Plague: A Review of its History and Potential as a Biological Weapon

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The increased threat of terrorism has revealed the importance of various diseases as potential weapons of destruction. Among the diseases that have been identified by the Centers for Disease Control and Prevention as being caused by category A organisms is plague. An ancient disease, it has played a role in both natural disasters and war and has been used as a weapon since at least medieval times. This article provides a brief historical overview of the disease in its natural occurrence and in its use as a biological weapon, as well as its potential for future use.

History of Plague as a Naturally Occurring Disease

Plague in Antiquity

Likely the oldest reference to bubonic plague is found in the biblical book of I Samuel, which records the devastation brought in approximately 1320 to 1000 BCE on the Philistines after they stole the Israelites’ Ark of the Covenant. In addition to having rats that appeared throughout the city, the Philistines felt “the Lord’s hand on the people of Ashdod and its vicinity, throwing [the city] into a great panic. He afflicted the people of the city, both young and old, with an outbreak of tumors (emerods) in the groin.” According to the biblical account, the Philistines, overpowered by the pestilence, were obliged to return the Ark of the Covenant with “five golden emerods and five golden mice.” The word emerods may denote buboes (Fig. 1), and the word translated mice may be translated rats, both of which support the theory that the disease was bubonic plague.

Some 900 years later, the plague of Athens (430-426 BCE) is credited with having played a role in Sparta’s winning the Peloponnesian War. The only surviving source for the Athenian plague, Thucydides’ The Peloponnesian War, is a systematic account that provides details of the symptoms and consequences. Thucydides attributed the success of the war to the plague, noting that the Spartans besieging the city were not affected by the disease. He records the arrival in the first days of summer of the Lacedaemonians and their allies in Attica, under the command of Archidamus, son of the king of Lacedaemon, during the second year of the war. The outbreak, which apparently began “not many days” later and was
seen in various places, was of a magnitude “nowhere remem-
bered.”

Although plague affects mainly rodents, infected fleas can
transmit the disease to people, who then infect others very
rapidly (Fig. 2). Thucydides records that the disease began in
parts of Ethiopia and then spread into Egypt and Libya, sud-
denly falling on Athens, where it first attacked the population
in Piraeus before appearing in the upper city. His descrip-
tions of the effects on individuals include the emotional strain
as well as the devastation in the cities, where bodies of dying
men lay one on another, “half-dead creatures reeled about the
streets and gathered round all the fountains in their longing
for water,” and sacred places were full of corpses of persons
who had died there. Burial rites dissolved into “the most
shameless sepultures.” The plague also affected the moral or
ethical values, as individuals openly committed crimes, re-
solving to enjoy life as much as they could and demeaning
any stand for honor. After describing the situations in the
city, Thucydides recounts that the events tallied with an or-
acle given to the Laedaemonians in which God was supposed
to have told them that if they put their might into it, victory
would be theirs and He would Himself be with them: the
plague broke out as soon as the Peloponnesians invaded Att-
tica, never entering the Peloponnesian army.

Plague or similar disease erupted sporadically during the
next several centuries. An epidemic of a similar disease
known as the Antonine plague occurred during the reign of
Marcus Aurelius (161-180 AD). Brought back by soldiers
returning from Seleucia, it affected Asia Minor, Egypt,
Greece, and Italy, destroying as much as one-third of the
population in some areas and decimating the Roman army.
before it finally abated. During the reigns of Roman emperors Trajan Decius (249-251 AD) and Vibius Trebonianus Gallus (251-253 AD), another epidemic of plague occurred in Egypt and throughout the entire empire. The mortalities severely depleted the ranks of the army and caused massive labor shortages. The epidemic, which began in 251, was still raging in 270 AD, when it caused the death of Claudius Gothicus (268-270).8

