

## 2. Biological warfare before 1914

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### I. Introduction

Hostilities between states, as well as civil conflict, have nearly always been accompanied by an increase in the incidence of infectious disease. In most instances of armed conflict, both military and civilian casualties caused by disease have outnumbered those inflicted in the course of combat, often by more than an order of magnitude. This has made the control of infectious disease a major preoccupation of military medicine, since the forces with the lightest burden of disease are at a significant advantage. It has also offered tactical and strategic opportunities, since any activity that would lead to an increase in the disease incidence of an opposing force would also lead to a comparative advantage. There is a broad range of such activities, from widely practised and generally accepted tactics, such as the interdiction of supply lines (which carry medical and sanitary supplies as well as food and ammunition), to outright biological warfare in which enemy troops or civilians are deliberately infected with a pathogenic micro-organism.

Given the potential advantage that could accrue from biological weapons (BW), and the fact that there was no explicit prohibition against them until well into this century, it is surprising that there are so few recorded instances of their use. Only one episode is convincingly documented prior to 1914: the 1763 attempt by British colonial forces in North America to infect Delaware Indians with smallpox-contaminated linens. Similar episodes probably occurred sporadically on the frontier in both North and South America, but their frequency cannot be reliably estimated; presumably they were rare. It is also probable that the British used smallpox as a weapon during the American Revolutionary War, inoculating civilians with the disease and sending them to mingle with Continental Army troops. The frequency of this practice, if it occurred at all, is unclear. Much earlier, there may have been occasional medieval and Renaissance attempts to transmit disease by hurling biological material into besieged cities. It is impossible to determine the frequency of this practice with certainty, but it also appears to have been rare.

Although the phenomenon of contagion has been recognized for millennia, its mechanisms were until recently not understood. This may at least partially explain the low incidence of reported BW use. Sophisticated manipulation of contagion was not possible until the early 20th century, coincident with a growing revulsion against such unconventional methods of warfare. For nearly the

\* Supported by grant USIP 049-3 from the United States Institute of Peace (USIP) and by a grant from the University of California Institute on Global Conflict and Cooperation (IGCC). The opinions and conclusions expressed here are those of the author and do not necessarily reflect the views of the USIP or the IGCC. The author would like to thank Mitra Assemi, Cristin O'Neill and Vicky Breeze for library assistance; and Martin Hugh-Jones, John P. Woodall and John Ellis van Courtland Moon for helpful comments.

entire period covered by this chapter, there was no possibility of any but the crudest methods of deploying disease as a weapon.

Complicating the problem of determining the credibility of allegations of biological warfare is the likelihood that there is a bias towards false accusations. An increase of the incidence of infectious disease is a natural consequence of the social disruption that accompanies military or civil conflict or the early encounters of peoples with different sets of endemic diseases, and under such circumstances political and social antagonisms are heightened. Natural outbreaks can thus be expected frequently to provoke suspicion and lead to accusations.

The probability that instances of biological attack have gone unrecorded, either because they were never suspected or because the victims were not in a position to have their suspicions recorded, is also a problem. However, this might partly counterbalance the tendency for false accusations.

The criteria used in this chapter to assess the credibility of an allegation include the following: (a) it should make political and historical sense; (b) it should be supported with sufficient detail to allow evaluation; (c) the alleged action should be technically feasible in the context of the state of knowledge at the time; (d) the reported outbreak should be a plausible consequence of the alleged action; (e) the source of the allegation should be clearly documented; and (f) there should be some evidence to support it. The kinds of evidence that can support an allegation include participant confession, eyewitness accounts and circumstantial evidence such as unusual aspects of an epidemic that suggest an unnatural aetiology.<sup>1</sup> While all criteria must be satisfied at least to some degree for the present author to consider an allegation credible, the passage of time and probable efforts to preserve secrecy mean that even correct allegations are unlikely to satisfy all criteria fully.

Biological warfare can take varied forms; this chapter is restricted to occasions on which it can reasonably be presumed that there was a conscious intent to communicate infectious disease.<sup>2</sup> Making intent a key feature of the operational definition is problematic, since intent may not be retrospectively determinable.<sup>3</sup> However, intent is assumed if it is consistent with the state of knowledge of the time.

This survey is necessarily incomplete because it relies almost entirely on published material in English. Much unpublished material on this topic remains to be searched, as do the primary literatures in other languages. Probably most

<sup>1</sup> Woodall, J. P., 'Review of WHO health and epidemic information as a basis for verification activities under a BWC', ed. S. J. Lundin, *Views on Possible Verification Measures for the Biological Weapons Convention*, SIPRI Chemical & Biological Warfare Studies no. 12 (Oxford University Press: Oxford, 1991); and Winer, S. L., 'Strategies of biowarfare defense', *Military Medicine*, vol. 152 (1987), pp. 25–28.

<sup>2</sup> Note that this excludes toxin warfare (the use of biological toxins as weapons). The historical roots of toxin warfare are to be found in the ancient and medieval literature on poisons, rather than in the medical literature on disease and contagion.

<sup>3</sup> E.g., histories of biological warfare commonly begin by discussing the ancient tactic of retreating armies putting human or animal cadavers into wells (used from the time of the Greeks until the present) as early instances of biological warfare. In keeping with the view of Milton Leitenberg that such activities are plausibly understood as an effort to deny opposing forces potable water, rather than as an attempt to spread disease (although the latter may well have been an anticipated secondary effect and an occasional consequence), such instances are not discussed here. 'Instances and allegations of CBW, 1914–1970', SIPRI, *The Problem of Chemical and Biological Warfare, Vol. I: The Rise of CB Weapons* (Almqvist & Wiksell: Stockholm, 1971), pp. 214–30.

serious is the almost complete lack of scholarship on biological aggression before 1925 in South America and in Asia.<sup>4</sup>

## II. Biological warfare in medieval and Renaissance siege warfare

From the late Middle Ages and through the Renaissance there were sporadic accounts of the use of siege machines to hurl potentially infectious material into a besieged city.

### **The siege of Thun l'Eveque (1340)**

The earliest account is from the beginning of the 100 Years War in the mid-14th century, when Edward III of England laid claim to the French crown. The French and the English negotiated alliances with the various dukes and counts who controlled the Low Countries, and hostilities broke out in 1337. Edward led an expeditionary force to the continent in 1338 and rather desultory fighting ensued. During these skirmishes, Thynne Levesque (now Thun l'Eveque) castle was taken by the English. This castle is located on the River l'Escalt (Schelde in Flemish) just north-east of Cambrai in north-western France; at the beginning of the 100 Years War it was in Flanders, bordering Hainault across the river. The former was allied with the French and the latter with the English.

In 1339 the castle was captured by Sir Walter of Manny,<sup>5</sup> who left an English garrison in possession. The garrison made continual provisioning and nuisance raids on Flanders, especially bothering the nearby city of Cambrai, which petitioned Jean, Duke of Normandy, for assistance. In 1340 the duke besieged the castle with a substantial force, as described by the chronicler Jean Froissart, a native of Hainault:

The duke caryed with hym out of Cambray and Doway, dyverse great engyns . . . and made them to be reared agayne the fortres, so these engyns dyd cast night and day great stones, the which bete downe the roffes of the chambers, halles, and towres, so that they within were fayne to kepe [to the] voutes and sellars . . . The ingens without dyd cast in deed horses, and beestes stynging, wherby they within had great[er] dystres

<sup>4</sup> Given the great inventiveness of the Chinese, it would not be surprising if they had developed various methods of biological warfare independently of the West. However, there is no such indication in the secondary sources examined in this study. The only mention of anything resembling biological warfare is the tactic of defending forces in besieged cities of dumping boiling urine and faeces on attacking forces, using large spoons to ladle the material out of iron cauldrons placed at intervals along the battlements; this is mentioned in texts from the 9th and 17th centuries. Needham, J. and Yates, R. D. S., *Science and Civilization in China, Vol. 5, Chemistry and Chemical Technology*, part 6, *Military Technology: Missiles and Sieges* (Cambridge University Press: Cambridge, 1994), p. 280; and Franke, H., 'Siege and defense of towns in medieval China', eds F. A. Kierman, Jr and J. K. Fairbank, *Chinese Ways in Warfare* (Harvard University Press: Cambridge, Mass., 1974), pp. 151–201. It is unlikely that this tactic was intended to transmit disease; it was probably designed to provide scalding liquid without depleting the defenders' supplies of water. No mention of the hurling of biological ammunition in sieges was encountered in this study, despite the fact that China was the original home of the most effective of the hurling machines, the trebuchet. Needham and Yates (note 4), pp. 203–40.

