Chapter 21

THE BIOLOGICAL WARFARE THREAT

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INTRODUCTION

Biological warfare agents may be more potent than the most lethal chemical warfare agents and provide a broader area of coverage per pound of payload than any other weapons system. The proliferation of technology and the scientific progress in biochemistry and biotechnology have simplified production requirements and provided the opportunity for creation of exotic agents.[1]

Genetic engineering holds perhaps the most dangerous potential. Pathogenic microorganisms capable of creating a novel disease, perhaps on an epidemic scale, could be tailor-made. Suppose that an adversary inserted a gene lethal to humans into a virus or bacterium. This agent could then spread a disease that could overwhelm the diagnostic, therapeutic, and preventive capacity of a country's health service.[2] The threat posed by new biological and chemical weapons requires our urgent attention:

> Certainly it is of great importance that new and insidious biochemical weapons are being developed and deployed, in total disregard for existing treaties, while the perpetrators routinely deny all charges and, in turn, counter that their accusers are fabricating the allegations as a propaganda device. It seems clear that the highest priority should be afforded this issue for efforts toward its resolution.[3(p498)]

The use of biological agents in future wars and terrorist attacks is a realistic concern. The difficult issues of degraded troop performance and health-care delivery are serious threats, and resources must be allocated to develop an effective response plan. Countering this threat will require that the highest levels of our government find ways to[1]

- strengthen and verify international arms control agreements,
- maintain the United States's ability to respond with a broad range of alternatives against any aggressor who attempts to proliferate biological weapons, and
- maintain a robust biological defense effort for our U.S. armed forces, one that would equally and effectively apply to our civilian population in case of use by terrorists.

Unfortunately, biological weapons are considered by some nations to be part of their military armamentarium, and there are military, technical, economic, and political incentives for nations to develop and maintain such a program. A goal of this chapter is to present the evidence in such a way that the reader can conclude that the threat is real and significant; it is neither in the realm of science fiction nor confined to our own nation. As a Russian writer stated in 1993:

> I have been gathering information on bacteriological weapons (BW) for several years. Out of all the means of mass destruction, this kind can be considered as the most mysterious.[4(p15)]

EVIDENCE OF A SOVIET BIOLOGICAL WARFARE PROGRAM

We have known for many years that the Soviet Union maintained an offensive biological warfare program in violation of the 1972 Biological Weapons Convention, which they initiated and signed without reservation. This knowledge has been reported to the U.S. Congress and the American public since 1984, and our government has repeatedly raised this subject, first with the Soviet leadership, and more recently with the current Russian leadership.[5]

Indirect Evidence

Beginning in the latter 1970s and continuing throughout the 1980s, U.S. intelligence agencies repeatedly alleged the existence of a Soviet biological weapons program. Then in April 1979, a major outbreak of anthrax in the city of Sverdlovsk (now Yekaterinburg) caused the death of a number of Soviet citizens from pulmonary anthrax.[1] (This event is also discussed in Chapter 22, Anthrax.) Details about this epidemic were not disseminated by the Soviets, and it was not until much later that the Western communications media became aware of it.

On February 13, 1980, the widely circulated German magazine *Bild Zeitung* carried a story describing an accident in a military settlement in Sverdlovsk in which an anthrax cloud resulted, which prevailing winds carried into the outskirts of the city. The magazine article went on to state that only a chance change in wind direction prevented the cloud from passing through the main section of the city. When this story was published, major Western newspapers finally began to take an interest in the event.

Several weeks later, the U.S. government asked the Soviet government for an explanation of the epidemic—specifically, whether this was a biological warfare experiment gone awry. Moscow denounced the suggestion as slanderous propaganda but did acknowledge the outbreak of anthrax. They insisted that the outbreak was caused by poor food control, which had somehow allowed contaminated meat to be dispensed to the population of Sverdlovsk.[6]

However, a recently released report[7] on a series of 42 autopsies, done on what is thought to be the majority of the fatalities from this outbreak, consistently revealed pathological lesions diagnostic of inhalational anthrax: hemorrhagic necrosis of the thoracic lymph nodes involved in the lymphatic drainage of the lungs, and hemorrhagic mediastinitis. These are not findings seen in gastrointestinal anthrax associated with contaminated meat.

The U.S. government found Moscow's explanation disturbing for several reasons, including strong U.S. intelligence reporting that listed Sverdlovsk as a site of a biological warfare establishment; the fact that shortly after 3 April 1979, D.F. Ustinov, then the Soviet Minister of Defense, visited Sverdlovsk; and the difficulty in imagining an anthrax epidemic attributable to contaminated meat in a developed nation with a highly effective and functioning public health service.[6] Last and perhaps even more compelling, satellite photography had revealed some time earlier that the compound in which the accident took place (Military Compound 19) was heavily guarded, had special security precautions, and had ventilation and animal pens typical of a biological weapons facility.[8]

In February 1992, Russian President Boris Yeltsin admitted that the 1979 outbreak of anthrax in Sverdlovsk was indeed linked to an accident at a secret biological weapons facility. He went on to reveal that the former Soviet Union had conducted an illegal biological warfare program in violation of the 1972 Biological Weapons Convention. He further acknowledged that the Soviet Union had failed (1) to implement its commitment under the convention to destroy existing biological weapons and (2) to conduct research only for defensive purposes. He also said that "past military efforts had crossed the line set by international treaties."[1(p16)]

The Washington Post published an article in August 1992 that stated that shortly after Yeltsin's admission, a confidential report on the extent of the Russian biological weapons program had been prepared by Anatoly Kuntsevich, a retired Russian general and a former director of Soviet research on chemical arms. Kuntsevich stated in the report that the military had illicitly developed aerial bombs and rocket warheads. These warheads were capable of carrying several biological warfare agents, including anthrax, tularemia, and Q fever. General Kuntsevich revealed that the biological weapons effort had been maintained through at least 1990 but had been scaled down during the 6 years of Mikhail Gorbachev's presidency.[9]

In April 1992, Yeltsin issued a decree that outlawed all activities that were prohibited by the 1972 Convention. General Kuntsevich stated, following Yeltsin's decree, that all offensive biological weapons programs in territorial Russia had been banned and placed under firm control of the government; that the large biological test area near the Aral Sea, Vozrozhdeniya Island, had been closed; and that Russia had no stockpiles of biological weapons.