Between the third and sixth centuries, no record exists of an epidemic of plague. However, in the mid-sixth century, the Justinian (bubonic) plague or “Great Plague of Justinian,” occurred. Originating between 541 and 542 AD in either Ethiopia or the Central Asian steppes, the disease followed trade routes, sweeping across the Roman world and beyond. Procopius is credited with providing the first description of the pandemic of plague that afflicted the Byzantium empire during the reign of the emperor Justinian.9 According to Procopius’ account, the disease started among the Egyptians in Pelusium, divided, and moved in one direction toward Alexandria and the rest of Egypt and in the other direction toward Palestine, from which it spread over “the whole world, always moving forward and traveling at times favorable to it.”9 During this epidemic, approximately 40 percent of the population of Constantinople died, as did approximately 100 million Europeans.10,11 It was transmitted by both traders and troops who spread the disease in their military movements from Asia Minor to Africa and Italy, as well as to Western Europe.12,13 In the spring of 542, it reached Constantinople, where Justinian himself contracted the disease. By 543, the plague had reached Italy, Syria, and Palestine; it then migrated to Persia, where it infected the Persian army and King Khusruf himself. It may have spread to Ireland by 544. It continued to emerge periodically, with the bacteria remaining endemic in the population for another 250 to 300 years. According to Agathias (558 AD), the plague never abated completely, but instead moved from one place to another. Both Gregory of Tours (History of the Franks, IV) and Bede (Ecclesiastical History of the English People, III) record various instances of its recurrence, the latter describing the devastation of Britain and Ireland by the plague in 664.14

The Justinian plague took an enormous toll on both urban life, where streets were deserted and trade was abandoned, and rural areas, where taxation crippled the economy. Two other groups greatly affected were the army, which had virtually no men either to volunteer or to be impressed by Justinian’s final years, and the monasteries, 84 of which existed before 542 but seemed to disappear after the plague. Rome, too, suffered politically and economically, creating conditions ripe for disaster. In both cases, the plague was viewed by many writers, most of whom were writing in the classical literary tradition that was in the process of being adapted to Christian culture and history, as being a judgment of God in response to human sinfulness or even, as Zacharia of Mytilene wrote, “a scourge from Satan, who was ordered by God to destroy men” (The Syriac Chronicle, X, 9).14

Symptoms are described in works by Procopius (Wars 11, 22-3), Evagrius, IV (Historia Ecclesiastica IV), John of Ephesus (Historia Ecclesiasticas fragments), and Thucydides (The Peloponnesian War).14 According to these accounts, many victims experienced hallucinations followed by fever and fatigue. Soon thereafter, buboes appeared in the groin area or armpits, the victims entered a semiconscious or lethargic state, and then they experienced a madness. Some patients broke out with black blisters covering their bodies, and others died vomiting blood. The disease progressed rapidly, and infected individuals usually died within 2 to 3 days. In some cases, the buboes grew to great size and then ruptured and suppurated, in which case, the patients usually recovered, but often suffered afterward from muscular tremors. Survivors usually were left with withered thighs and tongues.6,9

**Figure 3** Woodcut showing the concept of the plague as bringing death.

**The Black Death**

The second pandemic of plague, known as the Black Death, brought plague into the collective Western memory (Fig. 3). It is considered one of the great epidemic scourges of humankind. Between the years 1346 and 1352, it caused the death of some 25 million people, one-third of the world’s population at that time.15 Another 20 million are thought to have died by the end of the century.10 During the 15th to the 18th centuries, an estimated 30 percent to 60 percent of the populations of large cities, including Genoa, Milan, Lyons, and Venice, died from the disease. It continued into the 18th century, when a final “foray” occurred in Marseilles in 1720.16

Plague occurred in all three forms of the disease, bubonic, pneumonic, and septicemic. The form seen most commonly was the bubonic, which had a mortality rate of 30 percent to 75 percent, followed by the pneumonic and then the septi-
cemic forms, which had mortality rates of 90 percent to 95 percent and 100 percent, respectively.\textsuperscript{17}

**Spread**

The Black Death began in the early 1330s with an outbreak of deadly bubonic plague in China, one of the busiest of the world’s trading nations. It may have entered Europe when bales of furs were opened in Astrakhan and Saray, releasing hungry fleas that jumped from the furs, seeking the first available blood meal, often from a human leg.\textsuperscript{18,19} In 1347, several Italian merchant ships returning from a trip to the Black Sea, a key link in trade with China, docked in Sicily with numerous passengers on board already dying of plague. Within days, the disease had spread to the city and surrounding countryside, where it continued to spread slowly from village to village.