<sup>5</sup> Gautier de Masny of the Duchy of Hainault. When Edward III married Princess Philippa of Hainault in 1327, thereby sealing the alliance of Hainault with England, Gautier travelled with her to England and remained in her service. He became a knight in Edward's court and served with distinction. Thompson, P. E. (ed.), *Contemporary Chronicles of The Hundred Years War, from the Works of Jean le Bel, Jean Froissart, & Enguerrand de Monstrelet* (Folio Society: London, 1966), p. 30.

thane with any other thyng, for the ayre was hote as in the myddes of somer: the stynke and ayre was so abomynable, that they consydred howe that finally they coude nat long endure.<sup>6</sup>

The defenders obtained a truce, agreeing to surrender the castle if they could not persuade the Earl of Hainault to send a relief force within 15 days.<sup>7</sup> Their envoy was successful, and the earl assembled a large force that faced the Duke of Normandy across the Escalt. However, the earl could not cross without putting his forces at a serious disadvantage, and thus he advised the garrison to abandon the castle and cross the river. Froissart says that they did so during a diversionary skirmish between the armies (with ‘divers hurt on bothe parties’); Jean le Bel, the other major chronicler of the early part of the 100 Years War, says they abandoned the castle at night, with no assistance from the Hainault forces.<sup>8</sup>

Although this is probably a case of attempted biological warfare, the intent behind the hurling of animal cadavers is far from certain, and may have been merely to harass (successfully, it would appear). It may also be that dead horses were used during temporary ammunition shortages. While they would do little damage to heavy stonework, their impact would certainly bring down light masonry and woodwork, or cause human casualties. Martin Hugh-Jones has suggested, in the light of the substantial difficulties that veterinarians observe in disposing of large numbers of large animal carcasses resulting from some disease epidemics, that another intent might simply have been disposal.<sup>9</sup> However, an intent to communicate disease is plausible, since the prevailing theory of infectious disease in medieval times was that disease was a consequence of the bad air resulting from extensive decomposition. It is certainly likely that the ‘stynke and ayre . . . so abomynable’ was expected (by besiegers and defenders alike) to lead to an epidemic of disease.<sup>10</sup> Of course, these various explanations are not mutually incompatible and it may be that several or all of these purposes were simultaneously intended.

Some scepticism with regard to the actual occurrence of the alleged attack is warranted. Jean Froissart was only one year old at the time of the siege of Thun l’Eveque; however, he was raised in nearby Valenciennes and so he would most likely have heard tales of the battles told repeatedly by participants. As a young man he travelled in England, spending five years at the English court, where he would have had additional opportunities to hear first-hand accounts of the action in Flanders. There was even opportunity to interview French participants,

<sup>6</sup> Froissart, J., *The Chronicle of Froissart, Translated out of French by Sir John Bourchier Lord Berners, Annis 1523–25, Vol. 1* (AMS Press: New York, 1967), p. 142.

<sup>7</sup> Such conditional truces were common in siege warfare.

<sup>8</sup> Viard, J. and Déprez, E. (eds), *Chronique de Jean le Bel, Vol. 1* (Librairie Renouard: Paris, 1904), chapter 35.

<sup>9</sup> Martin Hugh-Jones, Private communication with the author, 12 Oct. 1994.

<sup>10</sup> Slack has written: ‘Even the most cursory perusal . . . will show that the shocks of epidemics elicited very similar responses in very different historical and geographical contexts . . . Almost all epidemics were seen by contemporaries, for example, as being transmitted from person to person and as arising from particular, usually filthy, local conditions: notions of ‘contagion’ and ‘miasma’, of a more or less undefined kind, were combined. *Again and again ‘stench’ lay at the root of disease*’ [emphasis added]. Slack, P., ‘Introduction’, eds T. Ranger and P. Slack, *Epidemics and Ideas: Essays on the Historical Perception of Pestilence* (Cambridge University Press: Cambridge, 1992), p. 3; and Slack, P., ‘Responses to plague in early modern Europe: the implications of public health’, ed. A. Mack, *In Time of Plague: The History and Social Consequences of Lethal Epidemic Disease* (New York University Press: New York, 1991), pp. 111–31.

as the French king and many of his nobles were held in London after their capture at the Battle of Poitiers. Froissart also travelled to Scotland, Flanders and Brittany and interviewed large numbers of participants in the campaigns he described.<sup>11</sup> It is thus likely that his description is based on eyewitness testimony of participants from both sides.

However, Jean le Bel does not mention the hurling of horse carcasses, although he recounts the siege.<sup>12</sup> Nearly 50 years senior to Froissart, and hence an adult at the time of the siege, Le Bel was also from Hainault, and had served with Jean de Hainault in Edward III's army in Scotland.<sup>13</sup> He was thus presumably also well positioned to have heard of any such tactics in Flanders. His failure to corroborate Froissart's story is therefore significant. However, even if Froissart's account is fictitious, it establishes that the hurling of biological material during sieges was part of the medieval imagination.

This is the only such account encountered during this study. However, Payne-Gallwey says that 'Numerous references [unfortunately not cited] are to be found in medieval authors to the practice of throwing dead horses into a besieged town with a view to causing a pestilence therein . . .'.<sup>14</sup> He also mentions the hurling of human battle casualties for the same purpose, and reproduces a 16th century illustration of a horse carcass in the sling of a trebuchet.<sup>15</sup> These accounts suggest that the practice was more widespread than this study has been able to document.

The standard siege machines of the 13th and 14th century were probably incapable of hurling an entire horse carcass;<sup>16</sup> however, it is clear that heavy artillery capable of hurling prodigious loads was available to armies that could employ the best engineers and take the time to build huge trebuchets. For instance, the 13th century engineer Villard de Honnecourt describes a machine with a 12 foot by 8 foot by 12 foot deep (or *c.* 34 m<sup>3</sup>) box of sand as counterweight;<sup>17</sup> this would have weighed about 50 000 kg. Such machines should have been capable of hurling at least small horse carcasses.<sup>18</sup> Perhaps the rarity of the

<sup>11</sup> Thompson (note 5), p. 11.

<sup>12</sup> Viard and Déprez (note 8), pp. 174–77.

<sup>13</sup> Thompson (note 5), p. 8.

<sup>14</sup> Payne-Gallwey, R., *A Summary of the History, Construction and Effects in Warfare of the Projectile-Throwing Engines of the Ancients, with a Treatise on the Structure, Power and Management of Turkish and Other Oriental Bows of Medieval and Later Times* (Longmans, Green and Co.: London, 1907), p. 29.

<sup>15</sup> Payne-Gallwey (note 14), p. 30. He attributes this to Leonardo's *Il Codice Atlantico*; however, no such print is contained in a facsimile edition of the *Codice* at the Bancroft Library, University of California, Berkeley. Leonardo da Vinci, *Il Codice Atlantico di Leonardo da Vinci nella Biblioteca Ambrosiana di Milano. Riprodotto e pubblicato dalla Regia Accademia dei Lincei sotto gli auspici e col Sussidio del Re e Governo* [Leonardo da Vinci's Atlantic Code in the Ambrosian Library, Milan, reproduced and published by the Royal Academy of Lincei, under the auspices and with the support of the king and the government] (University of Hoepli: Milan, 1894–1904). The woodblock reproduced by Payne-Gallwey is clumsy, and it is flawed by several technical errors in picturing the machine and its load. It probably is German, from the period 1515–40. Professor Jeffrey Ruda, Private communication with the author, Oct. 1995.

<sup>16</sup> Most siege machines of the time were probably capable of handling loads of less than 100 kg. To hurl 100 kg over 300 m (a distance necessary to keep the besieging forces out of archery range) required a counterweight-driven trebuchet with an arm of about 15 m and a counterweight of 8000 kg. Dupuy, T. N., *The Evolution of Weapons and Warfare* (Bobbs-Merrill: Indianapolis, Ind., 1980), p. 67; and Payne-Gallwey (note 14). Even the more generous calculations by Hill suggest that such a machine would be limited to hurling about 200 kg. Hill, D. R., 'Trebuchets', *Viator*, vol. 4 (1973), pp. 99–116.

<sup>17</sup> Cited in Payne-Gallwey (note 14), p. 29.

<sup>18</sup> Chevedden *et al.* claim (without citing their sources) that the largest trebuchets could hurl loads of 1 ton or more (about 900 kg)—twice the weight of a small horse—and they show pictures of a modern reconstruction that is said to be capable of hurling loads of 500 kg. Chevedden, P. E. *et al.*, 'The trebuchet,' *Scientific American* (July 1995), pp. 66–71.

practice reflects in part the scarcity of machines capable of hurling such massive loads.