Unfortunately, that same month, Russia failed to meet the deadline set forth for all Convention signatories to declare their total inventory, stockpiles, and production sites for offensive and defensive biological weapons programs. This requirement had been established in the set of confidence-building measures that had been agreed upon at the Third Review Conference on the Biological Weapons Convention in September 1991, at which Russia was a participant. The Russian government finally submitted their report in late July 1992, but, according to U.S. officials, the report lacked key details. This delay only strengthened our heightened concerns about the extent of the former or still-existent Soviet program.[9]

The Soviet offensive biological weapons program was monitored by the United States for decades. We know that scientific personnel at a number of microbiological research institutes in the former Soviet Union are capable of performing research and development with highly infectious disease agents and very potent plant, animal, and microbial toxins. Likewise, their considerable work in aerobiology, cloud physics, airborne infections, and disease-agent stabilization has direct application to biological warfare. Much of the knowledge and technical expertise at these institutes was in the recent past and possibly still is funded and utilized by the Ministry of Defense for offensive purposes as well as for defensive and protective aspects of biological warfare.[10]

Direct Evidence

Much of our current knowledge concerning the former Soviet Union's biological warfare program has been gleaned from Vladimir Pasechnik, a mi-

crobiologist who defected to the West in 1989 while attending a scientific conference in London, England. For years, Pasechnik had pled with Soviet officials to allow him to switch some of his research effort to civilian purposes, for which it had originally been established.

Pasechnik was born in 1939 in Stalingrad, a city that was largely destroyed during World War II. He became one of the brightest young scientists in the Soviet Union, determined to use his talent working for peace and never allowing his research in biophysics to be used to further a means of destruction that had cost the lives of his family. In 1974, a general from the Soviet Ministry of Defense offered Pasechnik the opportunity to set up and run his own biotechnology laboratory. The offer included an unlimited budget to buy Western equipment and the ability to recruit the best scientists in the Soviet Union.

Pasechnik was not concerned that the offer had come from the Ministry of Defense, as the military was the driving force behind most research conducted in the Soviet Union, even projects that had strictly civilian application. He built up his laboratory over the better part of the next decade, hiring 400 well-credentialed scientists to staff the facility, acquiring a relatively unlimited budget that gave his staff access to the latest Western biotechnology.

The laboratory began operating in 1981, and during the next 2 years Pasechnik realized the truth: far from running a state-of-the-art civilian research operation, he was part of a vast network of laboratories and factories working on deadly new weapons of war. A newspaper story quoted Pasechnik as stating:

> Officially we were involved in vaccine development and in producing preparations for protecting crops, but in fact, we were developing methods of production and equipment for a huge biological warfare program.[11(p1)]

He revealed a network of nominally civilian research institutes known as Biopreparat. This organization was created in 1973 by the Soviet Central Committee and the Council of Ministers as a cover for the existing military program. Biopreparat was a huge organization, employing more than 25,000 people at 18 or more research and development facilities, including six mothballed production plants and a major storage complex in Siberia.[12] Their budget in the early 1980s was 200 million rubles and tens of millions of U.S. dollars per year.

One of the goals was to genetically alter known pathogens in the hope of making the pathogens resistant to Western drugs. The institutes were also directed to produce new strains of diseases, more powerful than those previously known to science, and to produce them in aerosol form. In 1983, at a Biopreparat research institute in Obolensk, 60 miles south of Moscow, scientists developed their first superplague: a new strain of tularemia. Testing revealed such favorable results that Moscow gave permission for full-scale development and production. Then in 1985, scientists at the same institute were asked to develop a more deadly strain of pneumonic plague.

Pasechnik's role was to refine the production process to make the development more efficient. He claims that by 1987 the Soviet Union had sufficient industrial capability within Biopreparat to manufacture 200 kg of the superplagues every week, enough to kill up to 500,000 people. Owing to the fairly short half-life of the agent, these agents were never produced on this scale; in fact, only enough for testing was produced.

The fact remains, however, that the Biopreparat network stood ready to begin full production when told, at a time in the future designated as Day X. The Soviet Defense Ministry built these biological weapons, known as Weapons of Special Designation, into their military planning. They were to be used not only as a last resort but also as support weapons in a conventional (nonnuclear) conflict, to attack the enemy's troop reserves and hamper his operations at ports and rail centers.[11]

Pasechnik had first-hand knowledge of the program: he was a director of the Biopreparat organization known as the Institute of Especially Pure Biopreparations in Leningrad, and was also a member of the Scientific and Technical Committee, which was composed of institute heads. An article in the popular press[12] noted that, according to Pasechnik, Biopreparat officials had discussed putting weaponized forms of these agents into terrorists hands.