One of the most precise and clinically accurate descriptions of the disease was written by Boccaccio in his Decameron, which explains the development of the disease from buboes in the groin or under the armpit to the patient’s death.\textsuperscript{20}

**Consequences**

Lasting for more than 130 years, the Black Plague had innumerable major economic, cultural, scientific and medical, societal, and religious ramifications.

**Economic.** With the deaths of so many persons, government, trade, and commerce came to a halt. The streets were littered with dead bodies, cattle and livestock roamed the countryside unattended, and, accordingly to at least one account, brother deserted or turned against brother.\textsuperscript{21} As one generation after another was affected during the next 200 years, significant portions of the children born during this time also died from numerous other causes, with the result that economic and demographic growth in most parts of Europe were diminished until the late 17th century.\textsuperscript{22}

Some economic historians claim that the Black Death exacerbated a recession in the European economy that had been under way since the beginning of the century. Peasant uprisings in many parts of Europe, such as France (the Jacquerie rebellion), Italy (the Ciompi rebellion, which swept the city of Florence), and England (the English Peasant Revolt), also have been attributed to the plague. The depopulation further eroded the peasants’ already weakened obligations to remain on their traditional holdings, and, particularly in Western Europe, the sudden scarcity of cheap labor provided an incentive for landlords to compete for peasants with wages and freedoms, an innovation that may represent the roots of capitalism and the resulting social upheaval that caused the Renaissance and even Reformation. In contrast, Eastern Europe renewed stringency of laws that tied the remaining peasant population more tightly to the land than ever before through serfdom.\textsuperscript{23,24}

**Cultural.** The arts also suffered as gruesome death began to influence the depiction of human life: some of the sculptures showed worms and snails munching on the diseased persons, paintings showed people socializing with skeletons, and artists abandoned old traditions of painting items idolized by the Christian religion and began painting pictures of sad and dead people. The Dies Irae, a famous Latin hymn thought to have been written by Thomas of Celano that describes the day of judgment and the last trumpet summoning souls before the throne of God, where the saved will be delivered and the unsaved cast into eternal flames, and the popular allegory La Danse Macabre, which served as a subject for art for centuries (Fig. 4A and 4B), as did the instructive and popular Ars moriendi (“the art of dying”; Fig. 5), were created during this period.\textsuperscript{24} The children, often orphaned or deliberately abandoned, saw horrors of death around them from their early infancy. The child’s game of ring-around-the-rosy, today played without much general knowledge of either its history or meaning, has been suggested to offer evidence of their world view: “ring around the rosy” referred to the rosary beads that give one God’s help or to the ring seen on the skin of those afflicted with the fatal disease; “a pocket full of posies” referred to the use of such to stop the odor of rotting bodies and to protect the doctors from the infected patients or to flowers thrown on the graves of those who died; “ashes, ashes” referred to the burning of the dead when burying them became too laborious; and “we all fall down” referred to the fact that the children lived with the awareness that they, too, might succumb any day to the plague and death.\textsuperscript{25-27} Although that popular history of the nursery rhyme has been questioned in some circles,\textsuperscript{28} it nonetheless provides a picture of the cultural climate of the day.

**Medical and Scientific.** Although many doctors fled when the disease reached Rome, others upheld the highest standards of medical practice and continued to serve the sick, often at the cost of their own lives. At the time, physicians had no effective treatment because they did not understand the epidemiology of plague, and even at the highly regarded University of Paris, they theorized that a conjunction of the planets Saturn, Mars, and Jupiter led to the plague.\textsuperscript{10} Various remedies were offered, among which were a simple diet; avoidance of excessive sleep, exercise, and emotion; regular enemas; and abstinence from sexual intercourse.\textsuperscript{29}

In 1546, the first complete theory of infection was published by Girolamo Fracastoro (1478-1553).\textsuperscript{4} Fracastoro speculated that the plague was caused by an infective agent of minute size that he called seminaria contagiosum. He suggested that the seminaria caused spoiling and were transmitted by minute particles.\textsuperscript{4} Although some people killed cats and dogs, thinking they might be carriers of the disease, no one suspected that rats were involved.\textsuperscript{10}

One of the worst solutions was that of a church rector in Eyam Derbyshire, England, who in 1666 persuaded the entire community to quarantine itself when plague erupted there. This solution merely put the people in close proximity to the infected rats, with the result that the city experienced virtually a 100% attack rate with 72 percent mortality rate.\textsuperscript{30}