### **The siege of Caffa (1346) and the 14th century ‘Black Death’**

Only a few years after the siege of Thun l’Eveque came that of Caffa, the location of the best known account of early biological warfare: the alleged catapulting of plague cadavers into the fortified Genoese city of Caffa by the Mongol forces besieging it in 1346. The incident was reported by an Italian, Gabriele de’ Mussi,<sup>19</sup> who probably based his narrative on eyewitness accounts of survivors of the attack who fled Caffa and, in so doing, contributed to the transmission of plague from the Crimea to Mediterranean seaports.

Caffa (now Feodosia) was a Genoese seaport on the Crimean coast, founded about 1266.<sup>20</sup> It was of considerable economic importance as a link between the Mediterranean maritime trade and the overland caravans to the Far East, and the river trade up the Don and Volga rivers to Moscow. In the mid-14th century it was a thriving, cosmopolitan city of probably more than 50 000 inhabitants. It had been destroyed in 1308 after a siege by forces of the Golden Horde Khanate<sup>21</sup> (in which Caffa was situated) and was consequently heavily fortified (with two concentric walls) when it was re-established six years later.<sup>22</sup>

Hostilities broke out again in 1343 in the Venetian trading city Tana (now Azov) to the east, forcing the Italian merchants there to flee to Caffa, which was in turn besieged by a Kipchak<sup>23</sup> army in the service of Janibeg, Kahn of the Golden Horde. Although the siege was relentless, Genoese maritime hegemony allowed the city to be provisioned, and the siege was lifted after one year, only to be reimposed in 1345. The latter siege lasted until plague hit the Mongol forces, probably in mid- or late 1346.

The origin of plague in the Crimea is obscure. Plague is a rodent disease, endemic among the marmots and ground squirrels of the Eurasian steppes and elsewhere. Human epidemics are normally the result of transmission from wild to commensal rodents (most importantly in Eurasia, the black rat), and thence to humans via flea bites.<sup>24</sup> It is generally thought that the 14th century epidemic originated in Asia, perhaps as far east as Mongolia, and was brought to the Crimea by traders or Mongol troop movements. However, recent scholarship

<sup>19</sup> Horrox, R. (ed.), *The Black Death* (Manchester University Press: Manchester, 1994), pp. 14–26; and Wheelis, M. L., ‘The narrative of Gabriele de’ Mussi, the siege of Caffa, and the origins of the 14th century European Black Death’, manuscript in preparation.

<sup>20</sup> However, a city named Kafa predated Caffa at the same or a nearby site for several centuries. Vasiliev, A. A., *The Goths in the Crimea* (Mediaeval Academy of America: Cambridge, Mass., 1936).

<sup>21</sup> The most westerly of the 4 Mongol nations run by descendants of Genghis Khan.

<sup>22</sup> Howorth, H. H., *History of the Mongols, From the 9th to the 19th Century, Vol. 2* (Burt Franklin: New York, 1880), p. 1079.

<sup>23</sup> The Kipchak were a nomadic Turkic tribe of southern Russia largely subjugated by the Mongols.

<sup>24</sup> Bercovier, H. and Mollaret, H. H., ‘Yersinia’, eds N. R. Krieg and J. G. Holt, *Bergeys Manual of Systematic Bacteriology* (Williams and Wilkins: Baltimore, Md., 1984), pp. 498–506; Biraben, J.-N., ‘Current medical and epidemiological views on plague’, ed. L. P. S. E. Board, *The Plague Reconsidered: A New Look at its Origins and Effects in 16th and 17th Century England* (Local Population Studies: Matlock, Derbyshire, 1977), pp. 25–36; Boyce, J. M., ‘Yersinia species’, eds G. L. Mandell, R. G. Douglas, Jr and J. E. Bennett, *Principles and Practice of Infectious Disease* (John Wiley and Sons: New York, 1985), pp. 1296–301; Gutman, L. T., ‘Yersinia’, eds W. K. Joklik *et al.*, *Zinsser Microbiology* (Appleton & Lange: Norwalk, Conn., 1992), pp. 584–94; Pollitzer, R., *Plague* (World Health Organization: Geneva, 1954); and Twigg, G., *The Black Death: A Biological Reappraisal* (Batsford Academic and Educational: London, 1984).

suggests a less exotic origin: it may have originated in the spring of 1346 in the rodent populations of the grasslands north of the Black Sea, perhaps around Tana, spreading from this focus south-west to the Crimea, and east to the Caspian Sea.<sup>25</sup>

Regardless of its origin, its effect on the hostilities at Caffa was dramatic:

But behold, the whole [Mongol] army was affected by a disease which overran the Tartars<sup>26</sup> and killed thousands upon thousands every day. It was as though arrows were raining down from heaven to strike and crush the Tartars' arrogance. All medical advice and attention was useless; the Tartars died as soon as the signs of disease appeared on their bodies: swellings in the armpit or groin caused by coagulating humours, followed by a putrid fever.

The dying Tartars, stunned and stupefied by the immensity of the disaster brought about by the disease, and realising that they had no hope of escape, lost interest in the siege. But they ordered corpses to be placed in catapults and lobbed into the city in the hope that the intolerable stench would kill everyone inside. What seemed like mountains of dead were thrown into the city, and the Christians could not hide or flee or escape from them, although they dumped as many of the bodies as they could in the sea. And soon the rotting corpses tainted the air and poisoned the water supply, and the stench was so overwhelming that hardly one in several thousand was in a position to flee the remains of the Tartar army.<sup>27</sup>

The Mongols abandoned the siege, but plague spread westward in a stepwise fashion along established maritime trade routes: Caffa in 1346; Constantinople in spring 1347; Messina in October 1347; and Genoa, Venice and Marseilles in January 1348.

While it is nearly certain that refugees from Caffa contributed to the spread of plague, it is less certain that the plague within the walls of Caffa was the result of biological attack. Most seriously, de' Mussi's account is second-hand and not corroborated by others. It is thus possible that the biological attack never took place. However, de' Mussi appears to have been a reasonably careful witness and scribe, and he certainly would have had access to a number of eyewitnesses to the siege.

If the attack actually took place as described, it could easily have been the means by which plague was transmitted to the city. Certainly infected human or rodent fleas would have been carried by fresh cadavers. Probably more important, plague is transmissible by the handling of infected tissue (probably through small cuts or abrasions in the skin). The defenders at Caffa would have been working under stressful conditions, many of them probably with cuts, abrasions or other wounds resulting from the continued hostilities, and they were handling large numbers of badly mangled recent disease fatalities.

The numbers of cadavers hurled into the city could well have been in the thousands. The Mongols were skilled siege warriors, even organizing their census of conquered lands to identify tradesmen with strategically important skills

<sup>25</sup> Norris, J., 'East or west? The geographic origin of the Black Death', *Bulletin of the History of Medicine*, vol. 51 (1977), pp. 1–24.

<sup>26</sup> The term Tartar (or Tatar) originally referred to a nomadic Turkic tribe of Mongolia whose range overlapped that of the Mongols. Marshall, R., *Storm from the East: From Genghis Khan to Khubilai Khan* (University of California Press: Berkeley, Calif., 1993). They were nearly annihilated during conflict with the Mongols in the 13th century; those remaining were assimilated. The term is usually applied generally to any nomadic tribal people of central Asia, of Turkic or Mongol descent.

<sup>27</sup> Horrox (note 19), p. 17.

(e.g., carpenters, metalworkers and gunpowder makers), who could be drafted if siege machines needed to be constructed anywhere in the realm.<sup>28</sup> Their artillery at Caffa was probably numerous and sophisticated. Fourteenth century accounts agree on high mortality (30–90 per cent of the susceptible population) for this epidemic in crowded settings, such as a besieged city or the encampments of the besiegers. Certainly thousands of disease fatalities among the Kipchak forces is credible; a contemporary Arabic source estimates 85 000 plague fatalities in the Caffa region in this epidemic.<sup>29</sup> Given the magnitude of the mortuary problem, hurling machines may have been used for body disposal. The cumulative potential for infection might thus have been quite high.

There may have been other means of entry of plague into the city as well. Although commensal rats do not normally venture far from their nests (less than 30 metres being common),<sup>30</sup> it is still possible that the ranges of the rats inhabiting the city and those inhabiting the Kipchak camps overlapped, allowing the exchange of fleas between the two rat populations. It is also possible that defenders may have ventured outside the walls, on raids or to reclaim casualties, and thereby ventured into the range of infected fleas. However, if the biological attack occurred as described by de' Mussi, it provides a more plausible mechanism for plague transmission than do these other possibilities.

### **The siege of Karlstein, 1422**

Another instance of possible biological warfare was described by the 17th century historian Antoine Varrilas, writing of the Bohemian heresy of John Hus and the religious wars that it incited in eastern Europe.<sup>31</sup> Varrilas wrote over 250 years after the events he described, from unnamed sources, and is not corroborated. His credibility is thus low.