Current Evidence

Vladimir Pasechnik's story has been confirmed by another well-placed defector from the Biopreparat program whom the Central Intelligence Agency (CIA) brought out in late 1992. This second defector even stated that the research and development of new strains of genetically engineered superweapons were continuing up to the time of his defection, despite Yeltsin's decree that the program be dismantled. Again in the fall of 1993, a third defector from the Biopreparat group spoke to Brit-

ish intelligence and confirmed the stories of both previous defectors.[11]

Sound, compelling evidence from these recent defectors; confrontations among the leaders of the United States (President Bush), United Kingdom (Prime Minister Thatcher, Prime Minister Major), and the Soviet Union (President Gorbachev); and confrontations between U.S. President Clinton and Russian President Yeltsin have all failed to alleviate U.S. concerns about the current Russian biological warfare program. Invited by the Russians, a joint United States–United Kingdom delegation visited several Russian sites in 1990. The trip was intended to be reassuring but had the opposite effect. The team discovered a large aerosol test chamber that was designed to spray aerosols on animals tied down at various locations within the chamber. They also discovered a chamber used to test delivery systems for biological weapons. At another site, they saw row after row of huge fermentation vessels. All this evidence corroborates what Vladimir Pasechnik told.[11]

In 1992, in an attempt to meet the concerns expressed by the United States and the United Kingdom, Russia emphasized its commitment to comply with the Biological Weapons Convention officially, in a three-way agreement with the United States and the United Kingdom. The agreement, officially known as the Trilateral Agreement, was struck after negotiations in Moscow between U.S. Undersecretary of State Frank Wisner and senior British and Russian officials. This meeting resulted from an official request by the U.S. State Department on 31 August 1992 to the Russians for reassurance that the germ weapons program of the former Soviet Union has been terminated.[13]

The Trilateral Agreement (1) is intended to build confidence that the Russians will dismantle the former Soviet Union's offensive biological weapons program; (2) commits Russia to (*a*) open suspect facilities to inspection, (*b*) convert biological warfare facilities to civilian production, and (*c*) end biological weapons projects except for defensive programs; and (3) provides for mutual inspection of biological sites in the United States, the United Kingdom, and Russia. U.S. and British inspectors may visit any suspect site and conduct inspections as intrusive as necessary to resolve concerns. Russian inspectors will be permitted to visit U.S. and British civilian biological research facilities once the initial round of inspections within Russia is completed.[1] Military facilities will be open to inspection after the suspect civilian facilities have been inspected.

In 1991, a United States–United Kingdom delegation visited the St. Petersburg Institute of Especially Pure Biopreparations, which Vladimir Pasechnik had said was the site of work on biological weapons. The first visit under the Trilateral Agreement occurred in the fall of 1993, after a year of talks concerning the protection of proprietary information during the visits to the three participating countries. The delegation to this visit toured two sites: an installation at Berdsk, a town near Novosibirsk, Siberia, and Pokrov, a site outside Moscow. In January 1994, the United States–United Kingdom delegation visited two more sites in the former Soviet Union; later that year, a Russian delegation visited one nonmilitary site in the United Kingdom and three in the United States. Anatoly Kuntsevich, director of Russia's Presidential Committee on Problems of Chemical and Biological Disarmament, stated that these visits should put the Western concerns to rest; however, American officials say that ambiguities remain and that a working group should be formed to discuss the two sides' past biological warfare programs.[14]

Not fully alleviating the United States's concerns about the continuation of the former Soviet program, but a positive step forward, was Yeltsin's firing of Kuntsevich in April 1994. Kuntsevich had played a leading role in development of the former Soviet Union's chemical arsenal. He was regarded by some in Washington as an obstacle to progress on the germ weapon issue, and, in fact, was one of the main persons behind the attempt to hide the continuation of the Russian program from Yeltsin after Yeltsin had stated that it would be dismantled. President Yeltsin's office attributed Kuntsevich's dismissal to a "gross violation of his duties."[15(pA-28)] A news brief reported on 7 April 1994 by the Information-Telegraph Agency of Russia–Telegraph Agency of the Soviet Union (ITAR-TASS) stated that a Moscow daily newspaper, *Kommersant*, speculated that a connection existed between Western press accusations of continuing Russian work on biological warfare and the firing of Anatoly Kuntsevich.

Doubts linger in the West about Russia's claims that no biological weapons were ever produced and that all activities have been halted, never to be restarted. Moreover, the West worries that the political leadership in Moscow may be unable to ever get a full disclosure or a firm commitment to cease all biological warfare activities beyond those permitted by the Biological Weapons Convention of 1972.[16] In light of all these revelations, it is clear that the United States must maintain a strong Biological Defense Research Program.

PROLIFERATION OF BIOLOGICAL WEAPONS

International proliferation of biological weapons programs broadens the range of agents that U.S. forces may encounter. The modernization of many Third World nations with the subsequent development of industrial, medical, pharmaceutical, and agricultural facilities needed to support these advancing societies also provides the basis for development of a biological weapons program should that nation decide to pursue such an endeavor. A biological weapons program can be easily concealed within legitimate research and development and industrial programs within those countries that seek such capabilities.[1] In December 1991, Robert Gates, then Director of Central Intelligence, stated in testimony before the U.S. House of Representatives Armed Services Committee's Defense Policy Panel:

> The accelerating proliferation of nuclear, biological, and chemical weapons in other countries around the world is probably of gravest concern. The more countries that possess such weapons—even if acquired for deterrent purposes—the greater the likelihood that such weapons will be used.[1(p2)]

A report issued by the Committee on Armed Services, U.S. House of Representatives, on its inquiry into the chemical and biological threat noted that 11 nations possess or could develop an offensive biological weapons capability (Exhibit 21-1). These nations are in addition to the 31 that already possess or could develop an offensive chemical weapons capability.[1] While many in government, intelligence, and diplomatic circles express grave concern about the proliferation of biological weapons, there has been relatively little carryover into the general public. In part, the relative lack of interest in the proliferation of biological weapons can be attributed to the view that the Biological Weapons Convention successfully deters nations from pursuing a biological warfare capability. But another explanation is that the facts are hidden from the public domain: much of the information on biological weapons and proliferation is classified, and only those with a "need to know" have access.

An analysis of the incentives associated with a biological weapons program may offer the best insight into the current proliferation problem. Such a program has military, technical, and economic, as well as political, incentives.[17] Unless positive international controls can be established, the proliferation of biological weapons will probably proceed unchecked.