**Societal.** Despite the availability of medical tracts, moral treatises, and papal proclamations that provided rational explanations, at least within the medieval worldview, irrational
or superstitious ideas prevailed among many people. Christians blamed the disease on Muslims, who blamed it on Christians; both blamed it on Jews or witches. As a result, especially in the wake of initial infestations, women lepers and Jews were attacked as being the causes on the basis of either their deliberate spread of the plague or their innate dishonor had polluted society and brought on God's wrath. The city of Strasbourg alone slew 16,000 of its Jewish residents. By 1351, 60 major and 150 smaller Jewish communities had been exterminated, and more than 350 separate massacres had occurred. These persecutions often were more than the result of religious hatred, as they served as a way of attacking the kings (Jews often were considered the King's property) or Church who protected the Jews. An important legacy of the Black Death was that it caused the eastward movement of the remnant of north European Jews to Poland and Russia, where it remained until the twentieth century. In other cases, citizens blamed the developmentally delayed, deformed, and mentally challenged people, who became perfect candidates and often were stoned as witches.

Social and Religious. In the social sector, which defined itself as Christian, the recurrent plague changed religious practices, if not basic beliefs. A whole new series of “plague saints” came into existence, along with new religious brotherhoods and shrines dedicated to protecting the population from plague. One example was St. Roch (Fig. 6) who, according
to Catholic tradition, is said to have been born in 1295 miraculously marked on the breast with a red cross. After losing his parents when he was about 20 years old, he distributed his fortune among the poor, handed over to his uncle the government of Montpellier, and, disguised as a mendicant pilgrim, set out for Italy. He stopped first at Aquapendente, which was stricken by the plague, and devoted himself to the plague-stricken people, curing them with the sign of the cross. He subsequently visited numerous other cities with the same result. He himself was stricken with the plague, recovered, and returned to France, where he was taken for a spy in the disguise of a pilgrim and cast into prison by order of the governor, where 5 years later he died. The miraculous cross on his breast as well as a document found in his possession served for his identification. When in 1414, the Fathers of the Council of Constance ordered public prayers and processions in honor of Roth, immediately the plague reportedly ceased. His relics, according to Wadding, were carried furtively to Venice in 1485, where they are still venerated.

The Third Pandemic: China

In 1855, yet another pandemic of plague arose, this time in the Chinese province of Yunnan. It reached Honk Kong and Canton in 1894. Spread was more rapid than earlier because of more modern transportation. Within 4 years, it arrived in Bombay and for the next 50 years, it took the lives of more than 13 million Indians. During the next 2 years, 1899 and 1900, it was disseminated to Africa, Australia, Europe, Hawaii, India, Japan, the Middle East, the Philippines, North America, and South America.

It arrived officially in the United States in March 1900. The initial event was marked by the discovery of the lifeless body of a Chinese laborer in a hotel basement in San Francisco, California. An autopsy performed by a city health officer on March 6 revealed organisms that looked like plague. The previous summer, a ship sailing from Hong Kong to San Francisco reportedly had two cases of plague on board. Because of these cases, the passengers were ordered quarantined on Angel Island. A search of the ship revealed that 11 stowaways were on board, but the next day, two were missing. Their bodies later were found in the Bay, and autopsies revealed that both of them had plague bacilli. Nonetheless, no immediate outbreak of the disease occurred, although rats had been infected and are considered the source of the outbreak that hit San Francisco 9 months later. Chinatown was quarantined, sparking a political debate between the Chinese and health officials; the quarantine was lifted, but health officials persisted in having house-to-house inspections performed in Chinatown, where two more bodies were found. The governor refused to accept that any danger existed, and finally the Surgeon General got permission from President McKinley to pass antiplague regulations. A clean-up campaign begun in 1901 in Chinatown succeeded in stopping the spread, and the last victim, a woman in the town of Concord, California, died on February 29, 1904. Another epidemic occurred after the 1906 earthquake in San Francisco, which destroyed buildings that left rats as well as humans homeless. In 1907, cases of plague were reported again, but this time, experience in dealing with the rats led to a halt of the epidemic, at least in that area.