Hus was a popular Czech religious reformer who insisted, as did John Wyclif before him, and Martin Luther and John Calvin afterwards, that access to God was through faith, not the Church. He was burned at the stake in 1415 after being tried before the Council of Constance for heresy. The martyring of Hus, who was in Constance to defend himself under a safe conduct issued by Sigismund, King of Hungary and Holy Roman Emperor, unified the Czechs and incited open defiance of the Church. Defiance became outright revolt when in 1419 Wenceslas IV of Bohemia attempted to contain Hussitism by restricting it to a few churches. Wenceslas died a few weeks later and the crown of Bohemia passed to his brother Sigismund of Hungary, the betrayer of Hus. Czech nobles rejected Sigismund when he refused their demand for religious freedom, and in 1421 invited Alexander Witold, Grand Duke of Lithuania, to take the crown. Witold was uncertain how to act because the crown was offered on condition

<sup>28</sup> Allsen, T. T., *Mongol Imperialism: The Grand Qan Méngke in China, Russia, and the Islamic Lands, 1251–59* (University of California Press: Berkeley, Calif., 1987), p. 202.

<sup>29</sup> Cited in Dols, M. W., *The Black Death in the Middle East* (Princeton University Press: Princeton, N.J., 1977), p. 52.

<sup>30</sup> Twigg, G., *The Black Death: A Biological Reappraisal* (Batsford Academic and Educational: London, 1984).

<sup>31</sup> Varrilas, A., *Histoire de l'hérésie de Viclef, Iean Hvs, et Jerome de Prague, avec celle des guerres de Boheme qui ont esté les suites* [History of the heresy of Viclef, Ian Hvs and Jerome of Prague, and of the ensuing wars in Bohemia] (Iean Certé: Lyon, 1682). This book seems not to have been translated or reprinted. It was consulted at the University of California Los Angeles, in the Special Collections Department of the Research Library.



that he accept Czech religious freedom, which would in turn place him at odds with the Pope and the Holy Roman Emperor (who had already mounted two unsuccessful crusades against the Bohemian heresy). He temporized by sending as his regent in Bohemia Prince Sigismund Korybut, a nephew of the King of Poland (with whom Lithuania was closely allied). Prince Korybut, an exceptionally able soldier and diplomat (and probably himself desirous of the Bohemian crown), made one of his first public acts as regent a dramatic symbol of his support of the Czech reformation: he publicly accepted communion 'in two parts' (i.e., with both bread and wine; the Church had long restricted the use of wine at communion to priests). Thereafter he quickly unified the Czech nobles and the principal factions within the Hussite cause and was formally accepted as regent at the Diet of June 1422. Immediately thereafter he besieged Karlstein, the strongest fortress in Bohemia and the last Catholic city of importance in the vicinity of Prague. Prince Korybut had a large force outside Karlstein, supported by four of the largest siege machines available, but he was nevertheless unable to breach the defences.<sup>32</sup> Varrilas asserts:

Unable to take [Karlstein] by force, Coribut had all the corpses of the soldiers killed by the besieged and nearly two thousand barrow-loads of waste thrown into the besieged city by machines. The great stench made the teeth of the majority of the defenders fall out and loosened those of the rest so badly that they were only saved by the skill of a rich apothecary of Bohemia, who, in exchange for much money, provided Karlstein with remedies and preventives against the illness suffered there . . .<sup>33</sup>

Exactly what is meant by 'waste' ('ordures' in the original) is not clear; it could mean either manure or garbage. If the former, it could potentially be quite infectious; certainly intestinal diseases are prominent afflictions of armies and their animals, and are communicated via faecal contamination. However, if it was refuse and garbage rather than human or animal manure, it would probably have been more unpleasant than dangerous. There is also some question of intent. Battle casualties and refuse (or manure) are less obvious vehicles of contagion than plague victims. However, as with the siege of Thun l'Eveque, intent to transmit disease remains quite plausible; certainly Varrilas assumes it when he attributes the fever to the stench. In any event, the disease that afflicted the city seems not to have been a plausible consequence of the attack; it sounds more like scurvy than an infectious agent. The biological attack, if there was one, failed to provide any strategic effect and the city withstood the siege. After five months Korybut ended it with an armistice, freeing his troops to deal with the external threat of the Third Bohemian Crusade.<sup>34</sup>

### **The siege of Reval, 1710**

The last alleged incident of biological warfare is from 1710, in the Baltic region. After succeeding to the throne of Sweden in 1697, Karl XII rampaged across Northern Europe, taking cities and imposing a very fragile Swedish

<sup>32</sup> Heymann, F. G., *John Zizka and the Hussite Revolution* (Princeton University Press: Princeton, N.J., 1955).

<sup>33</sup> Varrilas (note 31), author's translation.

<sup>34</sup> Heymann (note 32).

hegemony over Poland and the Baltic.<sup>35</sup> Opposed by the emerging power of Russia, the Swedish empire collapsed over the period 1709–18. Early in the Russian offensive (in 1710), the Swedish occupying forces were driven out of Estonia, whose cities Riga, Pernau and Reval were garrisoned. At the siege of Reval (now Tallinn) Russian troops are said to have hurled plague casualties into the besieged city, following which plague broke out within the walls.<sup>36</sup> The city fell quickly, although there is no claim that the plague contributed to the military outcome. The credibility of this allegation is very low; even the published source says that it is ‘not documented’.

### III. Biological warfare against Native Americans

The European exploration and colonization of the New World, beginning in the late 15th century, brought devastating cultural, social and ecological changes. Probably none was more significant to humans than the admixture of the Eurasian and American disease pools, whose disastrous consequences for the Native Americans underlay their demographic collapse.<sup>37</sup> A wave of catastrophic depopulation swept across the continent, sometimes ahead of the advancing fringe of European settlement, sometimes behind.<sup>38</sup> Eurasian diseases such as smallpox, measles and influenza arrived with early explorers and colonists; Old World tropical diseases such as malaria and yellow fever (and their mosquito vectors) were brought by the African slave trade. Epidemics were unusually virulent, probably because of the lack of prior genetic selection for resistance and because of an unusually narrow range of genetic diversity among Native Americans.<sup>39</sup> Other diseases, endemic in the New World (e.g., tuberculosis<sup>40</sup>), became much more virulent in the social chaos and demographic collapse caused by the imported diseases.<sup>41</sup> In addition, new and more virulent strains of shared pathogens, like *Mycobacterium tuberculosis*, might have been brought by the Europeans.

<sup>35</sup> Scott, F. D., *Sweden: The Nation's History* (Southern Illinois University Press: Carbondale, Ill., 1988).

<sup>36</sup> Swedish National Defence Research Establishment (FOA), *A Briefing Book on Biological Warfare Agents*, FOA Orienterar om, no. 14 (Liber Förlag: Stockholm, 1995), p. 8.

<sup>37</sup> Thornton, R., *American Indian Holocaust and Survival: A Population History since 1492* (University of Oklahoma Press: Norman, Okla., 1987); Crosby, Jr., A. W., ‘The Columbian exchange: biological and cultural consequences of 1492’, ed. R. H. Walker, *Contributions in American Studies*, Vol. 2 (Greenwood Press: Westport, Conn., 1972); Crosby, A. W., *Ecological Imperialism: The Biological Expansion of Europe, 900–1900* (Cambridge University Press: New York, 1986); Crosby, A. W., ‘Hawaiian depopulation as a model for the Amerindian experience’, eds T. Ranger and P. Slack, *Epidemics and Ideas: Essays on the Historical Perception of Pestilence* (Cambridge University Press: Cambridge, 1992), pp. 175–201; McCaa, R., ‘Spanish and Nahuatl views on smallpox and demographic catastrophe in Mexico’, *Journal of Interdisciplinary History*, vol. 25 (1995), pp. 397–431; McNeill, W. H., *Plagues and Peoples* (Doubleday: New York, 1976); Stannard, D. E., *American Holocaust: Columbus and the Conquest of the New World* (Oxford University Press: Oxford, 1992); Dobyns, H. F., *Their Number Become Thinned: Native American Population Dynamics in Eastern North America* (University of Tennessee Press: Knoxville, Tenn., 1983), p. 13; and Verano, J. W. and Ubelaker, D. H. (eds), *Disease and Demography in the Americas* (Smithsonian Institution Press: Washington, DC, 1992).

<sup>38</sup> Snow, D. R., ‘Microchronology and demographic evidence relating to the size of pre-Columbian North American Indian populations’, *Science*, vol. 268 (1995), pp. 1601–604.

<sup>39</sup> Black, F. L., ‘Why did they die?’, *Science*, vol. 258 (1992), pp. 1739–40.