EXHIBIT 21-1

INTERNATIONAL BIOLOGICAL WEAPONS PROGRAMS

Known
Iraq
Former Soviet Union
Probable
China
Iran
North Korea
Libya
Syria
Taiwan
Possible
Cuba
Egypt
Israel

Source: Committee on Armed Services, House of Representatives. Special Inquiry Into the Chemical and Biological Threat. *Countering the Chemical and Biological Weapons Threat in the Post-Soviet World.* Washington, DC: US Government Printing Office; 23 Feb 1993. Report to the Congress.

Military Incentives

From a military viewpoint, the ability of biological warfare to produce large numbers of casualties makes these weapons highly attractive for long-range targeting of populations. Detailed in a report from the World Health Organization on the health aspects of the use of these weapons, the enormous impact these weapons would have on a population can readily be seen. According to this study, if a biological agent such as anthrax were used on an urban population of approximately 5 million people in an economically developed country such as the United States, an attack on a large city from a single plane disseminating 50 kg of the dried agent in a suitable aerosol form would affect an area far in excess of 20 km downwind, with approximately 100,000 deaths and 250,000 being incapacitated or dying. In the same scenario but using a different agent (such as Q fever), we would expect to find

only several hundred deaths but the same number of people temporarily incapacitated.[18]

The U.S. military confirmed the magnitude of the effects on a population such as that described above when it looked at the combat effects of major biological agents in studies conducted at Dugway Proving Ground, Utah.[19] We cannot help but ask: Is our medical system (civilian or military) ready for such a casualty situation—from either the purely medical patient-management perspective or the psychological perspective that the mass casualty situation would incite?

For the sake of argument, we might agree at this point that if nuclear weapons are not attainable, then biological weapons could be a feasible and economical alternative, filling the strategic role of nuclear weapons. Biological weapons could very easily fill an intimidation role. Further, if the agent and means of delivery were both carefully selected, biological weapons could also play a tactical role against a wide array of battlefield targets, including communications and logistical centers as well as areas of high troop concentrations. Because some biological agents (eg, Q fever, staphylococcal enterotoxin) are likely to incapacitate more victims than they kill and do not cause substantial collateral destruction, they have some significant advantages over nuclear weapons.[17]

It seems logical to conclude that countries might want to add biological warfare weapons to their military armamentaria out of fear, believing that they may be at a military disadvantage if their enemies have these weapons. Robert Gates, former Director of Central Intelligence, stated, in a speech delivered in San Francisco, California, to the Comstock Club on 15 December 1992, that for some,

> these weapons represent symbols of technical sophistication and military prowess—and that acquiring powerful weapons has become the hallmark of acceptance as a world power.[1(p4)]

Technical Incentives

In analyzing the biological weapons proliferation problem by scrutinizing the technical incentives that might attract a country to pursue such a program, we quickly see the comparative ease with which production of many biological warfare agents can be accomplished. Virtually all the technology needed to support a biological weapons program is dual use, obtainable off the shelf for a variety of legitimate purposes, and widely available.[16] This technology is very different from nuclear warfare technology, which requires dedicated facilities, or chemical warfare technology, where the agents have little if any civilian application. In addition, both nuclear and chemical technologies require raw materials that make innocent and legitimate use difficult to explain to the international community.

On the other hand, the equipment and technology used for offensive biological weapons research is no different from that used in legitimate biomedical research anywhere in the world. Equipment for processing and production of such agents is found in such diverse industries as wine and beer manufacture, pharmaceutical research and development, and the food and agriculture industries.[17] Few items need to be purchased from the "outside," and simple fermentation media are easy to make.[20]

Advanced capabilities have proliferated as Western universities have produced an abundance of graduate students in the biological sciences with training and expertise on the leading edge of biotechnology. Third-world facilities engaged in biological research are rapidly becoming more advanced as the dissemination of scientific information is at an all-time high. Dissemination equipment that could be purchased and used as off-the-shelf items, with few or minor modifications, may be found in the agriculture industry (sprayers) and hardware stores (paint sprayers), to name just a few.[17]

The potential agents may *themselves* be considered dual-use items. For example, botulinum toxin has been used investigationally for many years to treat ocular muscle disorders, and was approved in 1990 by the U.S. Food and Drug Administration (FDA) for intramuscular treatment of strabismus and blepharospasm.[21] As another example, saxitoxin has been widely used for decades to study the sodium channel in nerve tissue, and algal toxins are used in research as potential antineoplastic agents. Stating this concept another way, *all* of the infectious agents (bacteria, fungi, and viruses) as well as the toxins can be considered dual use in this sense: they can be used purposefully to inflict disease in humans, animals, and plants. Therefore, research needs to be done (and is, in fact, ongoing) on these agents so that better means of detection, prevention, and treatment of disease may be devised. Thus, we must acknowledge that potential biological warfare agents are currently found worldwide in laboratories and medical centers.[17]

Economic Incentives

In analyzing the biological weapons proliferation problem through economic incentives that might

attract a country to pursue such a program, we realize that the start-up costs of biological weapons programs are not prohibitive. This becomes a major incentive, especially relative to the cost of embarking on a nuclear weapons program.[17] The cost of a biological program is much less than either a nuclear or chemical program: estimates vary from $2 billion to $10 billion for a nuclear program; to tens of millions for a chemical program; to less than $10 million for a biological program.[20] From a purely economic standpoint, we can understand why biological weapons, according to a famous saying, are a poor man's nuclear bomb and can be produced by Third World countries.[4]

Even the weapons used to deliver these agents are relatively cost-effective. A group of chemical and biological experts, appearing before a United Nations panel in 1969, estimated that

> for a large-scale operation against a civilian population, casualties might cost about $2,000 per square kilometer with conventional weapons, $800 with nuclear weapons, $600 with nerve-gas weapons, and $1 with biological weapons.[22(p16)]

Unfortunately, long-range delivery systems are also proliferating. Aging ballistic missiles that the superpowers have discarded as obsolete are being acquired by Third World nations. The lighter biological warhead seems to extend the range of these missiles, and inaccuracy is a lesser problem with biological weapons, as dissemination of the agent depends on environmental conditions.[23]

