing the bacterium from natural sources would require a high degree of expertise. The former Soviet Union, the United States and Japan all developed tularemia as a bioweapon, with the Soviet research continuing into the 1990s. As with many other agents, the mass quantities produced by the Soviet biowarfare program and the scientists behind the program have not been located.

Summary

A very high percentage of those exposed to tularemia would become infected, but it would be only those individuals directly exposed, as tularemia is not contagious. Almost all of those infected can be effectively treated with antibiotics. Tularemia is not highly lethal like anthrax, or highly feared like smallpox, but it is highly infectious, making it a sufficiently dangerous bioweapon to pose a significant threat.

Viral Hemorrhagic Fevers

Short Description

Viral hemorrhagic fevers (VHFs) include four distinct families of viruses: filoviruses (e.g., Ebola and Marburg), arenaviruses (e.g., Lassa), bunyaviruses (e.g., Rift Valley Fever), and flaviviruses (e.g., yellow fever and dengue). All of these viruses can cause severe, life-threatening illnesses, but mortality rates vary tremendously for the different agents. All may cause hemorrhagic syndromes characterized by severe internal and external bleeding. Some VHFs are contagious, including Ebola, Marburg and Lassa.

While the Ebola virus gained widespread notoriety, partly as a result of "The Hot Zone" by Richard Preston and other reports of an outbreak of the disease in a colony of laboratory monkeys and of human outbreaks in Africa, VHFs generally are not considered likely to be developed into highly lethal bioweapons. Many of them incapacitate and kill their victims so efficiently that the virus does not have enough time to infect others, making containment easier and a widespread outbreak much less likely. Even in the event of an outbreak, routine infection control procedures are often adequate to break the cycle of transmission. However, depending on the particular virus, the majority of those infected may die, and those that do will die in a particularly horrifying manner.

All viral hemorrhagic fevers may cause syndromes characterized by severe internal and external bleeding.

Infection

The VHFs are vector-borne diseases, which means they occur naturally in humans only after contact with an infected insect, rodent or larger mammal. This contact can consist of touching fecal matter, receiving a direct insect bite, or handling contaminated meat. However, it is possible that these viruses could be disseminated in an aerosol form in a bioterror attack. The problem lies not in producing the virus but in acquiring a sample and refining it to a form suitable for aerosolization. These viruses are generally unstable in the environment and do not fare well as aerosols; a high degree of technical sophistication would be necessary to make the virus viable as a weapon.

Symptoms of VHFs vary but generally include high fever, dizziness, muscle aches and exhaustion; such nonspecific symptoms make initial diagnosis difficult. Initial symptoms usually appear anywhere

Viral hemorrhagic fevers vary in their potential as bioweapons, in contagiousness and in fatality rates.

from two days to three weeks after exposure. Individuals with severe cases may display signs of bleeding (which usually appear approximately five days after the appearance of initial symptoms). Bleeding can occur from internal organs, under the skin and from the eyes, nose, mouth, ears and other orifices. This bleeding makes for inherently frightening photographs and television footage that could lead to panic out of proportion with the actual situation. Advanced symptoms of VHFs also can include shock, nervous system malfunction, seizures and coma. Fatality rates range from as high as 90 percent for Ebola to less than 1 percent for the arenavirus Lassa.

Treatment

Treatments and vaccines exist for some VHFs but not for others. No treatment or vaccine exists for Ebola or Marburg, but supportive therapy may prevent shock and support organ functions and anecdotal evidence suggests that advanced intensive care can reduce mortality rates. Isolation and decontamination will be critical in stopping the spread of these diseases; the use of gowns and masks, decontamination and disposal of medical equipment, and education about containment can greatly mitigate the effects of an outbreak.

An antiviral drug called ribavirin may treat some VHFs effectively if administered early in the progression of the disease. A vaccine is available for yellow fever that is regularly given to people traveling to areas considered to be high-risk for the disease. Treatments and vaccines for other VHFs, including Ebola, are currently under development.

Prevalence

Accessibility to VHFs varies greatly depending on the specific virus; the viruses of greatest concern (such as Ebola and Marburg) would be very difficult to acquire from the wild because their natural host is unknown and outbreaks are rare. VHFs are studied in some laboratories, but due to the high fatality rate and infectivity of these agents, they are generally studied in high-security laboratories. Research on Ebola and other VHFs was performed as part of the Soviet Union's biowarfare program, raising the same security issues described above for the other agents.

Summary

Viral hemorrhagic fevers vary in their potential as bioweapons, in contagiousness and in fatality rates. One of the main factors to consider in the event of a bioterror attack using a VHF would be the public's fear and panic due to prior exposure to the gruesome effects of these viruses (or fictionalized viruses based on VHFs) through books and movies such as "The Cobra Event" by Richard Preston and the movie "Outbreak."

Category B Agents

The Centers for Disease Control and Prevention defines as Category B those potential biological weapons that are considered the second-highest priority, because they are moderately easy to disseminate, cause moderate amounts of disease and low fatality rates, but may require specific public-health action such as improved diagnostic and detection systems. The CDC revises the list periodically.

The agents currently listed as Category B are:

Brucellosis *(Brucella)* (broo-sul-OH-sis, broo-SELL-a) — This toxin is quite potent - it takes fewer than 100 of the Brucellosis bacteria to produce infection. Its lethality rate is low (fewer than 5 percent of infected individuals will die), but it is very stable in the environment. Incubation period is five to 60 days, and the illness itself can last for weeks to months once symptoms begin. There is no vaccine.

Enterotoxin B (produced by *Staphylococcus*) (STAFF-ill-oh-CAW-cuss) — This toxin, produced by staph bacteria, can cause illness within a few hours to six days, but has a very low lethality rate (less than 1 percent), and illness only lasts a few hours. It is stable in the environment, and can even survive freezing. There is no vaccine.

Epsilon toxin (produced by *Clostridium perfringens*) (claw-STRID-ee-um per-FRINGE-enz) — A common cause of food poisoning, especially from improperly cooked beef or chicken.

Glanders (*Burkholderia mallei*) (ber-cold-AIR-ee-ah MAL-ee-aye)—This bacterial disease is highly lethal, killing more than 50 percent of those exposed. Distributed in aerosol form, it produces symptoms within 10 to 14 days, and leads to death from septicemia (blood infection) within seven to 10 days of the onset of symptoms. It can be transmitted from person to person, but at a low rate. It is stable in the environment, and there is no vaccine.

Q fever (*Coxiella burnetti*) (cock-see-ELL-ah ber-NET-ee)—A bacterial disease that can be spread in aerosol form. It has an incubation period of 14 to 26 days, can kill within weeks, and is quite stable in the environment once dispersed—it can persist for months on wood or sand. It can be transmitted from person to person, but this is rare. Vaccination has proved effective in animal tests.

Ricin (toxin from *Ricinus communis,* or castor beans) (Rye-sin-us com-YOU-nis)—This naturally-produced toxin could be spread in aerosol form, and can produce symptoms within hours to days. It is stable in the environment, and can be fatal within 10 to 12 days.

Viral encephalitis—(alphaviruses, such as Venezuelan equine encephalitis, Eastern equine encephalitis, Western equine encephalitis)—A viral disease, it is unstable once dispersed, so only those directly contaminated in the initial attack will become ill. It has a low lethality rate, producing symptoms in one to six days.

Food safety threats (e.g. *Salmonella* species, *Escherichia coli* O157:H7, *Shigella*) — Globally, the various species of *Shigella* bacteria cause 600,000 deaths per year, usually through contaminated water or food. Symptoms begin with diarrhea, and proceed to seizures and sepsis. No vaccine exists, but treatment with antibiotics is usually effective with most strains. Some drug-resistant strains exist, however. *E. coli* has been responsible for outbreaks of food poisoning from ground beef.

Water safety threats (e.g. *Vibrio cholerae, Cryptosporidium parvum*)—For example, cholera (caused by the Vibrio cholerae bacterium) is unstable in the air or fresh water, but remains stable in salt water. It can be transmitted from person to person, but this is rare. Its symptoms begin to appear within four hours to five days (typically, two to three days). The illness last for a week or more, and is highly lethal without treatment, but has a low mortality rate with treatment.

Other category B agents (see Glossary for definitions):

Melioidosis (*Burkholderia pseudomallei*) (MELL-ee-oy-DOE-siss; burr-cold-AIR-ee-ah sue-doe-MAL-ee-eye).
Psittacosis (*Chlamydia psittaci*). (clam-ID-ee-ah sit-ACK-ee).
Typhus fever (*Rickettsia prowazekii*) (rick-ETT-see-ahh pro-ah-ZEK-ee-aye).

Category C Agents

The Centers for Disease Control and Prevention has classified some agents as Category C, considered the third-highest priority, because although they are not considered effective biological weapons in their present form, they might be developed or genetically engineered as weapons in the future. They are for the most part easily available, easy to produce and disseminate, and have a potential for producing high rates of disease and mortality. The CDC describes Category C as "emerging infectious disease threats" and lists only two specific examples (Hantavirus and Nipah virus).