<sup>40</sup> Salo, W. L. *et al.*, ‘Identification of *Mycobacterium tuberculosis* DNA in a pre-Colombian mummy’, *Proceedings of the National Academy of Sciences (USA)*, vol. 91 (1994), pp. 2091–94.

<sup>41</sup> Morell, V., ‘Mummy settles TB antiquity debate’, *Science*, vol. 263 (1994), pp. 1686–87.

Of the many novel diseases that the Europeans brought with them, smallpox was the most fearsome, and it is the only one associated with allegations of deliberate spread prior to the 20th century. It was an epidemic viral disease, now eradicated from the world by vaccination.<sup>42</sup> Among peoples of European descent, epidemics typically had a case fatality rate of 20–40 per cent; however, fatality rates of 90 per cent or higher are repeatedly mentioned in accounts of Native American epidemics, often coupled with very high attack rates. Even after several centuries of exposure to repeated epidemics, Native American fatality rates from smallpox remained high; in the late 19th century, the Indian Service doctor assigned to the Hopi of the South-West recorded that 74 per cent of the smallpox cases who elected traditional medicine died.<sup>43</sup> The very high intrinsic fatality rate was further increased by starvation and collapse of the ability to provide care for the sick because of social disruption. For instance, William Bradford describes a 1633 epidemic among the Indians around the Massachusetts colonies:

This spring, also, those Indians that lived aboute their trading house there fell sick of the small poxe, and dyed most miserably; for a sorer disease cannot befall them; they fear it more then the plague; for usually they that have this disease have them [pocks] in abundance, and for wante of bedding and linning and other helps, they fall into a lamentable condition, as they lye on their hard matts, the poxe breaking and mattering [suppurating], and runing one into another, their skin cleaving (by reason therof) to the matts they lye on; when they turne them[selves], a whole side will flea of at once, (as it were,) and they will be all of a gore blood, most fearfull to behold; and then being very sore, what with could and other distempers, they dye like rotten sheep. The condition of this people was so lamentable, and they fell downe so generally of this diseases, as they were (in the end) not able to help on another; no, not to make a fire, nor to fetch a litle water to drinke, nor any to burie the dead; but would strivie as long as they could, and when they could procure no other means to make fire, they would burne the woden trayes and dishes they ate their meate in, and their very bowes and arrowes; and some would crawl out on all foure to gett a litle water, and some times dye by the way, and not be able to gett in againe.<sup>44</sup>

Suicide by the afflicted may also have compounded the intrinsic mortality rate. This is described among the Huron in Jesuit archives;<sup>45</sup> by Catlin among the Plains Indians;<sup>46</sup> by Duffy among the Catawba of South Carolina;<sup>47</sup> and by Wagner among the Missouri River tribes.<sup>48</sup> Another possible contributing fac-

<sup>42</sup> For a full discussion of smallpox and its eradication, see Fenner, F. *et al.*, *Smallpox and its Eradication*, Vol. 6, *History of International Public Health* (World Health Organization: Geneva, 1988).

<sup>43</sup> Dobyns (note 37), p 13. Notably, victims who elected Western medical treatment, primitive as this was at the time (consisting largely of nursing support), had only about a 10% fatality rate. Clearly, Native American medical techniques (which made extensive use of sweating and cold baths) were highly inappropriate for acute viral diseases and probably significantly exacerbated intrinsic mortality rates throughout North and South America.

<sup>44</sup> Davis, W. T. (ed.), *Bradford's History of Plymouth Plantation, 1606–1646*, Vol. 6, *Original Narratives of Early American History* (Charles Scribner's Sons: New York, 1908), pp. 312–13.

<sup>45</sup> Kenton, E. (ed.), *The Indians of North America: Selections from 'The Jesuit Relations and Allied Documents: Travels and Explorations of the Jesuit Missionaries in New France, 1610–1791'* (Harcourt, Brace and Co.: New York, 1927), p. 21.

<sup>46</sup> Catlin, G., *North American Indians*, edited and with an introduction by Peter Matthiason (Viking Penguin: New York, 1989 (1876)), pp. 287–88.

<sup>47</sup> Duffy, J., 'Smallpox and the Indians in the American colonies,' *Bulletin of the History of Medicine*, vol. 25 (1951), pp. 324–41, see especially p. 338.

<sup>48</sup> Wagner, W. F. (ed.), *Leonard's Narrative: Adventures of Zenas Leonard, Fur Trader and Trapper 1831–1836* (Burrows Brothers Co.: Cleveland, Ohio, 1904, reprinted from the 1839 original), p. 43.

tor, of unknown frequency and importance, may have been mercy killing; Heagerty asserts that some Omaha men killed their wives and children to spare them from the disease.<sup>49</sup>

The disease transmission appears to have been almost entirely one-way, although many have speculated that the virulent syphilis outbreak of early 16th century Europe (the Great Pox) might have been an importation from the New World. If so, it was the only serious disease to move from west to east; the more disease-experienced and densely populated Old World supported a rich array of diseases highly dangerous to peoples never before exposed to them. The failure of the western hemisphere to develop comparable diseases new to Europeans was probably a reflection of its generally lower human population densities, less extensive urbanization and paucity of domestic animals from which new human diseases might have evolved.<sup>50</sup> This lack of endemic diseases and hypersensitivity to new epidemics significantly hastened European colonization.

The depopulation caused by disease fostered the myth of a nearly empty continent, waiting to be occupied. However, this emptiness was of very recent origin, as Francis Jennings observed:

The American land was more like a widow than a virgin. Europeans did not find a wilderness here; rather, however involuntarily, they made one. Jamestown, Plymouth, Salem, Boston, Providence, New Amsterdam, Philadelphia—all grew upon sites previously occupied by Indian communities. So did Quebec and Montreal and Detroit and Chicago. The so-called settlement of America was a *resettlement*, a reoccupation of a land made waste by the diseases and demoralization introduced by the newcomers.<sup>51</sup>

Clearly, there was widespread contemporary understanding of the extent of disease devastation among the Native Americans. For example, John Winthrop, the first Governor of Massachusetts Bay Colony, wrote a letter to Sir Nathaniel Rich, Member of Parliament, one of the supporters of the colony, in May 1634. After describing the natural abundance of the land and the good health of the 4000 or so settlers, he commented: ‘For the natives, they are neere all dead of the small Poxe, so as the Lord hath cleared our title to what we possess’.<sup>52</sup> A similar sentiment is expressed by Cotton Mather, in his 1702 account of the 1620 settlement of Plymouth:

[The Pilgrims’] design was to have sat down somewhere about *Hudson’s* River; but some of their Neighbours in *Holland* having a Mind themselves to settle a Plantation there, secretly and sinfully contracted with the Master of the Ship,<sup>53</sup> employed for the Transportation of these our English *Exiles*, by a more *Northerly* Course<sup>54</sup> . . . the *Lives*

<sup>49</sup> Heagerty, J. J., *Four Centuries of Medical History in Canada, and a Sketch of the Medical History of Newfoundland*, Vol. 1 (MacMillan: Toronto, 1928), p. 47.

<sup>50</sup> McNeill (note 37).

<sup>51</sup> Jennings, F., *The Invasion of America: Indians, Colonialism, and the Cant of Conquest* (University of North Carolina Press: Chapel Hill, N.C., 1975), p. 30.

<sup>52</sup> *The Winthrop Papers, Vol. 3: 1631–1637* (Massachusetts Historical Society: Boston, Mass., 1943), p. 167.

<sup>53</sup> Captain Christopher Jones of the *Mayflower*, a merchant ship of about 90 feet (c. 27 m) formerly in the European coastal trade (furs from Scandinavia, wine from France, cloth from England, etc.).