Political Incentives

Two distinct political incentives might persuade a country to pursue a biological weapons program: (1) domestic and international status and (2) a favorable risk–benefit ratio. First, a country's ability to threaten its enemies with a weapon capable of inflicting mass casualties offers some tangible advantages.[17] W. Seth Carus, Director for Defense Strategy on the Policy Planning Staff in the Office of the Secretary of Defense, summarizes this political incentive in the following statement:

> The perceived need for deterrence or compellence [*sic*] capabilities, a desire to influence the political-military calculations of potential adversaries, the search for national status, and even bureaucratic and personal factors can play a role in the initiation of such programs.[16(p22)]

Second, detecting a clandestine biological warfare program is difficult. The risk is relatively low that biological weapons research and development will be uncovered and confirmed—unlike a nuclear or chemical weapons program. Because virtually all of the equipment associated with biological weapons can be used for legitimate purposes, there is no easily discriminated, unambiguous signature.[16]

A country can undertake many illicit biological warfare activities—save actual use—toward developing a sophisticated offensive biological warfare program without provoking inquiries from the international community.[17] Even signatories to the Biological Weapons Convention can investigate, for public health and commercial purposes, the properties of bacteria, viruses, and toxins that are considered to be biological warfare agents without ever violating the convention. Legitimate production facilities can produce such agents for offensive purposes on short notice, and with no more than a temporary slowdown on their routine production output. Because biological weapons can be configured out of preexisting conventional or chemical munitions that have already been declared to international groups, such weapons do not always require extensive testing. Thus, biological weapons can be a nation's "silent equalizer" but not cost a large percentage of the country's gross national product.

Weapons of mass destruction should be compared from such perspectives as technology, cost, signature, effectiveness on troops—protected and unprotected—and tactics as well as strategy (Table 21-1). We can see from looking at Table 21-1 that a nuclear weapons program requires a very high level of technology and a significant investment in a unique and distinctive infrastructure for research, development, production, and support of such weapons on the battlefield.[1] The outlay of facilities that are associated with a nuclear weapons program usually results in a distinctive and readily observable signature. Chemical and biological weapons programs, on the other hand, usually require lower levels of technology and monetary investment. The infrastructure for development and production of chemical and biological agents can be embedded in the industrial chemical and pharmaceutical infrastructure of any modern or developing state, thus resulting in a nondistinctive and readily observable signature.

In trying to ascertain these weapons' effectiveness, we must keep in mind that nuclear weapons have immediate and decisive effects, whether employed tactically on the battlefield or strategically against rear areas, and regardless of whether per-

TABLE 21-1

COMPARISON OF WEAPONS OF MASS DESTRUCTION

				Effectiveness			
				Protected Troops		Unprotected Troops	
Type	Technology	Cost	Signature	Tactical	Strategic	Tactical	Strategic
Nuclear	++	++	++	++	++	++	++
Chemical	+	+	+	–	–	++	+
Biological	+	–	–	–	–	+	++

++: very high; +: high; –: lower
Adapted from Committee on Armed Services, House of Representatives. Special Inquiry Into the Chemical and Biological Threat. *Countering the Chemical and Biological Weapons Threat in the Post-Soviet World.* Washington, DC: US Government Printing Office; 23 Feb 1993: 7. Report to the Congress.

sonnel in the area are protected or not. On the other hand, protective measures can provide a high level of protection against chemical and biological weapons *if* they are in use at the time these weapons are employed. This requires an effective and timely detection system, as these protective measures cannot continually be in place. Finally, the delayed effect of most biological weapons (as a result of the incubation period before becoming ill) causes us to question the tactical utility of biological weapons.[1]

NONHUMAN TARGETS OF ATTACK

We must remember that humans need not be the only target of biological weapons. These weapons might be meant to attack a country's animal herds, crops, or even a material supply that is vital for revenue. For example, if purposely introduced into a large pig population, swine fever virus, also known as wart hog disease, could destroy the herd. This attack could be carried out with relative ease and virtually no immediately visible signature. The usual method of controlling such widespread disease—mass slaughter of the infected animals—can be economically devastating to many countries.[22]

The main purpose of this use of biological agents is to affect humans indirectly by limiting their food supply.[24] Such use of biological agents could initiate a longer-term decline in food stores, which could then add the prospect of starvation of a population to the immediate devastating effects of conventional weapons. A population dependent on a staple crop such as rice could be rendered helpless by the introduction of a specific disease that devastated their unprotected rice crop.[25]

Likewise, a purposely introduced organism that degrades specific metals and renders them useless could also be devastating for a small country's economy. With increasing technology, specific antimaterial agents could be designed and could create enormous problems.

Animals

The purposeful spreading of infectious agents that attack cattle or other domestic animals can lead to serious consequences for a country's food supply or export of animal products (hides, wool, fats, and biological medicinal products such as adrenalin, insulin, pituitary extracts, cortisone, vaccines, and antisera).[26] The first 20th-century allegations of the use of biological warfare were made against the Germans, this being in the form of antianimal use. In 1915, the Germans were alleged to have inoculated horses and cattle with disease-producing bacteria before the animals were shipped from the United States to our allies in Europe. The following year, the Germans again allegedly inoculated horses with glanders and cattle with anthrax, this time in Bucharest, Romania.[27] Then in 1917, they supposedly employed similar tactics to infect 4,500 mules in Mesopotamia. As expected, Germany issued official denials of these allegations.[28]

An example of economic setback (albeit as a result of unfortunate natural circumstances) caused by disease among animals occurred when African swine fever was spread from Africa to the Iberian peninsula during the latter 1950s. The annual loss amounted to $9 million as a result of reduced pig production.[29]