Hantavirus (HAN-tah)—Carried by rodents and mostly transmitted through their droppings, this virus was responsible for an outbreak of disease in Arizona and New Mexico in 1993. It causes Hantavirus Pulmonary Syndrome (HPS), which has now been identified in eight other countries besides the United States (all in the Americas). It has been fatal in 45 percent of reported cases, causing death through pulmonary edema and respiratory distress. There is evidence of human-to-human transmission.

Nipah Virus (NEE-pah)—A "new" virus, it was discovered in Malaysia in 1999, closely related to Hendra virus, discovered in Australia. Both of these are *Paramyxoviridae*. It infects both animals (mostly pigs) and humans, and has a high mortality rate (50 percent). It begins with flu-like symptoms, and can progress to encephalitis (brain inflammation) and coma.

Other possible biological weapons

A variety of other agents have been developed, and in some cases even stockpiled, by some nations as possible biological weapons. Others have been named by the World Health Organization and other agencies as possible bioweapons. Some of these are specific examples that fall within categories already included in the CDC list. Since many of these agents were actually developed for warfare by at least one nation, their potential as weapons is not just theoretical. In addition to those described previously, these include the following.

Aflatoxin (AFF-lah-TOCK-sin)—Although not usually considered a candidate for a biological weapon, primarily because its effects tend to be very long-term (cancer and respiratory disease that take years to develop), aflatoxin was in fact produced on a large scale as a weapon, mounted in munitions and missiles, and perhaps used against Iranian civilians, by Iraq in the 1980s and 1990s. Although technically a chemical weapon, it is produced by fungi and therefore sometimes classified with biological weapons.

Multi-drug-resistant tuberculosis—Tuberculosis, now rare in most countries, remains a major killer in developing nations. It kills about 2 million people per year. Normally, antibiotic treatment cures 95 percent of cases, but the resistant strains may require aggressive chemotherapy treatment for up to two years. Recent studies show that more than 4 percent of new cases are of the multi-drug resistant type (MDR-TB).

Tricothecene mycotoxins (try-CAW-the-seen MY-co-TOCK-sins)—This natural toxin could be distributed in an aerosol form, and begins to produce symptoms within two to four hours (one of the fastest-acting biological agents) which can persist for days to months. It is moderately lethal, and extremely stable—at room temperature, it can remain dangerous for years. There is no vaccine.

Other possible agents:

Bacteria: Trench fever (*Bartonella quintana*) and scrub typhus (Orientia tsutsugamushi).

Fungi: Coccidioidomycosis (*Coccidiodes immitis*) and histoplasmosis (*Histoplasma capsalatum*).

Protozoa: Naegleriasis (*Naeglaeria fowlerii*), toxoplasmosis (*Toxoplasma gondii*), and schistosomiasis (*Schistosoma*).

Viruses: Hantaan/Korean hemorrhagic fever, sin nombre, Crimeo-Congo hemorrhagic fever, lymphocytic choriomeningitis, Junin (Argentine hemorrhagic fever), Machupu (Bolivian hemorrhagic fever), tick-borne encephalitis, Russian spring-summer encephalitis, Omsk hemorrhagic fever, Japanese encephalitis, Chikungunya, O'nyong-nyong, monkeypox, white pox (a variant of *variola*), and influenza.

Agent Type	Structure	Usual Transmission	Incubation	Treatment
Bacteria	Single-celled organisms	Inhalation, ingestion, insect bite, wound exposure	1 week (range hours to months)	Antibiotics, prophylactics vaccination
Virusus	DNA, RNA requiring other cells to replicate	Inhalation, insect bite	1-2 weeks (range 2 days to 3 weeks)	Antivirals, vaccination
Rickettaias	Bacteria requiring other cells to replicate	Inhalation, insect bite	1-2 weeks (range 3 days to 2 weeks)	Antibiotics
Toxins	Poisonous substances produced by animals, plants, etc	Inhalation, ingestion, injection	5 minutes-several hours (range 5 minutes to 12 hours)	Anti-sera, specific pharmacological preparations

Agricultural bioterrorism

Although most concerns have focused on human pathogens, a biological attack against crops or livestock is also considered a possibility. A study by the National Research Council concluded that such an attack would almost certainly not be capable of producing famine or widespread malnutrition in the United States, but it could nevertheless have a severe economic impact. One study showed that an outbreak of foot and mouth disease (a cattle disease) in California alone, even if contained within three months, could cause a loss of $6 billion to $13 billion.

Some of the plant and animal diseases considered to pose the greatest threat:

Avian flu—Can have a serious economic impact. An outbreak in the United States in the mid-1980s resulted in the destruction of 17 million birds at a cost of $65 million. Found in humans only in Vietnam and Thailand as of early 2004.

Foot and mouth disease (**FMD**)—Can have serious economic impact, though its effects on cattle are relatively minor. To avert potential losses from exports, Taiwan spent $4 billion in an attempt to eradicate the disease in 1997, without success.

Karnal bunt of wheat—Even though it has little impact on wheat productivity, 80 countries ban wheat imports from areas where the disease has been found. A single outbreak in Arizona in 1996, probably because of an accidental introduction across the border from Mexico, posed a threat to that state's $6 billion in wheat exports, and caused over $100 million in actual losses, in addition to $60 million spent on control efforts.

Mad Cow Disease (**MCD**)—Though its actual impact on cattle is relatively minor, outbreaks have had devastating economic impact, as in England and much of Europe in 1996. In Japan in 2001, the detection of just three cases of the disease led to a 50 percent reduction in beef sales. So far, there have only been two documented U.S. cases, in late 2003, which were both traced to cows from a Canadian herd.

Swine fever—An outbreak in the Netherlands in 1997-'98 was caused by swine imported from Germany, and illustrated how a rapid outbreak could follow a single introduction into a previously uninfected country.

Other plant pathogens that have been named as possible weapons include **stem rust** (in wheat), **sorghum ergot,** and **barley stripe rust.**

There is no accepted list of the most likely biological agents that might be used against crops, and some researchers have suggested (e.g. Wheelis et al., BioScience, July 2002) that developing such a list is an important first step toward monitoring to detect a possible attack. At present, an outbreak might progress to a point at which control will be difficult and expensive before being detected.

Some other nations, with a less diverse agricultural base than the United States, could suffer more serious health and economic effects from such an attack.

Laws and Treaties That Govern Biological Warfare

Several international covenants currently pertain to biological warfare and bioterrorism. They vary in their language and membership, but none have verification or enforcement regimes, so some signatories and "states parties" (those nations that have both signed and ratified the covenants) do not adhere to their provisions.

The Biological and Toxins Weapons Convention

Short Description

The most widely established covenant is the Biological and Toxins Weapons Convention (BWC), which prohibits the development, production, stockpiling or acquisition of biological agents or toxins "of types and in quantities that have no justification for prophylactic, protective and other peaceful purposes." The BWC also forbids weaponization of biological agents and toxins as well as developing means of dissemination. It does allow defensive biological warfare research, including the development of vaccines and protective equipment. No verification regime has been established, and the convention requires only that parties voluntarily provide information about national biological activity. The convention was signed in London, Moscow and Washington, D.C. in April 1972 and entered into force in 1975. There are currently 167 signatories, 151 of which have ratified the convention.

A review conference is held every four years, and recent conferences have focused on establishing verification measures. The last review conference took place in Geneva in November 2002 despite some pressure from the Bush administration to delay further discussions until 2006. The administration contended that treaty revisions proposed by European Union and other countries—such as a legally binding enforcement protocol—would not work to deter state sponsors of terrorism from developing biological weapons and should not be pursued at this time.

However, the 2002 meeting decided to try to accelerate progress by planning a series of annual meetings to take place before the next formal meeting in 2006. These are expected to be preceded by two-week meetings of experts. The focus in 2003 was on national measures to adopt the convention's prohibitions, and on ways to ensure the security of pathogens. In 2004, the focus is on enhancing international coordination for responding to biological attacks or investigating new outbreaks of disease, and in 2005 the focus will be on codes of conduct for scientists.

Citations

The following paragraphs encapsulate the BWC's key provisions:

The Biological and Toxins Weapons Convention also forbids weaponization of biological agents and toxins as well as developing means of dissemination.

The Geneva Protocol was signed in 1925 and entered into force in 1928. The protocol currently has 132 states parties (nations that have signed and ratified the Protocol) and one signatory.

"The States Parties to this Convention,

"Determined to act with a view to achieving effective progress towards general and complete disarmament, including the prohibition and elimination of all types of weapons of mass destruction, and convinced that the prohibition of the development, production and stockpiling of chemical and bacteriological (biological) weapons and their elimination, through effective measures, will facilitate the achievement of general and complete disarmament under strict and effective international control,

"...Determined, for the sake of all mankind, to exclude completely the possibility of bacteriological (biological) agents and toxins being used as weapons,

"Convinced that such use would be repugnant to the conscience of mankind and that no effort should be spared to minimize this risk,

"Have agreed as follows:

"...never in any circumstances to develop, produce, stockpile or otherwise acquire or retain:

"(1) Microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes;

"(2) Weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict."