<sup>54</sup> There is dispute over this; some historians believe that Mather was correct, and the Dutch bribed Captain Jones to land the Pilgrims to the north to preserve Dutch interests in the Hudson valley; others believe that the English merchants financing the Pilgrims contracted with Jones to the same effect, believing that the profits (especially from fish and furs) would be greater if the Pilgrims were farther away from Dutch competition. Most, however, believe that it was an honest mistake. Certainly landfall at Cape Cod rather than the Hudson valley after more than 60 days at sea, much of it in stormy conditions where navi-

of all on Board were now hazarded, by the Ships falling among the Shoals of *Cape-Cod*: Where they were so entangled among dangerous *Breakers*, thus late in the Year, that the *Company* got at last into the *Cape-Harbour*, *Broke off* their Intentions of going any further. And yet behold the watchful Providence of God over them that seek him! This *False-dealing* proved a *Safe-dealing* for the good People against whom it was used. Had they been carried according to their desire unto *Hudson's River*, the *Indians* in those Parts were at this time so Many, and so Mighty, and so Sturdy, that in probability all this little feeble Number of Christians had been Massacred by these bloody Salvages [*sic*], as not long after some others were: Whereas the good Hand of God now brought them to a Country wonderfully prepared for their Entertainment, by a sweeping *Mortality* that had lately been among the Natives . . . The *Indians* in these Parts had newly, even about a Year or Two before, been visited with such a prodigious Pestilence; as carried away not a *Tenth*, but Nine Parts of Ten, (yea, 'tis said, *Nineteen* of *Twenty*) among them: So that the *Woods* were almost cleared of these pernicious Creatures, to make Room for a *better Growth* . . . they were consumed in such vast Multitudes, that our *first Planters* found the Land almost covered with their unburied Carcases . . .<sup>55</sup>

It must certainly have occurred to many that deliberate transmission of disease to the indigenous peoples would merely hasten the inevitable, and would lessen the danger the natives posed when strong and numerous. In a 1752 letter<sup>56</sup> reporting on the state of the colony, the newly appointed Governor of Montreal and Commandant of Canada<sup>57</sup> described the perfidies of several tribes that were shifting their allegiance to the English. Later in the same letter he mentioned food shortages, then commented: 'Famine is not the sole scourge we experience; the small-pox commits ravages . . . Twere desirable that it should break out and spread generally throughout the localities inhabited by our rebels. It would be fully as good as an army'.<sup>58</sup> While this stops short of confessing or recommending biological aggression, it suggests a most receptive climate.

Such comments are encountered largely in the records of colonial times. However, as late as 1855 a similar sentiment was expressed by John Montgomery, the US Indian Agent to the Kansa, a small tribe of Plains Indians of what is now north-eastern Kansas: '[Smallpox] has continued fatally with a

gation was entirely by dead reckoning, requires no explanation. The record indicates that Jones tried to head south after making land, but desisted when he encountered difficult tides and shoals at the southern tip of Cape Cod in waters that are even today regarded with respect. Caffrey, K., *The Mayflower* (Stein and Day: New York, 1974), pp. 78–79, 112.

<sup>55</sup> Mather, C., *Magnalia Christi Americana, Books I and II*, ed. K. B. Murdock (Harvard University Press: Cambridge, Mass., 1977 (1702)), Book I, chapter II, pp. 129–30. The nature of the disease that caused this devastating and probably widespread outbreak is not clear, although smallpox or bubonic plague have often been suggested. Heagerty (note 49), p. 61. For a full description of the scanty record of this epidemic see Williams, H. U., 'The epidemic of the Indians of New England, 1616–1620, with remarks on Native American infections,' *Johns Hopkins Hospital Bulletin*, vol. 2 (1909), pp. 340–49. Note that even this early there were frequent contacts between Europeans and Native Americans and hence opportunities for disease transmission. Morison, S. E., *The European Discovery of America: The Northern Voyages, Vol. 1: A. D. 500–1600* (Oxford University Press: New York, 1971).

<sup>56</sup> Letter to de Rouillé, the French Minister of the Marine and of the Colonies.

<sup>57</sup> Charles le Moyne, Baron de Longueuil.

<sup>58</sup> O'Callaghan, E. B. (ed.), *Transcripts of Documents in the Archives of the 'Ministère de la Marine et des Colonies', of the 'Ministère de la Guerre,' and in the 'Bibliothèque du Roi', at Paris, Vol. 10, Documents Relative to the Colonial History of the State of New-York, Procured in Holland, England and France by John Romeyn Brodhead, Esq., ed. E. B. O'Callaghan* (Weed, Parsons: Albany, N.Y., 1858), p. 249.

greater number of them, it seems, to the great satisfaction and admiration of all those who have any acquaintance with [them]'.<sup>59</sup>

There is also at least one record of a threat by Whites to loose smallpox. In 1812, James McDougall<sup>60</sup> probably averted an attack by the Chinook on Fort Astoria, at the mouth of the Columbia River, by this stratagem. Amid growing signs that an attack was impending, McDougall called the chiefs to a conference and, after sharing a pipe and making some preliminary remarks, said: 'You know the smallpox. Listen: I am the smallpox chief. In this bottle I have it confined. All I have to do is to pull the cork, send it forth among you, and you are dead men. But this is for my enemies, and not for my friends'.<sup>61</sup> The attack never materialized. Obviously such threats, if followed by a natural epidemic, would lead to the entirely understandable but false belief on the part of the victims that the outbreak was deliberately initiated.

### Fort Pitt, 1763

Despite all of this evidence suggesting a receptive climate in which the notion of deliberate infection might have flourished, there is no evidence of any European attempt to utilize disease as a weapon until the late 18th century, after nearly two centuries of frontier conflict. The only convincingly documented incident in North America occurred in 1763, during the Pontiac Rebellion, or Indian Wars. After the French surrender of Canada, Pontiac, a principal chief of the Ottawas, united tribes along the Western frontier from New York to Virginia into a fragile alliance to drive the British back out of Canada and the Mississippi watershed and to return the territory to the French (whom Pontiac thought would resume the war they had just conceded).<sup>62</sup> A principal reason for the tribes joining Pontiac was to enforce British promises, made during the war with the French, to withdraw to the east of the Allegheny Mountains if the Indians would abandon the French. A number of tribes entered into such agreements near the end of the French and Indian Wars, and were disappointed and angry when the British reneged on their promise to withdraw their military presence from the Western frontier.<sup>63</sup> The Native Americans also resented British restrictions on trade in powder and shot, which the French had traded freely.<sup>64</sup>

The British forces were badly overextended because the bulk of their troops in America had returned to Britain after the surrender of the French. Nearly simultaneous Indian attacks were mounted on military outposts, with eight forts being overrun and their garrisons killed or captured. Settlers were also killed and captured in large numbers (c. 2000<sup>65</sup>), and survivors fled east to the larger,

<sup>59</sup> Unrau, W. E., 'The depopulation of the Dheghia-Siouan Kansa prior to removal', *New Mexico Historical Review*, vol. 48 (1973), pp. 313–28.

<sup>60</sup> One of the 6 partners of John Jacob Astor in the Pacific Fur Company who established Fort Astoria in 1811.

<sup>61</sup> Bancroft, H. H., *History of the Northwest Coast, Vol. II: 1800–1846, Vol. 28, The Works of Hubert Howe Bancroft* (A. L. Bancroft: San Francisco, Calif., 1884), p. 176.

<sup>62</sup> Jennings, F., *Empire of Fortune: Crowns, Colonies, and Tribes in the Seven Years War in America* (W. W. Norton: New York, 1988); Parkman, F., *The Conspiracy of Pontiac and the Indian War*, 10th edn (Little, Brown: Boston, Mass., 1913); and Steele, I. K., *Warpaths: Invasions of North America* (Oxford University Press: Oxford, 1994).

<sup>63</sup> Sipe, C. H., *The Indian Wars of Pennsylvania* (Telegraph Press: Harrisburg, Pa., 1929).

<sup>64</sup> Peckham, H. H., *Pontiac and the Indian Uprising* (Princeton University Press: Princeton, N.J., 1947).

<sup>65</sup> Jennings (note 62).

better defended towns. Loss of a great deal of territory appeared imminent. On the Ohio River watershed and nearby, three forts had been lost (Presq'Isle on Lake Erie, and Le Boeuf and Venango on the Allegheny River), and the major outpost of Fort Pitt<sup>66</sup> was gravely threatened.

Among the personnel at Fort Pitt was William Trent, a partner in the Indian trading company of Levy, Trent & Company, who was in charge of the traders based there. When hostilities broke out, the traders were organized into a civilian militia, with Trent as commander reporting to the fort's commanding officer, Captain Simon Ecuyer.<sup>67</sup> Weeks of desultory hostilities had driven the traders and settlers into the fort, resulting in extremely crowded conditions,<sup>68</sup> with the garrison and militia on 24-hour alert. Smallpox had just broken out in the fort. Trent recorded in his journal the following account:

[June] 23 [1763] about 12 o'Clock at Night Two Delawares called for Mr. McKee<sup>69</sup> and told him they wanted to speak to him in the Morning.

[June] 24th The Turtles Heart a principal Warrior of the Delawares<sup>70</sup> and Mamaltee a Chief came within a small distance of the fort Mr. McKee went out to them and they made a Speech letting us know that . . . out of regard to us, they had prevailed on 6 Nations [not to] attack us but give us time to go down the Country and they desired we would set of immediately. The Commanding Officer thanked them, let them know that we had everything we wanted, that we could defend it against all the Indians in the Woods, that we had three large Armys marching to Chastise those Indians that had struck us, told them to take care of their Women and Children, but not to tell any other Natives, they said they would go and speak to their Chiefs and come and tell us what they said, they returned and said they would hold fast of the Chain of friendship. *Out of our regard to them, we gave them two Blankets and a Handkerchief out of the Small Pox Hospital. I hope it will have the desired effect.*<sup>71</sup> They then told us that [Fort] Ligonier had been attacked, but that the Enemy were beat of.<sup>72</sup>

This account clearly identifies the participants in this parlay as including McKee, Acting Deputy Assistant for Indian Affairs of the Crown, Captain Ecuyer, Commanding Officer at Fort Pitt, and perhaps Trent himself. They are all thus implicated in the transaction.