The cases in the United States were attributed to rodents infected from the San Francisco focus, which led to an infestation in the western United States of greater magnitude even than that in Europe during the time of the Black Death. As a result, human plague initially was a result of urban rat epizootics until 1925, at which time urban plague vanished due to general rat control and hygiene measures instituted in various port cities. Since then, virtually all cases in the United States have been in rural areas, where the disease spread after the measures taken in the urban areas proved successful.

During this pandemic, considerable progress was made in dealing with plague. First, the plague organism was isolated and the means of transmission was identified. In June 1894, Alexandre Yersin and Shibasaburo Kitasato, working independently, both announced within days of each other that the organism causing the diseases had been isolated. Kitasato initially was credited with the discovery, but the Yersin ba-
cillus, which satisfied Koch’s postulates for the bubonic plague,42 fits the current description of Y. pestis; he also used antiserum he developed against the organism to cure a patient in 1896.43,44 The organism identified by Kitasato, which he insisted was different from that identified by Yersin, had features that likely were caused by a contaminating pneumococcus. Yersin also made a connection between the organism and rats. However, Masanori Ogata and Paul-Louis Simon independently discovered in 1897 the role of the flea in the transmission of plague.44 That same year, Haffkine demonstrated the efficacy of a vaccine he had developed during the outbreak in Bombay, India.45 Between 1910 and 1911, during the Manchurian outbreak, L-T Wu realized that the epidemic was the pneumonic form of plague and instituted the use of protective measures to reduce the aerosol spread of the disease.46,47 Subsequently, K. F. Meyer and his colleagues advanced the work on vaccine and antibiotic efficacy, animal models, and pathology of the disease.36,42,48-51 M. Baltazard is credited with having provided early descriptions of the role of resistant or silent enzootic reservoirs in the maintenance and epidemic outbreaks of plague.44 This current pandemic is now on the decline, but it has established stable enzootic foci on every major inhabited continent except Australia.

Plague as a Biological Weapon of Warfare

Early Instances

The earliest record of what we now consider to be “biological warfare” is that of a purported effort to use plague at the Crimean port city of Caffa (also, Kaffa) on the Black Sea during the years 1346 to 1347.5,10 When the Tatar army was struck with plague, their leader catapulted corpses of victims at the Genoese sailors. They in turn contracted the disease and fled to Italy, and in the course of their retreat initiated the Black Death.1,52 This incident was described in 1348 or 1349 by Gabriel de Mussis, a notary born in Piacenza, north of Genoa53:

[The Tatars], fatigued by such a plague and pestiferous disease, stupefied and amazed, observing themselves dying without hope of health ordered cadavers placed on their hurling machines and thrown into the city of Caffa, so that by means of these intolerable passengers the defenders died widely.54,55

Although this measure was considered the cause of the outbreak of plague among the Genoese sailors, more likely the disease was transmitted by rats because the infected flea leaves its host as soon as the corpse cools.1,10,52 Later, at the battle of Carolstein in 1422, the Lithuanians, under Prince Coribat, catapulted bodies of plague-stricken soldiers plus 2000 cartloads of excrement into the ranks of enemy troops.55,56 In 1710, during the battle between Russian troops and Swedish forces in Reval, Russians hurled cadavers of plague victims into the ranks of the enemy.1,57,58

World War II

Although the 1710 event often is cited as being the last use of plague for biological warfare, more recent instances have been documented. During World War II (WW II), the Japanese army established a secret research unit (Unit 731) to study biological warfare agents. The physician leader, General Shiro Ishii, was particularly interested in plague because it could create casualties out of proportion to the number of organisms released. It also had the advantage of being a very dangerous weapon, the origins of which could be concealed to make it appear to be a natural occurrence. Although early experiments dropping bacteria from aerial bombs failed because air pressure and high temperatures killed almost all the bacteria, Ishii discovered that the human flea, Pulex irritans, could be used to both protect the bacteria and target humans. The attempt to spray infected fleas from compressed-air containers also failed because it required the planes to fly too low to the ground. Finally, the use of clay bombs solved the problems and resulted in an 80 percent survival rate of fleas.5,59