Further articles of the BWC discuss the destruction of existing weapons, export control of agents and the technology required to produce them, adherence to the Convention, and periodic review conferences.

Status of State Sponsors of Terrorism

Iraq, Iran, Libya and Cuba all signed and ratified the convention. Syria signed the convention but did not ratify it. North Korea and Sudan are not signatories.

The Geneva Protocol

Short Description

While the BWC is currently the primary covenant on biological weapons, the Geneva Protocol was the first multilateral international agreement to address chemical and biological weapons. It bans "the use in war of asphyxiating, poisonous or other gases and of all analogous liquids, materials or devices" and prohibits "bacteriological methods of warfare." The Geneva Protocol is considered part of customary international law and therefore binds even states that are not signatories to it. The protocol has no verification regime, and many of the signatories have stated that if chemical or biological weapons were used against them, they reserve the right to respond in kind. The protocol was signed in 1925 and entered into force in 1928. The protocol currently has 132 states parties (nations that have signed and ratified the Protocol) and one signatory.

Citations

The following text summarizes the Geneva Protocol:

"Whereas the use in war of asphyxiating, poisonous or other gases, and of all analogous liquids, materials or devices, has been justly condemned by the general opinion of the civilised world; and

"Whereas the prohibition of such use has been declared in Treaties to which the majority of Powers of the world are Parties; and

"To the end that this prohibition shall be universally accepted as a part of International Law, binding alike the conscience and the practice of nations;

"Declare:

"That the High Contracting Parties, so far as they are not already Parties to Treaties prohibiting such use, accept this prohibition, agree to extend this prohibition to the use of bacteriological methods of warfare and agree to be bound as between themselves according to the terms of this declaration."

Status of State Sponsors of Terrorism

Iran, Iraq, Libya, Sudan, Syria, North Korea and Cuba all signed and ratified the Geneva Protocol.

Australia Group

Short Description

The Australia Group is a loose association of nations that agree not to export materials that could be used to produce chemical or biological weapons. The Group formed in 1985 in response to the revelation that chemical weapons had been used in the Iran-Iraq war and began to address biological issues in 1990 as evidence suggested that legal biological equipment was being used for illegal purposes. The list of controlled items for biological weapons includes both technological items for production and specific agents and toxins. The Group meets annually to discuss how best to create and enforce export controls to help stem the proliferation of chemical and biological weapons. The agreement is not legally binding, so the Group strives to ensure that the export control measures are easy to implement and do not interfere with regular trade, while remaining effective in preventing proliferation. The Group presently has 34 participants, all of which are parties to the Biological Weapons and Toxins Convention.

Citations

The Group's written objectives state the following:

"The principal objective of participants in the Australia Group is...to ensure, through licensing measures on the export of certain chemicals, biological agents, and dual-use chemical and biological manufacturing facilities and equipment, that exports of these items from their countries do not contribute to the spread of CBW. The Group does this through consultation and harmonisation, thus maximising the effectiveness of participants' national licensing measures. The Group's activities are especially important given that the international chemical and biological industries are a target for proliferators as a source of materials for CBW programs.

"Participating countries have recognised from the outset that export licensing measures are not a substitute for the strict and universal observance of the 1925 Geneva Protocol and the 1972 Biological and Toxin Weapons Convention (BWC) and the early implementation of and universal adherence to the Chemical Weapons Convention (CWC), which entered into force on 29 April 1997. All members of the Australia Group are States Parties to both the BWC and the CWC.

"...Export licensing measures also demonstrate the determination of participating countries to avoid not only direct but also inadvertent involvement in the spread of chemical and biological weapons, and to express their opposition to the use of these weapons."

Status of State Sponsors of Terrorism

Iran, Iraq, Libya, Syria, Sudan, North Korea and Cuba are not members of the Australia Group.

The Need for New Criminal Laws

A number of groups, notably the Harvard-Sussex Program, have long advocated a new international criminal law that would classify the use of biological weapons as a crime with universal jurisdiction, a category already applied to such crimes as airplane hijacking, hostage taking, the theft of nuclear materials, and piracy. At present, the treaties described above technically apply only to the actions of nations against other nations, and do not explicitly prohibit the use of biological weapons by individuals, terrorist organizations or by a nation's military against its own citizens (as, for example, in the case of Iraq's use of chemical and perhaps biological weapons against its own Kurdish population). Some nations, including the United States, have individually enacted such laws, but there is at present no such international agreement.

As the Harvard-Sussex Program notes, "Treaties defining international crimes are based on the

The Australia Group is a loose association of nations that agree not to export materials that could be used to produce chemical or biological weapons.

concept that certain crimes are particularly dangerous or abhorrent to all and that all states therefore have the right and the responsibility to combat them. Certainly in this category, threatening to the community of nations and to present and future generations, are crimes involving the hostile use of disease or poison and the hostile exploitation of biotechnology."

In the wake of the 2001 terrorist attacks, there has been some increased pressure to enact such a law, and Canada has formally proposed doing so. At this writing, no action had been taken on this proposal.

The project has produced a draft convention that would make it a crime under international law "for any person knowingly to develop, produce, acquire, retain, transfer or use biological or chemical weapons or knowingly to order, direct or render substantial assistance to those activities or to threaten to use biological or chemical weapons. Any person who commits any of the prohibited acts anywhere would face the risk of prosecution or extradition should that person be found in the territory of a state that supports the proposed convention."

The Harvard Sussex Program notes that with such a convention in place, "the norm against chemical and biological weapons would be strengthened, deterrence of potential offenders would be enhanced, and international cooperation in suppressing the prohibited activities would be facilitated."

Although the Netherlands has shown interest in the draft convention, so far no nation has formally submitted it to the United Nations General Assembly, which would have to approve it.

Who Has Biological Weapons?

Nation States

Conventions and covenants, no matter how carefully laid out or widely ratified, cannot stop nations from developing biological weapons. A number of nations, some of which are signatories of the BWC and/or the Geneva Protocol, currently are believed to have biological weapons programs or to be pursuing them. Definitive information on exactly which nation states have biological weapons is hard to come by. There is a strong international norm against the production and use of biological weapons. Openly violating this norm or the numerous agreements prohibiting the sale, production, stockpiling and use of these weapons would necessarily condemn the nation or group before most of the world, resulting in sanctions and other diplomatic, economic or even military actions. Below is an alphabetical list of nation states believed to have biological weapons; because of the aforementioned factors, this list is probably incomplete.

China

China denies having a biological weapons program, but some international intelligence sources claim to have evidence that a program exists.

France

According to intelligence reports in November 2002, France is believed to be one of four nations that possess unauthorized stocks of the smallpox virus (the others at the time were Iraq, Russia and North Korea). The French government has said such stocks, if they exist, are solely for the development of vaccines.

Iran

Iran is believed to have large stockpiles of biological weapons, although intelligence on Iran's program is sparse.

Iraq

The United Nations Special Commission (UNSCOM) was established in the wake of the 1991 Gulf War by the U.N. Security Council to oversee the destruction of Iraq's weapons of mass destruction stockpiles. UNSCOM began inspections in 1991 and discovered that Iraq had produced 19,000 liters of botulinum toxin, 8,400 liters of anthrax, and 2,000 liters of aflatoxin and clostridium, much of which had been mounted in munitions and warheads. In fact, UNSCOM estimated that Iraq may have produced 10 billion doses of these three agents-more than enough to infect every human on Earth. The agents were primarily produced in facilities at Al Hakam and Al Salman, but a total of 86 sites may have been involved in the program. In 1988, it had imported 39 tons of growth medium for agents such as anthrax and botulinum toxin. UNSCOM destroyed much of the growth medium, but as much as 17 tons remain unaccounted for. Iraq admitted to having missiles tipped with warheads containing biological weapons agents during the Gulf War. Iraq ceased cooperation with UNSCOM in 1998 and inspections ended.

In 2002, inspections resumed under pressure from the U.S. and a new U.N. resolution. In February 2003, having declared the inspections inadequate, the U.S. attacked Iraq, citing evidence of weapons of mass destruction, including biological weapons, as a major reason for the attack. Subsequent inspections, however, have found no evidence of such agents. Most analysts now

A number of nations, some of which are signatories of the BWC and/or the Geneva Protocol, currently are believed to have biological weapons programs or to be pursuing them.

With the advent of the Internet, the increase in global trade and travel, and the dissolution of the Soviet Union, accessibility to information about making and using weapons of mass destruction has increased rapidly.

conclude that any such weapons Iraq may have still had after the 1991 Gulf War were destroyed long before the 2003 attack, and all that remained was the knowledge of some scientists and technicians who had experience in setting up production facilities for such agents. It remains unclear why Saddam Hussein had resisted inspection efforts if no such weapons were present.