The transfer of infectious material is confirmed by Captain Ecuyer's June 1763 ledgers, which list the Crown's obligations to Levy, Trent & Company ('had by order of Capt. Simon Ecuyer Commandt'). After an accounting of a variety of items purchased from the trader (such as moccasins, tomahawks, kettles, deerskins and candles) comes the following notation:

<sup>66</sup> Now the site of Pittsburgh, where the Monongahela and Allegheny rivers join to form the Ohio River.

<sup>67</sup> Volwiler, A. T. (ed.), 'William Trent's Journal at Fort Pitt, 1763', *Mississippi Valley Historical Review*, vol. 11 (1924), pp. 390–413.

<sup>68</sup> There were 330 men, approximately 100 women and more than 100 children.

<sup>69</sup> Alexander McKee was a trader as well as Assistant Deputy Superintendent of Indian Affairs for the Crown, stationed with his superior, George Croghan (the Deputy Superintendent), at Fort Pitt. Since Croghan was away on a trip East, McKee was Acting Deputy Superintendent.

<sup>70</sup> He was one of the important chiefs. Sipe (note 63).

<sup>71</sup> Emphasis added. These sentences have been attributed by a number of authors to Captain Ecuyer's journal, but these attributions all lack proper documentation and are undoubtedly confused.

<sup>72</sup> Volwiler (note 67). This exchange epitomizes 'negotiation' in the frontier wars, which seemed more often an extension of hostile manoeuvres than an effort to reach peace. Here the Delaware pose as friends of the British, offering them safe passage if they leave immediately. The British well know that several previous 'safe passages' resulted in massacre or capture. They pretend to accept the offer, but they decline to leave and claim falsely that 3 armies are marching to their relief. The Delaware then claim (also falsely) to abide by their agreement of friendship, and the British give a trojan horse as a gift.

To Sundries got to Replace in kind those which were taken from people in the Hospital to Convey the Smallpox to the Indians Viz:

2 Blankets. . . . . at 20/£2..0..0  
 1 Silk Handkerchief 10/ & 1 linnen do:<sup>73</sup> 3/6. . . . . 0..13..6

The account was signed by Captain Ecuyer, who noted ‘I do hereby Certify that the above Articles were had for the uses above mentioned’. It was also signed by Captain Lewis Ourry in Philadelphia (who adjusted the accounting to reflect the cost of services provided by the Crown to the trading company); and finally by General Thomas Gage (Commander-in-Chief of British troops in America), who instructed:

The Within acct. not belonging to any particular Department, but the Articles ordered for the use of the Service, by the offr. Commandg. Col. Bouquet will order the acct. to be discharged & place it in his acct. of extraordinaries, deducting what is due to the King on acct. of the use made of the Horses, as certified by Capt Ourry, & paying the actual Price given for the several Articles.<sup>74</sup>

It thus appears that the ranking officers at Fort Pitt for both the military and civilian authority of the Crown, acting in concert, transferred the linens from the infirmary to the Indians, and they were replaced by Trent, for which he then billed the English. This account, with its endorsements, not only confirms the act of biological aggression against the Delaware, but also indicates that it was approved by the military chain of command, albeit after the fact.

The matter-of-fact tone and ordinary administrative handling of Ecuyer’s account suggest a lack of embarrassment over the incident and no intent to conceal it. However, this may be misleading. In Captain Ecuyer’s official report, written at the time of the incident (which reproduces the content of the parlay on 24 June in more detail than Trent’s journal) there is no mention of the gift.<sup>75</sup> It seems probable that Captain Ecuyer considered concealing the act and so left it out of his account.

Perhaps he was persuaded to reveal it by learning that the British command had independently decided upon a biological attack on the Indians of the Fort Pitt region. Sir Jeffery Amherst (General Gage’s predecessor as Commander-in-Chief of the British forces in America) and his regional commander for the Pennsylvania frontier, the Swiss professional soldier Henry Bouquet, had agreed that Colonel Bouquet would attempt to infect the natives with smallpox when he arrived at Fort Pitt with reinforcements. Amherst, who had presumably just heard that smallpox had broken out at Fort Pitt, wrote (in an undated postscript, probably to a 7 July letter): ‘Could it not be contrived to send the *Small Pox* among those disaffected tribes of Indians? We must on this occasion use every stratagem in our power to reduce them’ [Amherst’s emphasis].<sup>76</sup>

<sup>73</sup> ‘Do’ is an abbreviation for ditto (i.e., another handkerchief). Note the discrepancy between the number of handkerchiefs billed and that described in Trent’s journal, suggesting that Trent may not have been involved until after the fact, only then learning that there were 2 handkerchiefs, not 1, involved.

<sup>74</sup> Papers of Col. Henry Bouquet, Series 21654, folio 168v, British Library Department of Manuscripts.

<sup>75</sup> Albert, G. D., *The Frontier Forts of Western Pennsylvania, Vol. 2, Report of the Commission to Locate the Sites of the Frontier Forts of Pennsylvania* (State Printer of Pennsylvania, 1896), pp. 116–17.

<sup>76</sup> Knollenberg, B., ‘General Amherst and germ warfare’, *Mississippi Valley Historical Review*, vol. 41 (1954), pp. 489–94; and Parkman (note 62).



Colonel Bouquet, on his way to Fort Pitt with reinforcements, replied on 13 July 1763: 'I will try to inoculate the . . . with some blankets that may fall in their hands, and take care not to get the disease myself' [Bouquet's ellipsis].

General Amherst approved (again in an undated postscript, probably to a letter of 16 July): 'You will do well to try to inoculate the Indians by means of blankets, as well as to try every other method that can serve to extirpate this execrable race'.

On 19 July Bouquet promised that 'all your Directions will be observed'. However, there is no further mention of the plan in the correspondence between the two officers, perhaps in part because it became unnecessary after Bouquet dealt the Indians a decisive defeat on 5 and 6 August in the Battle of Bushy Run, when his forces were ambushed as they neared Fort Pitt. He may, however, have told Ecuyer of the plan and have learned in turn of Ecuyer's independent action. It is significant that Ecuyer signed his accounting on 13 August, only a few days after Bouquet's arrival at Fort Pitt. Of course the timing of the signature may be innocent; certainly it would have been the first time in a long while that Ecuyer would have had time to attend to routine administrative matters, undisturbed by hostilities.

This part of the Bouquet–Amherst correspondence is too brief for confident interpretation of its tone. Amherst's wording ('We must *on this occasion* use every stratagem' [emphasis added]) suggests that this was not an ordinary tactic. Bouquet, on the other hand, mentions a specific method of disease transmission (inoculation 'with some blankets') that clearly needed no explanation, suggesting that the technique, if unusual, was nevertheless self-explanatory. The correspondence gives no hint of embarrassment about, or reluctance to implement, the suggested strategy.

Whether the infected blankets had 'the desired effect' is unclear; a White captive of the Delaware, repatriated in April 1764, claimed that smallpox had been raging among the tribes of the Ohio since the previous spring.<sup>77</sup> If correct, the incident at Fort Pitt would have been redundant. However, it is probable that the captive's memory was in error by a few months, since the English would certainly have known if smallpox had been present before hostilities broke out in May (their traders travelled widely among the Indians). It would thus seem reasonable that the smallpox epidemic began among the Delaware sometime around June 1763. Even so, the role of the incident at Fort Pitt must remain unclear. Given the hostilities between Native Americans and settlers, and the ugly realities of frontier warfare, there were probably many physically close encounters between Indian assailants and English settlers, some of whom may have had smallpox.<sup>78</sup> Therefore, although the act of biological aggression at Fort Pitt is indisputable, its effect is impossible to determine. It was probably at most only one of several nearly simultaneous routes of transmission of a spreading epidemic.

<sup>77</sup> Knollenberg (note 76), pp. 489–94.

<sup>78</sup> E.g., after the 1758 surrender of Fort William Henry during the French and Indian Wars, Indians allied with Montcalm killed and scalped the sick in the smallpox infirmary, and may have dug up and scalped the recently buried, many of whom were disease casualties. Parkman, F., *Montcalm and Wolfe* (Little, Brown: Boston, Mass., 1914); and Jennings (note 62). They were subsequently afflicted with a devastating smallpox epidemic. Heagerty (note 49), p. 46, also mentions cases in which Chippewas and Sioux caught smallpox from clothes taken from murdered settlers who had the disease.