On several occasions during WW II, the Japanese apparently used plague as a biological weapon. On October 4, 1940, they released plague bacteria in the form of rice and wheat grains mixed with infected fleas at Chuhsien, resulting in the deaths of 21 people. Several weeks later, on October 29, Japanese planes dropped plague bacteria at Ningpo; within 2 days, bubonic plague occurred for the first time in that city, killing 99 people in 34 days. As in other events, no excessive mortality was found in the rat population. In January of the following year, the Japanese introduced plague into Suiyuan and Ningsha provinces, resulting in a serious epidemic.5,55,59 Later, at 05:00 hours on a morning in November 1941, a Japanese plane made three low passes over the business center of Changteh in the Hunan province. No bombs were dropped, but a strange mixture of wheat and rice grains, pieces of paper, cotton wadding, and other particles were released. Within 2 weeks, people in the area began dying of plague in a miniepidemic thought to be of human origin.59

After World War II

Since the end of WW II, several accusations have been launched by the popular press against the allied forces in the Korean conflict and, later, the Soviet Union. According to these reports, the allied forces dropped on North Korea insects that were capable of spreading plague, typhus, malaria, Japanese B encephalitis, and other diseases. This charge later was shown to have no support.59

In the 1950s, the United Kingdom closed down its offensive biological weapons program, and in 1969, the United States followed suit. The allied programs had grown from fledgling efforts by British researchers into a large U.S.-based research and development with production capability. By 1969, the U.S. military was in possession of seven type-classified agents and had production plants that could produce 650 tons of agent per month for use as weapons. The program was unilaterally abandoned in 1969 for numerous rea-
sons, giving impetus to the creation of the Biological and Toxin Weapons Convention (BWC). The BWC was drafted by the British and finalized by the Soviet Union, although the latter did not expect the United States actually to abandon its biological weapons capability, regarding the disarmament agreement as a "worthless piece of paper."  

In 1970, the World Health Organization (WHO) issued a comprehensive report on the potential possible use of biological weapons over populated areas; it indicated that the deliberate release of 50 kg of Y. pestis in aerosolized form over a city of 5 million could cause cases of pneumonic plague in as many as 150,000 persons, 36,000 of whom likely would die from the disease. In addition, plague bacilli would remain viable in the area for at least 1 hour, within a distance of 10 km. Of added concern was the possibility that people seeking to escape the scene would carry the bacilli with them, thereby causing even further spread.  

Despite signing the BWC, the Soviets continued their program until 1992, with a substantial increase in size and scope occurring between 1972 and 1987. The 15th Main Directorate of the Ministry of Defense (MOD; named Post Office Box A-1968 for secrecy reasons) was formed under the direction of General Yefim I. Smirnov, who held the position until 1985. Another program was established under the civilian cover of a vast pharmaceutical research and production complex known as Biopreparat. Concealed under the cover of legal and civil biotechnology research, offensive biological weapons research and development and production were performed by Biopreparat, which at no time ever had more than 15 percent of its activity at any of its 52 sites actually devoted to civilian biotechnology work. One of the main purposes of the enormous Biopreparat organization was to hide biological weapons research, development, and production that formerly had been the sole responsibility of the MOD. It also was to apply advances in biotechnology such as genetic engineering to improving the biological weapons capability of the Soviet Union. By the time of the dissolution of the Soviet Union in 1992, significant progress had been made, and war mobilization plans were in place for the surge production of huge quantities of various agents, especially plague and smallpox. An overwhelming concern is the capability they had to undertake a strategic attack using plague or smallpox: intercontinental ballistic missiles with MIR Ved warheads containing plague were available for launch before 1985. Plague and smallpox were categorized as strategic weapons and were destined for use against enemy population centers.  

Some of this information came to light when an article published in Newsweek charged that the Soviet Union in the 1970s and 1980s had created lethal diseases that defied cures. Among these agents was a genetically engineered, dry, antibiotic-resistant form of plague. The article quoted a defecting Soviet microbiologist as saying that the production of such a plague agent had been a top priority of the Soviets in a 3-year plan that started in 1984. During the next 2 decades, more information about the Soviet Union’s activities was acquired from defectors and scientists still in the area. From their reports, we know that the USSR developed a unique national public health system that included an agency called the "antiplague system." It was charged with protecting the country from highly dangerous diseases of either natural or laboratory etiology. During the 1960s, the system became the lead agency of a program designed to defend against biological warfare; it was code-named Project 5. By the middle 1970s, the responsibility of this agency had been expanded to include undertaking tasks for the offensive biological warfare program, code-named Ferment.  