Israel

Israel is believed to have a biological weapons program, but the details are not known.

Libya

Libya was believed to have been pursuing a biological weapons program, but the status of the program was unknown. As of early 2004, Libya was fully cooperating with international inspectors and the details of its biological weapons program are expected to emerge.

North Korea

North Korea is suspected to have a large stockpile of biological weapons, but details are not known. Both Russian and U.S. intelligence sources have reportedly claimed there is evidence that North Korea has worked on development of weapons using anthrax, cholera, bubonic plague and smallpox. Intelligence reports in November 2002 identified North Korea as one of four nations believed to possess unauthorized stocks of smallpox virus.

Russia (Former Soviet Union)

The former Soviet Union had a massive biological weapons program, with scores of laboratories scattered across thousands of miles, employing tens of thousands of people. Several high-level defectors in the 1990s revealed the extent of the program, which produced hundreds of tons of anthrax and dozens of tons of smallpox and plague, among many other viruses, bacteria and toxins. Ken Alibek, former director of this program, has written that at least 70 different biological agents were identified as potential weapons, and 11 were actually developed by the Soviet Union as weapons. When this offensive program ended with the dissolution of the Soviet Union in 1992, Russia committed to destroying existing stockpiles. However, the whereabouts of supplies, samples of agents and many of the scientists who spent their careers researching and developing them are unknown. Nations seeking to develop biological weapons programs recruited some of these scientists, and samples of viruses and bacteria might have gone with them. Samples and supplies also might have been sold through the mail. Russia's Vector Laboratory is the repository of one of the world's two known, authorized samples of smallpox virus, but Russia is also believed to posses unauthorized samples.

Syria

Syria is believed to be pursuing a biological weapons program, but the status of the program is unknown.

Transnational Groups

With the advent of the Internet, the increase in global trade and travel, and the dissolution of the Soviet Union, accessibility to information about making and using weapons of mass destruction has increased rapidly. Transnational groups may have been the biggest beneficiaries of this change; expertise, equipment and supplies formerly possessed only by nations sponsoring biological weapons programs now are available to anyone with the interest and a fistful of money. But which groups have these weapons?

While it is difficult to estimate nation states' biological warfare capacities, it is even harder to gather information on the capabilities of transnational groups. By definition, they are not traceable to a single location, and their organizational structures and activities are more opaque than those of states. What these groups lack in size, compared to states, they compensate for in terms of advanced infrastructures and significant resources. With states' sponsorship, they become even more effective in planning, carrying out and getting away with terrorist attacks. While a transnational group might not possess laboratory equipment or scientific expertise, a state sponsor with an established program may provide biological weapons for the group's use.

Aum Shinrikyo was not even on the radar as a terrorist group until its Sarin attack on the Tokyo subway in 1995, yet the cult had been experimenting with chemical and biological weapons for years. It had even carried out several botched biological weapons attacks in Tokyo without anyone noticing. Present knowledge of transnational groups' biological weapons capabilities is poor at best, almost nonexistent at worst.

Determining the extent of al Qaeda's capabilities is obviously a priority now. While evidence exists that the group possesses a solid chemical weapons capability, definitive information about its biological capability is not presently available. Some international intelligence suggests that the well-funded, well-connected group is on its way with purchases of laboratory equipment and the distribution of a how-to guide for manufacturing biological weapons.

What Can Be Done for Defense

Intelligence, both domestic and international, is an important building block in the preparedness structure.

A Good Offense

While the United States no longer has an offensive biological weapons program, the government maintains a defensive program. Designed to respond to a variety of potential threats, it includes aggressive measures to develop early warning systems; educate first responders and the public health community; produce and stockpile vaccines, antibiotics and other medical supplies; establish efficient laboratory capabilities; and expand hospital systems to accommodate attack victims.

Inter- and intraorganizational exercises and tabletops (verbal exercises carried out around a table instead of full-scale in the field), ever-improving work on modeling (computer simulations of infection progressions and patterns), and more aggressive intelligence gathering are just some of the ways in which the United States has and can actively increase preparedness for a biological attack. Key areas that will require extra attention and unprecedented cooperation include intelligence, international cooperation and public communications.

Intelligence, both domestic and international, is an important building block in the preparedness structure. Because of the crucial time elements involved in biological warfare, prior knowledge of a possible attack could drastically mitigate its effects. A study published in 2003 by Abt Associates found that a worst-case bioweapons attack could produce up to 3 million deaths and an economic impact of up to $630 billion (not counting the value of the lives lost). But, the same study concluded, countermeasures that might cost $10 billion a year could reduce the maximum death toll by a thousand fold, to 3,000, and the economic losses to $21 billion. The recommendations included installing 10,000 biodetectors in 100 major cities to provide early warning. (However, such detectors have not yet been proven effective.) The study also recommended improved biolab facilities for identifying the pathogens; pre-deployed vaccines; and regular educational sessions for those likely to be called upon to respond.

International cooperation also will be necessary to keep certain biological agents away from ill-intentioned parties. Domestically, the nation must closely monitor such agents. Obtaining a sample of anthrax once required little more than sending a request on letterhead, but new policies and procedures now restrict and monitor the sharing of such agents.

The National Research Council, the U.S. government's official research agency, in June 2002 issued a report titled "Making the Nation Safer: The Role of Science and Technology in Countering Terrorism," that said the United States remains highly vulnerable to a terrorist attack, including one with biological weapons. The report concluded there are serious shortcomings in the nation's preparedness for a biological attack.

Among the challenges cited in the report were the need to develop vaccines for airborne pathogens, the need for better sensors to detect such agents and filters to protect against them, better systems to protect the nation's food supply, and the need for a "coherent overall strategy" for coordination of the myriad federal, state and local agencies. Because of the divisions between agencies responsible, the report said, "the Federal government is not appropriately organized to carry out" a science and technology agenda to counter large-scale terrorism. One new program under discussion is to have the U.S. Postal Service ready to respond with mass mailings of antibiotics to U.S. households in the event of a biological attack. This would only be effective against certain agents, however.

New Technology for Detection

Several promising projects have yielded detectors that are either available now or may soon become practical for widespread use. Here are some examples of recent developments:

- A device developed at Washington University in St. Louis is said to capture and destroy a variety of airborne pathogens, including smallpox, anthrax, and ricin, and is small enough to be installed in aircraft in addition to public buildings. It uses x-rays, electrostatic fields and catalysts to deactivate any organic molecules that pass through it.
- A system being developed by a researcher at NASA's Jet Propulsion Laboratory and the California Institute of Technology is designed to detect a particular compound given off by bacterial spores. Installed in large public spaces, it should be able to detect individual spores of agents such as anthrax, days before anyone exposed might begin to display symptoms. This could greatly speed up response to an attack and prevent its wide spread into the population.
- The U.S. Army is developing a system for recognizing clouds of aerosol particles, using a laser-based equivalent of radar called LIDAR. It is expected to be able to detect such clouds, characteristic of an airborne bioweapons attack, from great distances, with the ability to discriminate accurately between different biological agents.
- Disposable hand-held assay kits. These typically use enzymes to detect specific agents and produce a visible glow in the presence of the target compound. Typical units available now cost $20 per test and take about 20 minutes to give a result.
- The Biowatch program, set up in July 2003, has 500 air monitors in 31 cities that are checked every 12 hours and tested for various biological agents using genetic tests.

A Good Public Health Policy

Some specialists feel that public health was neglected for decades in the United States. While some preparations began years ago, the anthrax attacks in 2001 were a wake-up call for the nation, signaling that the public health system was not equipped to handle biological terrorism on any scale. Of course, public health needed an infusion of money, but more importantly, a cohesive public health community was needed to face challenges with a united front. Emergency room doctors, state and local public health officials, rural clinicians, first responders and federal public health officials all needed not only to talk but also to forge working relationships.

Once the public health community is internally coordinated, the public health system—from individual paramedics to the Department of Health and Human Services—will need to coordinate and cooperate effectively with all agencies and departments involved in emergency preparedness and response. These include fire and police departments; local, state and federal emergency management agencies; the military; and intelligence agencies, among others.

One of the greatest challenges to this coordination and cooperation effort is that no one has a great deal of experience in the field of bioterrorism response. Turf wars, miscommunications and inadequacies of information are therefore more likely and more dangerous. Experts from a variety of fields must pool their knowledge and form an effective public health policy for a type of event of which we have only seen two examples—the relatively minor bioterrorism attack of the Rajneesh followers in 1984, and the anthrax attacks by mail in 2001. This public health policy will have to address a wide range of issues, including drug stockpiles, the control of dangerous agents, and whom to vaccinate before and after an attack. Most importantly, though, this policy must unite a nation of scattered public health interests into an effective bioterrorism preparedness and response machine.