A much more recent occurrence was in January 1984, in the state of Queensland, Australia, when an extortionist threatened to infect the livestock with foot-and-mouth disease if certain prison reforms were not undertaken. Authorities could not afford to take this threat lightly: Queensland is home to 60% of the Australian beef industry. The Australian government sought urgent and highly secret consultations with the United States and some of its other allies. The threat was ultimately determined to be a hoax perpetrated by a local convict; however, the economic implications of such an attack are obvious, and even the Australian authorities concluded that it would have been almost impossible to prevent.[22]

It seems reasonable that aggressor forces will use this deliberate spreading of infectious agents—either in peacetime or immediately before an outbreak of war—with the intention of initiating economic breakdowns. From the very beginnings of our biological warfare program, our scientists felt confident of their abilities to cause catastrophic epidemics in domestic animal populations with such viral diseases as foot and mouth, rinderpest, wart hog disease, fowl pest, and hog cholera. Each disease had devastating mortality and could render a predictable epidemic-producing agent in the animal population, much more certain than the predictability of agents inducing epidemics in humans.[30]

Antianimal research began in 1942 in the United States and was initially concerned with developing methods for protecting our large livestock population against biological warfare attack. This research resulted in the development of vaccines to protect against rinderpest, a deadly cattle disease and Newcastle disease, a serious poultry affliction. Research was initially carried out at Camp Detrick (now Fort Detrick), Frederick, Maryland, but when research on a larger scale was needed, a facility was established at Camp Terry on Plum Island, New York. Two field tests of potential antianimal agents were conducted using hog cholera virus and Newcastle virus. The program at Camp Detrick was terminated in 1954. By agreement between the secretaries of defense and agriculture, the Department of Agriculture assumed responsibility for the defense of our livestock against biological warfare attack, and the Plum Island facilities were transferred to that agency.[31]

Crops

Plants, like man, have been plagued with numerous diseases, and history is dotted with recordings of human suffering caused by naturally occurring plant epidemics (epiphytotics). Biological antiplant agents (ie, living organisms that cause disease or damage to plants; note that this definition includes insects and other crop-eating pests in addition to plant diseases), may be used intentionally by an enemy to attack food or economically valuable crops, thereby reducing a nation's ability to resist aggression.[26]

Attacks with biological weapons on a country's agriculture could have serious economic consequences and, if international sanctions or an embargo were in place, could prove devastating in the production of foodstuffs. Modern agricultural methods dictate that large areas be planted with genetically identical crops. This genetic homogeneity leaves entire regions susceptible to attack with an antiplant agent to which the crop is not resistant. Entire crops are thus susceptible to being wiped out during a single harvest season.[29] Resistant crops could eventually be planted, but enough seeds could not be produced in a short enough time to prevent dire economic consequences.

Speculations as to how to destroy a nation's agricultural base are not idle fantasy. Both the U.S.[32] and the British[33] governments sponsored extensive anticrop research programs during World War II. Not only were powerful herbicides developed but, in addition, fungi capable of eradicating specific crops were identified, and efforts were made to mass-produce them. In 1944 and 1945, serious consideration was given to destroying the Japanese rice crop using the fungus *Helminthosporium oryzae van Brede de Haan*. That this did not happen reflects not so much legal or moral factors but practical problems, notably the relative delay with which the desired effect would be obtained against the Japanese, compared to the effect of more conventional weapons such as firebombs.[33]

Research on biological warfare agents included strain selection, evaluation of nutritional requirements, development of optimal growth conditions and harvesting techniques, and preparation in a form suitable for dissemination.[31] Much of our knowledge in this area of anticrop biological warfare came from the British. In fact, the United States is said to have provided the money and resources, and the British provided the brains, as they had begun experimenting with this form of warfare much earlier than the United States.[33] Between 1951 and 1969, the U.S. Army carried out at least 31 anticrop tests, and rice and wheat blast fungi were stored at Fort Detrick and at Edgewood Arsenal, both in Maryland, and the Rocky

Mountain Arsenal, Denver, Colorado. Experiments showed that 3 g of the rice blast fungi per hectare could infect between 50% and 90% of the crops exposed.[30]

The CIA was also involved in antiplant agents about the same time as the U.S. Army. In materials provided to the U.S. Senate Select Committee on Intelligence Activities by the CIA during the mid 1970s, the agency acknowledged that it had developed "methods and systems for carrying out a covert attack against crops and causing severe crop loss."[34(p16)] The CIA denied that it had ever employed such systems, and there is no evidence that it has ever used herbicides or biological agents against the crops of another nation.[34]

Some have wondered whether the United States may have been a target of bioterrorism as recently as the late 1980s. A very peculiar pattern had emerged in the spread of the Mediterranean fruit fly, a major threat to agriculture in California. In 1989, a panel of scientists led by Roy Cunningham, U.S. Department of Agriculture, met in Los Angeles, California, to discuss possible reasons for this unexpected ecological anomaly. Despite heroic attempts to eradicate this insect, new infestations repeatedly appeared in odd and unexpected places. Some members of the panel questioned whether a person or group was purposely breeding and releasing Mediterranean fruit flies. This scenario might have seemed totally farfetched had not the mayor of Los Angeles, Tom Bradley, received several letters during this time frame from a group calling itself The Breeders, which claimed to be spreading the insect to protest California's agricultural practices.[35]

Material

Antimaterial biological warfare might be attempted by an adversary because biological agents are hard to detect and identify, are readily concealed, and can plausibly be denied. Antimaterial agents are organisms that degrade some item of material. Most of the material damage done by microorganisms is a result of natural contamination that grows only under special conditions of temperature and relative humidity. Fungi, for example, damage fabrics, rubber products, leather goods, and foodstuffs. Some bacteria produce highly acidic compounds that cause pitting in metals; these agents could create potential problems with stockpiled material.[24]