In 1989, a Russian visitor to France presented himself at the United Kingdom embassy in Paris and requested asylum. Within hours, his identity was verified and he was flown to England, where he remained in a safe house for several years while being debriefed. In January 1991, a visit to Biopreparat facilities was undertaken by a joint U.K./U.S. technical team under a cloak of secrecy. In 1994, the defector finally was identified as Dr. Vladimir Pasechnik (d., November 21, 2001), the former general director of Science Production Organisation Farmpribor and director of The All Union Scientific Research Institute of Ultra Pure Biopreparations in Leningrad. For the first time, the public became aware of the Soviet Union’s former biological warfare program, the world’s largest and most sophisticated offensive program.  

In 1992, Kanadjan Alibekov, a former senior deputy director of Biopreparat, also defected and provided sufficient information to establish that the biological weapons program was continuing, for which the new Russian regime was openly charged. Russian President Boris Yeltsin acknowledged that the Soviet biological weapons program had continued for some 20 years, in violation of the 1972 BWC, and ordered it to be closed down.  

After these defections and admissions, other scientists came forward to share their stories about involvement in secret military programs. Their accounts revealed only the ostensibly civilian part of Soviet experience with biological weapons, and the larger, more important part of the program, which was operated in strict secrecy by the USSR MOD, remains unknown, at least to the general public. Among the information gathered is the knowledge that the program reached its peak by the late 1980s, that it likely was more than 10 times the size of the program possessed by the United States before 1969; that it was scientifically sophisticated, making use of advanced biotechnologies such as genetic engineering; and that it developed modified bacterial and viral strains for weapons purposes.  

After 1992, little published information noted the actions of autonomous groups or individuals who were seeking to develop plague as a weapon. The only subsequent reported suspicious activity occurred in 1995, when a microbiologist with ties to subversive organizations was arrested after deceitfully obtaining Y. pestis by mail.  

Recent Years  

After the events of September 11, 2001, public awareness has been raised substantially regarding the threat of bioterrorism. In the months after the attack on the World Trade Center, several cases of biological warfare surfaced. In October of that
year, a Florida man died of pulmonary anthrax, and another 10 individuals developed symptoms of inhalational anthrax. Four of them died of the disease. The agent had been sent through the U.S. mail system. New antiterrorism legislation has been passed, and appropriate measures have been taken to educate and alert the public and the medical community to be prepared in the event of any more such attacks.4 Today, China also poses a particular concern, especially with evidence mounting that it is pursuing biological research at two ostensibly civilian-run research centers controlled by the Chinese military. These centers are known to have been involved previously in the production and storage of biological weapons, and strong indications are that China probably maintains an offensive program.69 Other countries that pose specific threats and are thought by the United States to be developing an offensive biological warfare capability include Syria, Iran, Egypt, Libya, Taiwan, North Korea, and Israel.70,71

With regard to the use of Y. pestis, it most likely would be released in aerosol form, causing an outbreak of pneumonic plague. Symptoms likely would occur within 1 to 6 days after exposure, and most affected individuals would die soon after the onset of symptoms. Furthermore, a bioterrorism attack with plague might use a natural or goengineered drug-resistant strain. Although natural resistance of Y. pestis to antibiotics has been a rare occurrence, in 1995, a plague isolate from Madagascar containing a multidrug-resistant transferable plasmid was described.72 Later that year, a second strain was identified that had a plasmid encoded for the streptomycin-modifying phosphotransferase gene, which resulted in high-level resistance to streptomycin.73 Both organisms contained plasmids that were transferred easily to other strains of Y. pestis, as well as to Escherichia coli. This new evidence of naturally occurring drug resistance in isolates of Y. pestis, combined with the reports that the former Soviet Union bioengineered multidrug-resistant and fluoroquinolone-resistant strains of Y. pestis, underscores the need for continuous reevaluation of guidelines for diagnosis and treatment of plague and for more research to be conducted for effective treatment and vaccine development.4

References

3. I Samuel 5:6, 9 (NIV)


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