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Knowing exactly whom to call… could prevent a lot of last-minute scrambling and on-air uncertainty

New computer systems are actively being developed to monitor everything from emergency room admissions to the sales of pharmaceuticals, looking for patterns that might not be apparent to individual doctors or pharmacists but might indicate the beginnings of a suspicious outbreak. For example, one of the first indicators that revealed a natural outbreak of water-borne cryptosporidium infection in Milwaukee the 1990s was an increase in sales of Kaopectate. Such a system, according to officials at the office of the secretary of defense for chemical and biological defense, would include biodetection, using information from medical surveillance systems and environmental sensors, and integrating the data into one comprehensive system.

Good Public Information

Among the myriad necessary preparedness efforts, public communications plans are paramount. Coordination and cooperation between government and the media will be critical to ensure early, clear and accurate reporting of facts and events. Constructive dialogues between journalists and government officials before an attack occurs can establish crucial lines of communication, and prescreening of experts can help to prevent unnecessary confusion, conflicting information and even misinformation. The sections below suggest a few steps the media might take toward ensuring informed reporting on bioterrorism.

Finding the Experts

By locating and making contact with experts in advance who can be reliable, knowledgeable sources following a bioterror attack, and becoming familiar with public health plans, journalists can minimize the inevitable confusion and misinformation that would ensue. Media coverage following the anthrax attacks in 2001 showed that there's no certification or license to be an "expert," and the scramble to find sources yielded a surprising array of people, regardless of experience and education, who got their words on the air or in print. By pre-vetting good sources about bioterrorism and researching how to contact them in case of an emergency, journalists can secure access to those who are truly knowledgeable and avoid mistakes the next time around.

Journalists will need access to experts in a variety of fields—from virology to crisis management—from both inside and outside the government. Media outlets can start now to contact those few experts who are widely recognized as such and seek recommendations on other appropriate people to interview or consult in the event of an attack. By contacting established academic institutions, think tanks, medical associations and experienced government officials, journalists can compile a strong list of contacts before an attack, alleviating concerns about airing or printing information and opinions that might not turn out to be as authoritative as they were originally touted to be.

In particular, it could make a big difference in covering an unfolding attack to have spent the time beforehand getting to know who is really in charge of public health decisions—from the local level on up through county, state and federal agencies—and knowing what kinds of plans they have drawn up for dealing with a biological weapons attack. Knowing exactly whom to call, before the phones start ringing off the hook, and knowing what procedures they will be following, could prevent a lot of last-minute scrambling and on-air uncertainty.

Some Questions to Think About

Reliable reporting might be enhanced by addressing certain questions about the response to an attack in advance. This would give journalists much needed background material and provide them with a more solid understanding of exactly how events might unfold during an actual attack. More important, those directing response efforts may not be available for lengthy interviews and a multitude of questions should an attack occur.

Questions about preparedness and response protocols could be directed to officials at all levels of government, from the local fire chief to cabinet members in Washington and might include the following questions:

How do health care professionals report suspicious cases? How does the government receive, process and respond to these reports? Who decides when the government should mount a response? How do the various agencies and departments coordinate their actions during the response? Who is in command, and what is the chain of command? What elements are involved in a response, and who is responsible for each? What is the timeline for each element of a response?

While many obvious contingencies cannot be accounted for in advance, immediate access to a substantial amount of basic information could help ensure accurate reporting as soon as authorities detect an attack—a period especially prone to misinformation and potentially inflammatory reporting. In preparing a good defense against biological warfare, government, local fire departments and hospitals can no longer afford to take a "wait and see" stance. Neither should the media.

Conclusion

Communication before, during and after a biological attack will be a critical element in effectively responding to the crisis and helping people to protect themselves and recover. Misinformation—or even accurate information relayed in an overblown manner—could undermine even the best response and cause unnecessary deaths, chaos, panic and instability. Even a handful of poorly produced media reports could undermine antibioterrorism efforts at the local, state and federal levels. The news media are key to an informed public—and to the preparedness and response efforts of the nation. Responsible, sensitive coverage gives citizens improved ability to understand events and offers them better prospects for quick recovery from a biological attack.

Where to Get Information

Government, International and Public Health Sources

Centers for Disease Control and Prevention (CDC)
Web site: www.cdc.gov
Phone: 1-800-311-3435
Media Relations: 404-639-3286
Media Relations web site: http://www.cdc.gov/od/oc/media/
Additional information on bioterrorism: www.bt.cdc.gov
Specific information on hoaxes and rumors relating to biological weapons: www.cdc.gov/hoax_rumors.htm

Center for Drug Evaluation and Research
(U.S. Food and Drug Administration)
Has extensive information on drug preparedness (vaccines, antibiotics) for a bioweapons attack.
Web site: www.fda.gov/cder/drugprepare/

Chemical and Biological Defense Programs
(U.S Dept. of Energy, Pacific Northwest National Laboratory)
Information on detection and decontamination.
Web site: http://www.pnl.gov/chembio/

Federal Emergency Management Agency (FEMA)
Web site: www.fema.gov

National Disaster Medical System
(U.S. Dept. of Health and Human Services)
This web site is aimed at disaster responders, public health officials, emergency managers and practitioners.
Web site: ndms.dhhs.gov

National Institute of Allergy and Infectious Diseases (NIAID)
A division of NIH, NIAID has its own useful web site with information on biological weapons and defensive measures.
Web site: www.niaid.nih.gov/biodefense/

National Institutes of Health
Web site: www.nih.gov
NIH has good information and links on biological weapons agents at the National Library of Medicine site:
http://sis.nlm.nih.gov/Tox/biologicalwarfare.htm

World Health Organization
Biological weapons (which WHO refers to as "deliberate epidemics")
Web site: www.who.int/csr/delibepidemics/en/
Media Center web site: www.who.int/mediacentre/en/

U.S. Military Sources

Anthrax Vaccine Immunization Program (AVIP) Agency.
Provides information on anthrax including: why anthrax is a threat, what the anthrax vaccine is, what the vaccine does, history of anthrax and a facts vs. myths section.
Web site: www.anthrax.osd.mil

CBIAC (Chemical Warfare/Chemical Biological Defense Information Analysis Center)
CBIAC serves as the Defense Department's focal point for CW/CBD technology. It collects, reviews, analyzes and summarizes information and provides a searchable database for authorized users and links to many other CW/CBD related sites.
Web site: www.cbiac.apgea.army.mil

Defense Technical Information Center
DTIC is the central Department of Defense facility for the exchange of scientific and technical information.
Web site: www.dtic.mil

Defense Threat Reduction Agency (DTRA)
DTRA consolidates a variety of Defense Department functions to deal with threats posed by WMD.
Web site: www.dtra.mil

U.S. Army Edgewood Chemical Biological Center
The Army's principal R&D center for chemical and biological defense technology, engineering and service.
Web site: www.edgewood.army.mil

U.S. Army Homeland Defense
Web site: hld.sbccom.army.mil

U.S. Army Nuclear, Biological and Chemical Defense Program
Web site: www.pmnbc.army.mil

U.S. Department of Defense Global Emerging Infections Surveillance and Response System
Web site: www.geis.ha.osd.mil

Academic Institutions and Nonprofit Organizations

Center for Biosecurity (University of Pittsburgh Medical Center)
Web site: www.upmc-biosecurity.org

Center for Infectious Disease Research & Policy (University of Minnesota)
Good information and links on infectious diseases and bioweapons.
Web site: www.cidrap.umn.edu

Center for Nonproliferation Studies (Monterey Institute of International Studies)
Claims to be the world's largest non-government organization devoted to combating the spread of weapons of mass destruction. Chemical and biological weapons resource page
Web site: cns.miis.edu/research/cbw

Center for the Study of Bioterrorism & Emerging Infections (St. Louis University)
This center produces an excellent set of "Fact Sheets" about different potential biological weapons.
Web site: www.bioterrorism.slu.edu

Chemical and Biological Arms Control Institute
Nonprofit corporation established to promote arms control and nonproliferation, with a special focus on elimination of chemical and biological weapons.
Web site: www.cbaci.org

Chemical Biological Database
The Joint University of Bradford-SIPRI Chemical and Biological Warfare Project provides information on the 1993 Chemical Weapons Convention (CWC), the 1972 Biological and Toxin Weapons Convention (BTWC) and related issues.
Web site: www.brad.ac.uk/acad/sbtwc

Chemical and Biological Weapons Nonproliferation Project
This project serves as a problem-solver and an information clearinghouse in the general subject areas of CB treaties, chemical demilitarization (especially in Russia), CB terrorism and related areas. Sponsored by The Stimson Center, Washington, DC.
Web site: www.stimson.org/cbw

Federation of American Scientists, Chemical & Biological Weapons Arms Control Program
Web site: fas.org/bwc

Harvard Sussex Program on CBW Armament and Arms Limitation
The Harvard Sussex Program is an international program of research and communication to promote the global elimination of chemical and biological weapons and to strengthen the constraints against hostile uses of biomedical technologies.
Web site: www.sussex.ac.uk/spru/hsp

Infectious Diseases Society of America
Bioterrorism information and resources.
Web site: www.idsociety.org/BT/ToC.htm

Stockholm International Peace Research Institute
Information on actual and potential uses of chemical and biological weapons.
Web site: projects.sipri.se/cbw

BOOKS

"America's Achilles' Heel: Nuclear, Biological, and Chemical Terrorism and Covert Attack (BCSIA Studies in International Security)"
By Richard A. Falkenrath, Robert Newman and Bradley Thayer.
Paperback. Cambridge: MIT Press, 1998.