Other bacteria can use petroleum products as an energy source, producing organic residues that might clog fuel or oil lines. Imagine the disastrous implications for the military if such a residue-producing bacterial agent were purposely introduced into a jet fighter aircraft's fuel system. If the residue were to clog the fuel line, the fuel pumps would be rendered inoperable.[24]

THE CURRENT THREAT

Despite the end of the Cold War, the United States still faces a range of serious national security issues. One at the forefront is the issue of the proliferation of biological weapons, and the accelerated development of the capabilities to design and produce biological weapons on the part of many Third World nations.[17] The Committee on Armed Services of the U.S. House of Representatives, in their Special Inquiry Into the Chemical and Biological Threat, concluded that despite the demise of the Soviet Union, with its sizable chemical and biological arsenal, the threat has increased in terms of widespread proliferation, technological diversity, and the probability of use.[1]

Of the nations currently believed to have an offensive biological warfare program, only a few are candidates for a direct armed conflict with the United States. The most likely route for the United States or our allies to become involved in a biological conflict would be as third parties in regional conflicts, whether as members of a United Nations peacekeeping force or through an act of terrorism.[17] This is due to our increased participation in low-intensity operations, however, and does not diminish the threat that biological warfare poses to our forces fighting a conventional war.

North Korea and China

During the 1990s, hostilities have mounted in North Korea over allegations that evidence of nuclear weapons activities is being hidden from international inspectors. This is the kind of future conflict that could involve the United States. In 1993, the Russian Foreign Intelligence Service, successor to the Soviet Union's KGB, released a statement that said, in part:

> North Korea is performing applied military-biological research in a whole number of universities, medical institutes and specialized research institutes. Work is being performed in these research

> centers with inducers of malignant anthrax, cholera, bubonic plague and smallpox. Biological weapons are being tested on the island territories belonging to the DPRK (Democratic Peoples Republic of Korea).[36(pA-10)]

Mr. Gordon Oehler, director of the CIA's Non-Proliferation Center, confirmed this Russian report.[36] The use of smallpox in a weapon, whether the use be tactical or strategic, would have disastrous effects, as the military and civilians are not immunized against this disease nor have they been for many years.

In his last message to congressional leaders on 19 January 1993, outgoing President George Bush revealed intelligence reports (previously highly classified) that China still has an active biological warfare program—despite their having signed the international treaty banning such weapons.[37] Even as recently as May 1994, a reporter investigating China's military–industrial complex stated that arms sales, especially unreported sales and transfers of weapons of mass destruction to some of the most dangerous governments in the world, are part of the dark side of China's commercial activities. The newspaper report went on to state: "China has violated every non-proliferation pledge it has ever made, including its pledge not to engage in an offensive biological warfare program."[38(pC-3)] This is alarming, especially as we consider the close relationship between China and North Korea.

Iraq

As reported by the department of defense in 1992,[39] by the time Iraq invaded Kuwait, Iraq had developed the most extensive biological warfare program in the Arab world (despite having been a signatory to the 1972 Biological Weapons Convention outlawing such endeavors). After the Persian Gulf War (1990–1991), Iraqi authorities admitted the program included anthrax bacteria and botulinum toxin.[1] Then in August 1995, Iraq revealed to United Nations inspectors that it had had a far more extensive and aggressive biological warfare program prior to the Persian Gulf War than had previously been admitted. The Iraqi authorities claimed production of thousands of liters of botulinum toxin and of *Bacillus anthracis*. Additionally, they stated that unspecified amounts of both agents were loaded on Scud missile warheads and aerial bombs. In this same revelation to United Nations inspectors, the Iraqis claimed to have destroyed the agents during the January–February 1991 time frame, but they have yet to produce evidence to support their claim.[40]

Iraq's biological capabilities, described as "a sizable stockpile,"[41(pA-1)] by William Webster, former Director of Central Intelligence, caused the coalition forces to procure large quantities of special biological warfare vaccines (against anthrax and botulinum) for their military personnel. These vaccines were in extremely limited supplies, forcing commanders to allocate vaccine only to troops they believed were at greatest risk to the use of these agents. Situations like this require commanders to make ethical decisions, as it was not known definitively who was at greatest risk.

The anthrax vaccine, which is licensed by the FDA, was given to approximately 150,000 military personnel (25%–30% of the deployed U.S. forces).[42] The botulinum toxoid vaccine was given to approximately 8,000 military personnel (1% of deployed U.S. forces).[42] The biological weapons threat posed by Iraq during this crisis has been characterized as the most serious such threat faced by U.S. forces since World War I.[1] During January 1991, the image of a scared, shaking television reporter wearing a gas mask and the trembling of his voice as he reported the detonation of an incoming Iraqi Scud missile near Tel Aviv, Israel, brought home to all a frightening view of the increasing sophistication of the chemical and biological threat and the apparent vulnerability of soldiers and civilians alike.

The reasons why Iraq did not use these weapons during the Persian Gulf War, the subject of much speculation, will probably never be known with certainty. However, this Iraqi threat highlighted the problems posed by the proliferation of weapons of mass destruction among Third World nations and the potential threat posed to U.S. forces as well as other nations. On 3 April 1991, the United Nations Security Council passed Resolution 687, which required that

- Iraq's chemical, biological, and nuclear weapons be registered;
- these weapons and all production and research facilities be destroyed, rendered unusable, or removed;
- Iraq disclose all its holdings and programs and allow unhindered on-site inspections, and destroy the weapons-making potential on its territory itself or permit those weapons to be destroyed.

In conjunction with a longer-term verification regime established by United Nations Resolution 715, Iraq was also required to renounce the possession of any weapons of mass destruction. On 6 April

1991, Iraq accepted the terms of Resolution 687. However, the Iraqi government has steadfastly refused to accept Resolution 715 and regards the resolution as an unwarranted infringement on its sovereignty.

