

History of biological warfare and bioterrorism

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Abstract

Bioterrorism literally means using microorganisms or infected samples to cause terror and panic in populations. Bioterrorism had already started 14 centuries before Christ, when the Hittites sent infected rams to their enemies. However, apart from some rare well-documented events, it is often very difficult for historians and microbiologists to differentiate natural epidemics from alleged biological attacks, because: (i) little information is available for times before the advent of modern microbiology; (ii) truth may be manipulated for political reasons, especially for a hot topic such as a biological attack; and (iii) the passage of time may also have distorted the reality of the past. Nevertheless, we have tried to provide to clinical microbiologists an overview of some likely biological warfare that occurred before the 18th century and that included the intentional spread of epidemic diseases such as tularaemia, plague, malaria, smallpox, yellow fever, and leprosy. We also summarize the main events that occurred during the modern microbiology era, from World War I to the recent 'anthrax letters' that followed the World Trade Center attack of September 2001. Again, the political polemic surrounding the use of infectious agents as a weapon may distort the truth. This is nicely exemplified by the Sverdlovsk accident, which was initially attributed by the authorities to a natural foodborne outbreak, and was officially recognized as having a military cause only 13 years later.

Keywords: Anthrax, biological warfare, bioterrorism, history, military medicine, plague, tularaemia

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Introduction

The current definition of terrorism emphasizes that its main objective is to threaten and terrorize large groups of humans, governments, armies, or society as a whole. Thus, one may assume, in the context of a historical analysis of bioterrorism, that it involves the use of various biological agents by all kinds of actors or groups, including political or military actors and official states, motivated by different reasons (be they political, religious, or other ideological objectives), in order to attain such objectives. As expressed by a prominent expert on the topic, the 'transcendence of biological warfare—over medicine and public health, private criminal acts, terrorism, interstate warfare, and international law directed at the elimination of biological warfare—makes this one of the most intricate topics of discourses, poses very difficult problems, and open some

novel challenges in the ethical domain. Biological warfare events (BW) is widely regarded as the absolute perversion of medical science' [1]. As well as this being perfectly true with regard to contemporary political and scientific concerns, the claim of the transcendence of biological warfare (BW) and bioterrorism also has historical pertinence, insofar as the fact of threatening one's neighbours' health by using biological technologies seems to be as old as humanity itself. However, the historical study of BW and bioterrorism is made extremely difficult, and any conclusions in this respect must be drawn with caution, because of several concomitant factors: first, the lack of reliable scientific data regarding alleged bioterrorist attacks, especially before the advent of modern microbiology; second, the polemical conditions surrounding any alleged biological attack, within which the available documents become susceptible to multiple political manipulations, and thus difficult

to interpret objectively; and third, the historical distance of ancient stories about biological attacks, and the possible misunderstanding of them if they are read with contemporary lenses [2]. Given such factors, it is easy to understand why it may become difficult for historians to differentiate natural epidemics from alleged biological attacks.

From an epistemological perspective, the advent of modern microbiology at the end of the 19th century undoubtedly marks the major turning point in the scientific history of BW long after its beginnings in remote antiquity. Thus, Louis Pasteur's and Robert Koch's advances in the theoretical understanding of microbiology, and the derived practical microbiological methods, suddenly offered scientists the possibility of systematically isolating and producing a huge number of specific pathogens, as well as, in the majority of cases, controlling their dissemination. From a socio-political perspective, however, one might consider other turning points: the major world conflicts of the 20th century constitute, in this respect, the main events that turned BW from a sporadic, if dangerous, mass weapon, to an almost standard, if not constantly used, weapon, in brief a classic tool of most of modern armies. From that period on, modern states felt compelled to mutually negotiate and agree on international regulations in order to try to master the threat of biological (as well as chemical) weapons. A crucial step in the history of BW and bioterrorism occurred after World War II, when small groups of activists acquired the ability to master the technologies involved in BW, and were suddenly able to threaten not only individuals but huge amounts of people, thus adding to the threat of the states' armies the more uncontrollable one of single individuals or small groups, and thus representing a major concern for state security.

Use of Biological Weapons During Antiquities, Middle Ages and Colonial Period

Contagious diseases and other biological weapons were recognized for their potential impact on armies or people as early as the 14th century BC (Table 1). The Hittites might have produced the first documented example of BW by sending diseased rams (possibly infected with tularaemia) to their enemies to weaken them [3]. In the fourth century BC, the Greek historian Herodotus relates that Scythian archers used to infect their arrows by dipping them in a mixture of decomposing cadavers of adders and human blood. According to our modern interpretation, this mixture might have contained *Clostridium perfringens* and *Clostridium tetani*, as well as the snakes' venom [4]. In the third century BC, the military commander Hannibal of Cartagena set fire to the enemy's fleet

TABLE 1. Examples of biological warfare before the microbiology era [13]

Year	Event
14th century BC	The Hittites send rams infected with tularaemia to their enemies
4th century BC	According to Herodotus, Scythian archers infect their arrows by dipping them into decomposing cadavers
1155	Barbarossa poisons water wells with human bodies, Tortona (Italy)
1346	Mongols hurl bodies of plague victims over the walls of the besieged city of Caffa (Crimea)
1422	Lithuanian army hurls manure made of infected victims into the town of Carolstein (Bohemia)
1495	Spanish mix wine with blood of leprosy patients to sell to their French foes, Naples (Italy)
1650	Polish army fires saliva from rabid dogs towards their enemies
1710	Russian army catapult plague cadavers over the Swedish troops in Reval (Estonia)
1763	British officers distribute blankets from smallpox hospital to Native Americans
1797	The Napoleonic armies flood the plains around Mantua (Italy), to enhance the spread of malaria among the enemy
1863	Confederates sell clothing from yellow fever and smallpox patients to Union troops during the American Civil War

(belonging to King Eumenes II of Pergamon) with pots full of venomous snakes. Similar examples are reported by historians or, for cases closer to our epoch, by anthropologists of the use of arrows or other vessels infected with different products extracted from animal parts or plants in order to attack the human enemy [5,6]. Similarly, the use of arrows for the transmission of plague is suggested by some allegoric documents, such as the drawing painted in 1437 by an anonymous artist on a wood cover used by the government of Siena to protect official documents (Fig. 1). In the Middle Ages, a famous although controversial example is offered by the siege of Caffa (now Feodosia in Ukraine/Crimea), a Genovese outpost on the Black Sea coast, by the Mongols. In 1346, the attacking army experienced an epidemic of bubonic plague. The Italian chronicler Gabriele de' Mussi, in his *Istoria de Morbo sive Mortalitate quae fuit Anno Domini 1348*, describes quite plausibly how the plague was transmitted by the Mongols by throwing diseased cadavers with catapults into the besieged city, and how ships transporting Genovese soldiers, fleas and rats fleeing from there brought it to the Mediterranean ports. Given the highly complex epidemiology of plague, this interpretation of the Black Death (which might have killed >25 million people in the following years throughout Europe) as stemming from a specific and localized origin of the Black Death remains controversial. Similarly, it remains doubtful whether the effect of throwing infected cadavers could have been the sole cause of the outburst of an epidemic in the besieged city. However, this episode of the use of cadavers in order to infect a population remains a landmark in the history of BW [7–9]. Similar examples of the use of the technique of catapulting infected cadavers can be found throughout the

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