"Biohazard: The Chilling True Story of the Largest Covert Biological Weapons Program in the World-Told From the Inside by the Man Who Ran It"
By Ken Alibek with Stephen Handelman. New York: Random House, 1999.

"Biological Weapons Defense: Principles and Mechanisms for Infectious Diseases Counter-Bioterrorism (Infectious Disease)"
By Luther Lindler, Frank Lebeda, George Korch, editors. Humana Press, 2004.

"Biosecurity: Limiting Terrorist Access to Deadly Pathogens"
By Jonathan B. Tucker. U.S. Institute of Peace, 2003. Online report, downloadable in pdf format at
http://www.usip.org/pubs/peaceworks/pwks52.html

"Bio-Terrorism: How to Survive the 25 Most Dangerous Biological Weapons"
By Pamela Weintraub, Paul Rega. Citadel Trade, 2002.

"Bioterrorism and Public Health: An Internet Resource Guide"
By John G. Bartlett, Tara O'Toole, Thomas V. Inglesby, Mair Michael. Thomson Healthcare, 2002. This is a list of 500 web sites from U.S. government sources. May be slightly out of date.

"The Cobra Event"
By Richard Preston. New York: Random House, 1998.
Fictional but highly detailed and fact-based account of a bioterrorism attack involving a fabricated agent. President Bill Clinton considered it so important he convened a panel of experts and increased the federal budget for research on defenses against biological weapons after reading it.

"Combating Chemical, Biological, Radiological, and Nuclear Terrorism: A Comprehensive Strategy: A Report of the CSIS Homeland Defense Project"
By Frank J. Cilluffo, Sharon L. Cardash and Gordon N. Lederman. Paperback. Center for Strategic and International Studies, 2001.

"The US Armed Forces Nuclear, Biological and Chemical Survival Manual"
By Dick Couch (Compiler), John Boswell. New York: Basic Books, 2003.

"The Survival Guide: What to Do in a Biological, Chemical, or Nuclear Emergency"
By Dr. Angelo Acquista. Paperback. New York: Random House, 2003. From the medical director of the New York City Mayor's Office of Emergency Management, this is a step-by-step guide to protecting oneself in large-scale emergencies.

"The Demon in the Freezer: A True Story"
By Richard Preston. New York: Random House, 2002.
A detailed account of smallpox and its potential danger as a biological weapon.

"Facing the Unexpected: Disaster Preparedness and Response in the United States"
By Kathleen Tierney, Michael Lindell and Russell W. Perry. John Henry Press, 2001.

"First Responder Chem-Bio Handbook"
By Ben Venzke. Tempest Publishing, 1998.
A hands-on approach for those who will need to deal with emergency situations, covering signs and symptoms, diagnosis, treatment, decontamination and precautions.

"Germs"
By Judith Miller, Stephen Engelberg and William Broad. New York: Simon & Schuster, 2001.
Written by three New York Times reporters, this book details the dangers of biological weapons and contends that they are not as difficult to make and distribute as some others claim.

"Jane's Chem-Bio II Handbook"
By Frederick R. Sidell, William Patrick and Thomas Daschle. Spiral-bound. Jane's Information Group, 2002.
The original version was considered the professional standard since 1998, and it has been reissued in a new edition in September 2002. Written by top experts in the field and used by many federal, state and local law enforcement, fire and emergency responders.

"Living Terrors"
By Michael T. Osterholm and John Schwartz. New York: Delacorte Press, 2000.

"The New Craft of Intelligence: Personal, Public, & Political: Citizen's Action Handbook for Fighting Terrorism, Genocide, Disease, Toxic Bombs, & Corruptions"
By Robert David Steele. OSS International Press, 2002.

"Weapons of Mass Destruction : The No-Nonsense Guide to Nuclear, Chemical and Biological Weapons Today"
By Robert Hutchinson. Cassell Academic, publication in April 2004.

"PDR Guide to Biological and Chemical Warfare Response"
By John G. Bartlett (Editor), David Sifton. Medical Economics, 2002. Paperback.

"Preparedness for the Deliberate Use of Biological Agents: A Rational Approach to the Unthinkable"
World Health Organization, Geneva, May 2002.
Available for download at:
www.who.int/emc/pdfs/WHA_TerrorismW.pdf

"Public Health Response to Biological and Chemical Weapons: WHO Guidance"
2nd edition, World Health Organization, 2003.
Available for download (draft version) at:
http://www.who.int/csr/delibepidemics/biochemguide/en/index.html

"Saddam's Bombmaker: The Terrifying Inside Story of the Iraqi Nuclear and Biological Weapons Agenda"
By Khidr Abd Al-Abbas Hamzah, et al. New York: Scribner, 2000.

"When Every Moment Counts: What You Need to Know About Bioterrorism from the Senate's Only Doctor"
By Bill Frist. Rowman & Littlefield, 2002.

"21st Century Bioterrorism and Germ Weapons-U.S. Army Field Manual for the Treatment of Biological Warfare Agent Casualties (Anthrax, Smallpox, Plague, Viral Fevers, Toxins, Delivery Methods, Detection, Symptoms, Treatment, Equipment)"
By U.S. Department of Defense. Ring-bound. Progressive Management, 2001.
This is the manual currently used by U.S. Armed Forces Medical Services to respond to any biological weapons use.

CD-ROMs

"2002 Bioterrorism After the Anthrax Attacks: Complete Revised Guide to Biological Weapons and Germ Warfare-Anthrax, Smallpox, Medicines, Treatment, Preparedness, White House, Homeland Security, CDC, HHS, FDA, NIH, Military Manuals"
Washington, D.C: U.S. Government, Progressive Management, 2002.
This updated CD-ROM contains 12,415 pages of documents.

"21st Century Complete Guide to Bioterrorism, Biological and Chemical Weapons, Germs and Germ Warfare, Nuclear and Radiation Terrorism: Military Manuals and Federal Documents With Practical Emergency Plans, Protective Measures, Medical Treatment and Survival Information"
Washington, D.C: U.S. Government, Progressive Management, 2001.
This comprehensive CD-ROM contains over 30,000 pages in 146 documents (occupying over 600 MB) from all major federal agencies, including the Department of Defense, U.S. Army, Federal Emergency Management Agency (FEMA), Department of Health and Human Services, Centers for Disease Control and Prevention (CDC), Department of Energy, Nuclear Regulatory Commission (NRC), EPA, and GAO. Gives detailed, practical and current information on the NBC (nuclear, biological and chemical) threat. Descriptions of biological and chemical agents, history, agent delivery methods, environmental detection, prevention, military equipment and civilian emergency plans.

"Bioterrorism Awareness Training"
Center for Food Security and Public Health, Iowa State University.
Contains in-depth PowerPoint presentations and fact sheets on CDC category A, B, and C potential bioterrorism agents.
Web site: http://www.vetmed.iastate.edu/services/institutes/cfsph/ProductList/resources_cdrom.htm

Glossary

[Note: Words shown in **bold** type have their own glossary entries.]

Aerosols—Particles of liquid or solid material small enough to remain airborne indefinitely and thus spread widely. The preferred size range for biological weapons agents is small enough to be easily inhaled but large enough to become lodged in the lungs rather than immediately exhaled.

Aflatoxin—Although not usually considered a candidate for a biological weapon, aflatoxin was in fact produced on a large scale as a weapon by **Iraq** in the 1980s and 1990s. Although technically a chemical weapon, it is produced by **fungi** and therefore sometimes classified with biological weapons.

Al Qaeda—Transnational terrorist organization, which various international intelligence sources suggest either has or is developing a biological weapons capability.

AMRIID—The U.S. Army Medical Research Institute of Infectious Diseases, it does research aimed at medical responses to biological weapons attacks or natural epidemics. Located at Fort Detrick, Md., it houses the military's largest Biosafety Level 4 containment facility.

Anthrax—A **bacterium** that can remain in dormant **spore** form for decades and can infect the skin, lungs or **gastrointestinal** system in humans. The **pulmonary** form (tiny inhalable particles) is the most deadly and considered the most likely form to be used in a biological attack.

Antibiotics—Antibiotics, which can treat bacterial diseases, can be effective against **plague** and **anthrax,** but are useless against **viruses,** such as **smallpox,** and **toxins,** such as **botulinum.**

Aum Shinrikyo—A religious sect in Japan that attempted numerous times to carry out biological weapons attacks, but which did not cause any deaths or disease. In 1995, the group released **Sarin,** a chemical nerve gas, in the Tokyo subway system, killing 12 people and injuring thousands.