The Security Council entrusted implementation of the resolution to a special commission known as UNSCOM (*U*nited *N*ations *S*pecial *Com*mission), which was set up by the United Nations Secretary-General in May 1991. UNSCOM has carried out a series of inspections of Iraqi facilities, but relations with Iraq have been marked by frequent instances of misinformation, concealment, lack of cooperation, and obstruction and harassment of the inspection teams. Before the 1995 admission by Iraq of having weaponized biological agents, inspections into two suspected key Iraqi biological warfare facilities—Salmon Pak and Al Hakam—found no conclusive evidence of an Iraqi offensive biological program. However, evidence (such as Iraq's inability to explain the use of tons of growth media suitable for biological agent production) strongly pointed to the existence of a program. Furthermore, the inspection teams had only obtained an admission by Iraqi officials that Iraq had carried out a program of biological research for military purposes.[1] The UNSCOM experience underscores the difficulty of monitoring compliance with the Biological Weapons Convention.

Foreign and Domestic Terrorism

Although biological warfare is most often discussed in terms of weapons of mass destruction, usually in the context of war, terrorist use of biological agents cannot be excluded. Biological warfare agents are, for the most part, inexpensive and readily obtainable, and "cookbook" approaches are readily available. One such book is *Silent Death*, by an author who calls himself Uncle Fester.[43] Other titles from the same publisher include *The Poisoner's Handbook* and *Crimes Involving Poisons*.

Unfortunately, recent examples of possible intent to use are not difficult to find. A laboratory in a safe house of the Red Army Faction in Paris, France, was found to have made quantities of botulinum toxin; it is believed that none was used.[16] More alarming were the actions of the Aum Shinrikyo cult in Japan in early 1995. In addition to releasing the nerve agent sarin in the Tokyo subway on 18 March 1995, cult members were preparing vast quantities of *Clostridium difficile* bacterial spores for terrorist use.[44] Although possibly not producing large numbers of casualties, the use of even small amounts of such an agent would almost assuredly create major panic.

In March 1989, the most intensive food safety investigation in FDA history took place when a terrorist threatened to poison this nation's fresh fruit supply, to focus attention on the living conditions of the lower classes in Chile. The terrorist made good on his phone call to the FDA, as two grapes were found laced with small amounts of cyanide. Fortunately no one was poisoned, but the incident cost millions of dollars to investigate in this country, and had a significant impact on Chile's national economy, where fruit and vegetable exports are second in importance only to copper.[45] A biological toxin could have been used just as easily as cyanide in this instance.

The amounts of toxin needed to obtain the desired effect are exceedingly small. "For example, about 30 grams of the toxin ricin, easily concealed in a pocket, would be sufficient to lethally poison one batch of 150 pounds of meat, enough to produce 1,500 hot dogs."[46] The threat is real. And the knowledge required is not esoteric:

> To engage in bioterrorism requires only the type of knowledge that Kateuas found in his herbals—that is, a sophisticated understanding of the properties of various edible plants, medicinal herbs, toxins and venoms, and infectious and pharmaceutical agents.[35(p45)]

The use of biological agents in domestic terrorism has been attempted on several occasions in recent years, causing alarm and illustrating the ease of obtaining these agents. In May 1995, the American Type Culture Collection (ATCC), a nonprofit organization in Rockville, Maryland, that supplies biological specimens to scientists all over the world, shipped a package containing three vials of *Yersinia pestis* to the home of a white supremacist in Ohio.[47] (This organism, which causes plague, killed one quarter of the population when it struck Europe in the 14th century and wreaked havoc in India as recently as 1994.[48]) The American Type Culture Collection has tightened its controls on whom it will provide hazardous materials to, but even terrorists can produce legitimate request documents: the white supremacist is a qualified microbiologist. When his house was searched, police reported finding hand grenade triggers, homemade explosive devices, and detonating fuzes.[47] Fortunately, he was caught prior to any intentional use.

Two members of the Minnesota Patriots Council were convicted in 1995 for planning to use a lethal biological agent against U.S. marshals and Internal

Revenue Service agents. According to trial testimony, they planned to poison U.S. agents by placing ricin toxin on doorknobs.[49]

Lastly, in March 1992, a Tyson's Corner, Virginia, man was arrested and charged with malicious wounding in a hoax in which he sprayed his roommates with a fluid that he claimed contained anthrax bacteria. The house was placed under quarantine immediately after the incident, and while awaiting test results, 20 people—one a pregnant woman—were treated for possible exposure to anthrax.[50]

The threat that terrorists will use biological agents cannot be ignored and we have to remain strong, vigilant, and determined to defeat this form of terrorism as we do every other act of terrorism.

SUMMARY

International proliferation of biological warfare programs broadens the range of agents that members of the U.S. armed forces may encounter. Ironically, the modernization of many Third World nations—with the subsequent development of industrial, medical, pharmaceutical, and agricultural facilities needed to support these advancing societies—provides the basis for development of a biological weapons program, should a nation decide to pursue such an endeavor. A biological weapons program can easily be concealed within legitimate research-and-development and industrial programs, even by countries that are signatories to the 1972 Biological Weapons Convention. Actions such as these are grave threats to our national security.

Biological warfare agents may be more potent than the most lethal chemical warfare agents, and provide a broader area coverage per pound of payload than any other weapons system. The proliferation of technology and of scientific progress in biochemistry and biotechnology has simplified production requirements and provided the opportunity for the creation of exotic agents. This could involve the tailoring of pathogenic microorganisms capable of creating a novel disease, perhaps on an epidemic scale. Humans need not be the only target of biological weapons. These weapons might be meant to attack a country's revenue or food crop, animal herds, or even a supply of a material that is vital for revenue or defense.

Despite the end of the Cold War, the United States still faces serious national security issues. One at the forefront is the issue of the proliferation of biological weapons, especially in Third World nations that have compelling military, technical, economic, and political incentives to pursue this capability. The use of biological agents in future wars and actions by terrorists—foreign and domestic—is a legitimate issue of concern. Resolution of this problem should be given the highest priority.

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