Australia Group—A loose association of nations dedicated to controlling the export of any items that could be used to produce biological weapons. It was formed in 1985 to address chemical weapons and began to address biological issues in 1990.

Avian flu—An emerging new disease in humans in late 2003 and early 2004, found only in Vietnam and Thailand as of early 2004. It is considered an example of a new strain of disease that might someday trigger a **pandemic.**

Bacterium, bacteria—Single-celled organisms, some of which can infect humans, usually through the lungs, skin or intestines, and release destructive toxins.

Biological and Toxins Weapons Convention (BWC)—The primary covenant governing biological weapons today, the Convention prohibits all activity associated with offensive biological weapons production. First signed in 1972, 167 countries now are signatories, and 151 have ratified it.

Biopreparat—The massive Soviet biological weapons program that produced hundreds of tons of **anthrax** and tens of tons of **smallpox** and **plague,** among other agents. Before the Soviet Union collapsed, Biopreparat employed more than 30,000 people at more than 40 sites.

Biosafety—Containment levels have been defined by the CDC for Biosafety Levels 1 through 4, reflecting increasing danger. Each level requires a specific set of clearly defined protective clothing, ventilation, construction, etc.

Bioweapon — A biological weapon; that is, a type of **bacteria, virus,** or biologically produced **toxin** that can or might be made into a weapon.

Botulinum — A **toxin,** produced by the **bacterium** *Clostridium botulinum,* which is one of the most poisonous known substances. The **CDC** lists it as a **Category A** biological agent.

Brucella—A **toxin** produced by **bacteria,** which is considered a potential bioweapon. The **CDC** lists it as a **Category B** agent.

Bubonic plague—Usually transmitted by flea bites, this form of the bacterial (*Yersinia pestis*) disease was responsible for the Black Death in medieval Europe and was used as a weapon by Japan against China in World War

II. It is considered an unlikely weapon in modern times because the inhalational (**pneumonic**) form is considered capable of causing much higher casualties.

BWC—Biological and Toxins Weapons Convention.

Category A—The group of biological agents currently believed by the **CDC** to pose the greatest threat as biological weapons. Category A includes **anthrax, smallpox, plague, tularemia, botulinum** and **viral hemorrhagic fevers.**

Category B—Potential biological weapons listed by the **CDC** as being moderately easy to disseminate. They can cause moderate amounts of disease and low fatality rates but may require specific public-health action.

Category C—Described by the **CDC** as emerging infectious disease threats that might at some point be engineered to produce biological weapons. The CDC names **Hantavirus** and **Nipah virus** in this category.

CBN—Chemical, biological and nuclear weapons. Also known collectively as weapons of mass destruction.

CBW—Chemical and biological weapons.

CDC—Centers for Disease Control and Prevention. This U.S. agency, based in Atlanta, Ga., is responsible for protecting the health and safety of people by developing and applying disease prevention and control, environmental health, and health promotion and education activities.

Chemical weapons — Weapons using chemical agents to affect the skin, eyes, circulatory system, nervous system and/or respiratory system. Examples include tear gas, **Sarin** and cyanide.

Cidofovir—An antiviral treatment option for those suffering from adverse reactions to the **smallpox** vaccine.

Ciprofloxacin—An antibiotic used to treat bacterial infections such as **anthrax** and **plague.**

Contagion—The process by which one person infected with a disease passes it to another, either through direct skin contact, inhaled droplets or contact with contaminated materials. Some potential biological weapons, such as **anthrax** and **botulism,** are not contagious, while **smallpox** and **plague** are highly contagious.

Cuba—One of the nations currently on the State Department's list of state sponsors of terrorism.

Cutaneous—Contracted through direct contact with the skin. Among possible biological weapons, **anthrax, plague** and **smallpox** can be contracted cutaneously, as can the toxins **botulinum** and **mycotoxins.**

Doxycycline—An antibiotic used to treat certain bacterial infections, including anthrax and plague.

Ebola—A **viral hemorrhagic fever** with fatality rates ranging from 50 to 90 percent, Ebola has gained public notoriety in books and movies.

Eczema—A condition characterized by scratchy, itchy, red, dry, blistered and/or leathery skin.

Encephalitis—Swelling of brain tissues, which can be caused by a variety of viral and bacterial diseases.

Enterotoxin B—A toxin produced by *Staphylococcus* **bacteria.** It is listed by the **CDC** as a **Category B** potential **bioweapon.**

Epidemic—An outbreak of disease that attacks many people at about the same time and may spread through one or several communities.

Epsilon toxin—Produced by the bacteria *Clostridium per fringens* and a common cause of food poisoning. It is listed by the **CDC** in **Category B** of potential **bioweapons.**

FEMA—The U.S. Federal Emergency Management Administration. In case of a national emergency, including a biological weapons attack, this agency would be responsible for coordinating local and imported emergency response teams.

Flu—See **Influenza.**

Foot and mouth disease (FMD) — A disease of cattle, it might be used as a weapon because of its potential economic impact on beef sales, especially for export.

Fungus—A group of relatively primitive and often parasitic organisms, including mushrooms, yeasts, rusts, molds, and smuts, some of which produce **mycotoxins.**

Gastrointestinal—Pertaining to the stomach and intestines.

Geneva Protocol—The first multinational covenant to address chemical and biological weapons, the Geneva Protocol was signed in 1925.

Gentamicin—An antibiotic used to treat certain bacterial infections, Gentamicin is administered intravenously and is therefore less efficient to administer in mass quantities.

Glanders—A highly lethal bacterial disease that can kill 50 percent of those exposed. Has been developed as a **bioweapon** and was used against livestock by Germany in World War I. The **CDC** lists it as a **Category B** potential bioweapon.

Hantavirus—Carried by rodents and mostly transmitted through their droppings, this virus causes Hantavirus Pulmonary Syndrome (HPS), which has now been identified in nine countries. The **CDC** lists it as a **Category C** potential **bioweapon.**

Hemorrhage—Uncontrollable bleeding. Some biological agents cause death primarily through hemorrhaging, including the **viral hemorrhagic fevers** (**VHFs**).

HHS—Health and Human Services, the federal cabinet-level agency under which the **CDC, NIH** and other agencies are based.

Incubation period—The time between exposure to a disease or **toxin** and the appearance of the first symptoms. For most potential biological weapons, this can range from a day or two to a month or more. (See **Latency**).

Infection—The invasion of a body by microorganisms (**bacteria, viruses** or **fungi**), which can reproduce in the body to produce disease or can remain dormant for long periods.

Infective, infectious —Capable of causing infection.

Influenza (flu)—A common viral infection with initial symptoms, such as fever, chills, nausea, cough, that closely resemble those of many biological agents. The resemblance makes flu a likely initial diagnosis for a disease actually caused by a bioterror attack.

Inoculation—Introduction of a **vaccine** (or other material) into the body.

Inversion—A weather condition that can exacerbate the effects of the release of an outdoor biological agent, in which a cold layer of air traps warmer air close to the ground, preventing vertical mixing of air and allowing an aerosol to remain at ground level. Inversions generally occur at night, sunrise and sunset, but can persist for days.

Iran—One of the nations currently on the State Department's list of state sponsors of terrorism. Iran is presently believed to have large stockpiles of biological weapons, but the details of its program are unknown.

Iraq—One of the nations that was on the State Department's list of state sponsors of terrorism. Iraq was known to possess large quantities of biological weapons during the 1990s, but after the U.S. attack in 2003 its biological weapons program appeared to have been terminated and no weapons or facilities for making them were found. In the past, Iraq was known to have developed weapons using **aflatoxin** and **botulinum.**

Isolation—The sequestration of an infected individual to prevent the spread of **infection** to others.

Israel—Israel is believed to have a biological weapons program, but the details are not known.

Japan—Japan's **Unit 731** used biological weapons on the Chinese people before and during World War II. The agents used included **anthrax, cholera** and **plague.**

Latency—The period between exposure to a disease (**bacteria** or **virus**) and the onset of symptoms, or after an initial set of symptoms in certain diseases, which can then produce a relapse.

Mad Cow Disease (MCD)—A disease of cattle, it could be used as a weapon to produce economic harm. The first U.S. cases of the disease were discovered in late 2003.

Marburg—A **viral hemorrhagic fever** closely related to **Ebola.**

Melioidosis—A disease caused by the *Burkholderia pseudomallei* **bacteria,** it is listed by the **CDC** as a **Category B** potential **bioweapon.**

Metropolitan Medical Response System (MMRS)—This program, originated in 1996, was developed to increase coordination at all levels in the event of any incident involving weapons of mass destruction (WMD). Managed by the Office of Emergency Response (OER), it works with local police, fire, hazmat, EMS, hospital, public health and other emergency-response personnel in the event of a terrorist attack.

Milling—A mechanical process for powdering biological agents (**bacteria** or **viruses**) to produce uniform particles tiny enough to remain aloft in the air for long periods and be easily inhaled and become lodged in the lung.

Monkeypox —An animal disease from central Africa, known since 1970 to be capable of infecting humans, produced a U.S. outbreak in July, 2003. The transmission was blamed on prairie dogs that were kept as pets. The disease is related to **smallpox** but produces milder symptoms.

Mycotoxins —**Toxins** produced by **fungi.** Some, such as *Tricothene mycotoxins,* have been used as biological weapons.

NDMS—The National Disaster Medical System is a partnership between the U.S. Department of Health and Human Services (**HHS**), the Department of Defense (DoD), the Department of Veterans Affairs (VA), **FEMA,** state and local governments, private businesses and civilian volunteers. Its purpose is to coordinate response to a natural or terrorist emergency at all levels.

Nipah virus—A "new" virus discovered in Malaysia in 1999 and closely related to the Hendra virus in Australia. Both of these are *Paramyxoviridae.* It has a high mortality rate (50 percent) and is listed by the **CDC** as a **Category C** potential **bioweapon.**

North Korea—One of the nations currently on the State Department's list of state sponsors of terrorism. North Korea is suspected to have a large stockpile of biological weapons, but details are not known.

Nosocomial spread—The contraction of a disease while in a hospital. During an **epidemic,** this can become a significant route for the spread of disease unless countermeasures are carefully followed.

Orthopox: A family of viruses including **smallpox, monkeypox** and cowpox.

Pandemic: When an **epidemic** spreads throughout much of the world.

Pathogen—Any agent (such as a **virus, bacteria, fungus** or **toxin**) that causes a disease.

Plague—A bacterial infection that can infect humans and was responsible for the "Black Death" in the Middle Ages. It occurs in three forms: **bubonic, pneumonic** and **septicemic.** Pneumonic plague, the only **contagious** form, is thought to be the most likely to be used in a bioterror attack.

Pneumonic—Contracted through the lungs, as in pneumonic **plague** or pneumonic **anthrax.**

Psittacosis—A disease caused by the *Chlamydia psittaci bacteria,* it is listed by the **CDC** as a **Category B** potential **bioweapon.**

Pulmonary—Pertaining to the lungs.

Q fever—A bacterial disease, listed by the **CDC** as a **Category B** potential bioweapon.

Quarantine—The sequestration or restriction to a given area of individuals who may have been exposed to a disease but have not yet shown signs or symptoms of the disease, or those who have developed symptoms and must be kept apart from others not exposed to the disease.

Rajneeshee cult—The religious cult that deliberately contaminated salad bars with **Salmonella** in Oregon in 1984. Hundreds became ill, but no one died. This was the first incident of biological terrorism in the United States.

Rickettsiae—Bacteria that respond to **antibiotics** but have longer incubation periods like **viruses** and are not **contagious.** Rickettsiae include **Q fever** and **typhus.**

Ricin—A toxin produced by castor beans. It is included in the **CDC's Category B** of potential **bioweapons.** It was used in mail attacks on a Senate office building in Washington in early 2004, but no deaths resulted.

Salmonella—A type of **bacterium** that can cause severe **gastrointestinal** symptoms when ingested.

Sarin—A human-made chemical warfare agent classified as a nerve agent, used by **Aum Shinrikyo** in terrorist attacks in Japan.

SARS—Severe Acute Respiratory Syndrome, first reported in early 2003. Although not considered a potential biological weapon, it is an example of the kind of emerging new diseases that might, naturally or through genetic engineering, someday become a potential weapon.

Sepsis, septicemia, septicemic —The presence of bacteria in the blood.

Smallpox—A **contagious viral** disease that has killed hundreds of millions of people through history, it was the first disease ever eradicated from natural occurrence in humans, with the last natural case in 1977. However, reserves of the disease remain, and it is perhaps the most feared potential **bioweapon.**

Soviet Union—The former Soviet Union had a massive biological weapons program called **Biopreparat** that employed tens of thousands of scientists and produced mass quantities of a wide range of biological agents. The whereabouts of many of the scientists and many of the samples of biological agents are unknown. It is feared many of the scientists may now be in the employ of nations or subnational groups seeking offensive biological weapons programs and may have brought samples of agents with them.

Spores—**Bacteria** in a dormant, often dehydrated form, that can be very resistant to degradation by heat, ultraviolet and other agents that would destroy the living bacterium. **Anthrax** is one potential **bioweapon** that could be distributed as an **aerosol** in spore form.

Stability—The ability of a biological agent to retain its ability to cause disease over time and to resist degradation by heat or cold, UV radiation and other factors.

State sponsors of terrorism—The State Department's May 2002 report, "Patterns of Global Terrorism," includes a list of nations believed to be state sponsors of terrorism. The list, which has not been updated, currently includes Cuba, Iran, Iraq, Libya, North Korea, Syria and Sudan. Of these, Iraq (now being administered by a multinational coalition) and Libya (which has agreed to international inspections) no longer appear to belong.

Streptomycin—An **antibiotic** used to treat certain bacterial infections, streptomycin is administered intravenously and is therefore less efficient to administer in mass quantities.

Sudan—One of the nations currently on the State Department's list of state sponsors of terrorism.

Sverdlovsk—The location of an accidental release of **anthrax** from a Soviet **bioweapons** facility in 1979. At least 68 people were killed.

Syria—One of the nations currently on the State Department's list of state sponsors of terrorism.

Tabun—A man-made chemical warfare agent classified as a nerve agent.

Tokyo—The location of the chemical weapons attack by the **Aum Shinrikyo** cult in 1995. The cult released the nerve agent **Sarin** into the Tokyo subway system, killing 12.

Toxins—Poisonous substances produced by many types of organisms, including **bacteria,** animals and plants.

Transmission—The passing of a **contagious** disease from one individual to another.

Tularemia—A bacterial infection (*Francisella tularensis*) that is not **contagious** but is highly **infectious.** Tularemia can infect humans through various routes, but the most likely route in a bioterror attack is thought to be inhalation of an **aerosol.**

Typhus fever—A disease caused by the *Rickettsia prowazekii* **bacteria,** it is listed by the **CDC** as a **Category B** potential **bioweapon.**

Unit 731— The notorious Japanese army unit that used biological weapons such as **cholera, plague** and **anthrax** on Chinese people before and during World War II.

United Nations Special Commission (UNSCOM)—The commission established in the wake of the Gulf War to oversee the destruction of weapons of mass destruction. After discovering large stockpiles of biological weapons, UNSCOM inspections were suspended in 1998 when **Iraq** ceased to cooperate, resumed in 2002, and ended in 2003.

Vaccine, vaccination—The deliberate introduction into the body of either a known **pathogen,** such as a **virus** or a closely related form, to create immunity against later exposure. Vaccination is considered the most effective public health countermeasure for many biological agents.

Vaccinia—The **virus** used to create immunity to **smallpox** in humans. Vaccinia is a relatively harmless virus closely related to **smallpox** and is the origin of the term "vaccinate."

Vaccinia immune globulin (**VIG**)**—**A treatment option for people suffering from adverse reactions from the **smallpox** vaccine.

Vector—The Institute for Viral Preparations, Moscow, known as Vector, is one of only two locations in the world officially permitted to hold stocks of the **smallpox virus.** The other is the Centers for Disease Control and Prevention (**CDC**) in Atlanta.

Vector-borne —Illness that is transmitted through an invertebrate such as an insect.

Viral—Caused by a **virus.**

Viral encephalitis—A **viral** disease, listed by the **CDC** as a **Category B** potential **bioweapon.**

Viral hemorrhagic fevers (**VHFs**)—A group of **viruses** that cause internal and external bleeding. While some VHFs such as **Ebola** cause severe illness and have high fatality rates, others cause only mild illnesses.

Virulence—The ability of a disease agent to produce illness, sometimes expressed as a percentage of exposed people who will develop the disease.

Virus, viruses—Organisms smaller than **bacteria** and unable to survive on their own, which can invade the cells or humans (or other species) causing illness and death. Viruses can infect humans through a variety of different routes: **pulmonar**y (through the lungs), **cutaneous** (through the skin), or **gastrointestinal** (through food or drink).

Vozrozhdeniye Island—The location of a possible test of **aerosolized smallpox** in 1971. Three people died and a mass **vaccination** effort was undertaken to control the outbreak.

Weaponization—The process of turning a naturally occurring disease agent into a biological weapon. This usually involves treatments to increase stability, increase virulence and (for **aerosol** distribution) **milling** to produce tiny, uniformly sized particles.

WHO—The World Health Organization, headquartered in Geneva, Switzerland, is the primary coordinating body for global health programs and policy.

"Worried well"—The term used for people who seek medical attention in the wake of a biological, chemical or nuclear attack who are not ill but are concerned they might be.

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