### Other possible instances of frontier biological attack

Less well documented than the incident at Fort Pitt, but with more than a passing mention, is the alleged transmission of smallpox to the Pawnee in 1831.<sup>79</sup> This is said to have occurred on the trade route from Saint Louis to Santa Fe. These western trade routes, across 1600 km of prairie, sustained heavy losses of men, horses and goods to the Plains Indians, and some of the traders are alleged to have brought infectious material from the settled lands to distribute to Indians they might meet on the way. The materials included ‘the virus of smallpox<sup>80</sup> . . . on a present of tobacco’ as well as contaminated clothing. What is meant by virus-contaminated tobacco is not clear; perhaps tobacco wrapped in contaminated handkerchiefs;<sup>81</sup> or perhaps dried smallpox scabs ground to a powder and mixed with the tobacco.<sup>82</sup> The latter could have been particularly effective; if freshly and finely ground, the airborne dust produced by handling the tobacco would be highly infectious by the respiratory route. Alternatively, Hyde’s account of this incident (based, he claims, on primary sources that he unfortunately does not identify) mentions ‘a bottle of smallpox virus’ which was spread on tobacco and clothing.<sup>83</sup> Obviously, the scheme required pre-meditation and immune participants; this would not have been a serious obstacle as many Europeans were immune because of vaccination (discovered by Edward Jenner in 1798 in England) or previous exposure to the disease.<sup>84</sup>

Some or all of these infectious goods were alleged to have been dispensed to a war party of Pawnee south of their home range on the Platte River (about 160 km above its confluence with the Missouri<sup>85</sup>). The Pawnees suffered a devastating epidemic in spring 1832, in which one-half of the tribe was said by McCoy to have died within days of the return of the war party; the Indian agent said that nearly all Pawnees over 30 years old died.<sup>86</sup>

These are the only two incidents known to the author that are documented by more than a passing mention. However, there are a number of undocumented allegations. For example, an outbreak among the Ottawa in 1681 was said to have been deliberately instigated, but the Governor of Canada was unwilling to

<sup>79</sup> McCoy, I., *History of Baptist Indian Missions: Embracing Remarks on the Former and Present Condition of the Aboriginal Tribes; Their Settlement Within the Indian Territory and Future Prospects*, Series in American Studies, ed. J. J. Kwiat (Johnson Reprint Corporation: New York, 1970 (1840)), pp. 411–12. The documentation is apparently in the form of an affidavit, since disappeared, from one of the employees of the company, an observer of but not a participant in the alleged activity. McCoy claims to have known the informant personally and to have a high opinion of his veracity.

<sup>80</sup> The term virus is used here in its pre-microbiological sense of a ‘poison’.

<sup>81</sup> John P. Woodall, Private communication with the author, 29 Nov. 1994.

<sup>82</sup> Ground smallpox scabs had been used for centuries for variolation (the deliberate infection of someone to induce immunity), and in the 19th century vaccinia (cowpox) scabs were being used for smallpox vaccination.

<sup>83</sup> Hyde, G. E., *Pawnee Indians* (University of Denver Press: Denver, Colo., 1951), p. 127.

<sup>84</sup> However, while smallpox infection normally leads to lifetime immunity, vaccination often does not. A scheme such as described could thus carry significant risk of infection to vaccinated participants.

<sup>85</sup> Catlin (note 46).

<sup>86</sup> Hyde (note 83), p. 127. This epidemic led to McCoy’s intervention with the government to persuade it to institute a programme of vaccination among the Western Indians, which it did. The programme was implemented promptly but unsuccessfully (too little money was spread too thinly across a long frontier). However, since the law ‘authorized the Executive [ironically via the Secretary of War] to extend the benefit of vaccination to the Indian tribes’, it could be invoked successfully for subsequent vaccination programmes. McCoy (note 79), p. 443; Trimble, M. K., ‘The 1832 inoculation program on the Missouri River’, eds Verano and Ubelaker (note 37), pp. 257–64.

prosecute.<sup>87</sup> Baegert hints at intent when in 1763 a Spaniard just recovered from smallpox is said to have given an Indian some contaminated clothes or bedding.<sup>88</sup> Heagerty claims that a 1770 outbreak among the Chippewa (Ojibway) was transmitted on a tightly rolled flag, given with a cask of liquor by a Mackinac fur trading company in retaliation for the robbery of one of its traders.<sup>89</sup> A different account of smallpox transmission to the Chippewa is given by Blackbird, who describes a set of nested boxes, the final one containing mouldy material.<sup>90</sup> Finally, Bancroft reports that a man was accused of having brought the epidemic of 1836 to the 'pestiferous' Blackfeet by a gift of contaminated material brought (presumably with intent) from Saint Louis.<sup>91</sup> Of course, many more such mentions must have escaped notice during this study. Such undetailed and uncorroborated accounts cannot individually be taken very seriously, but in aggregate they hint at a history of sporadic British and American efforts to infect North American tribes with smallpox, possibly extending over centuries.

The same is probably true of South America. A frontier persists there to the present, and it has been an intermittent war zone for hundreds of years.<sup>92</sup> Only one mention of biological aggression prior to 1914 is known to the author (but the Spanish and Portuguese literature was not searched during this study). Claude Levi-Strauss, writing of 1934, observed:

I suppose he [the expatriate Brazilian Ambassador in Paris] preferred to cast a slur on the Brazilians of the sixteenth century,<sup>93</sup> so as to divert attention from the favourite pastime of the men of his parents' generation, and even of the period of his own youth, which was to collect garments of smallpox victims from the hospitals and hang them, together with other gifts, along the paths still frequented by the Indian tribes. This pro-

<sup>87</sup> Asserted in a letter from Du Chesneau, Intendant of New France, to his superior in Paris, Colbert de Seignelay, Minister of the Marine and the Colonies. O'Callaghan, E. B. (ed.), *Documents Relative to the Colonial History of the State of New-York, Procured in Holland, England and France by John Romeyn Brodhead, Esq., Vol. 9, Documents Relative to the Colonial History of the State of New-York, procured in Holland, England and France by John Romeyn Brodhead, Esq., ed. E. B. O'Callaghan* (Weed, Parsons: Albany, N.Y., 1855), p. 154.

<sup>88</sup> Baegert, J., 'An account of the aboriginal inhabitants of the California peninsula', *Smithsonian Institution Annual Report, 1864*, pp. 379–99, see especially p. 385.

<sup>89</sup> Heagerty (note 49), p. 44. However, the same incident (although attributed to 1781) is discussed by Warren, who dismisses the proposed explanation on the basis of discussions (in the 1840s) with the Ojibway chief, who indicated that the smallpox was a consequence of a raiding party bringing it back from the Gros Ventres. Warren, W. W., *History of the Ojibway Nation* (Ross & Haines, Inc.: Minneapolis, Minn., 1957), pp. 256–62.

<sup>90</sup> Blackbird, A. J., *Complete both Early and Late History of the Ottawa and Chippewa Indians of Michigan, a Grammar of their Language, Personal and Family History of Author* (Babcock and Darling: Harbor Springs, Mich., 1897). It is possible that this is a variant of the incident described by Heagerty and by Warren (note 89).

<sup>91</sup> Bancroft (note 61), p. 602. This account is suspect, as the date is almost certainly in error. As far as is known to the present author, the Blackfeet were free of smallpox in 1836. There was a massive outbreak of smallpox among many tribes of the upper Missouri in 1837–38, which was quite clearly a result of transmission along the river by an infected steamer carrying trade goods. No other accounts of this outbreak refer to deliberate infection, although the steamer captain was grossly negligent in not quarantining the crew and passengers of his ship. Trimble, M. K., 'The 1832 inoculation program on the Missouri River', eds Verano and Ubelaker (note 37), pp. 257–64; and Abel, A. H., *Chardon's Journal at Fort Clark, 1834–1839: Descriptive of Life on the Upper Missouri; of a Fur Trader's Experiences Among the Mandans, Gros Ventres, and Their Neighbors; of the Ravages of the Small-Pox Epidemic of 1837* (South Dakota Department of History: Pierre, S.D., 1932).

<sup>92</sup> Hecht, S. and Cockburn, A., *The Fate of the Forest: Developers, Destroyers and Defenders of the Amazon* (Verso: New York, 1989).

<sup>93</sup> He was attributing native depopulation to early Portuguese colonial atrocities.

duced the following remarkable result . . . by the time I arrived in 1935 not a single Indian was left [in the huge state of Sao Paulo].<sup>94</sup>

#### IV. Native American use of biological warfare

There is some evidence that Native Americans also employed biological warfare, very occasionally, against Whites.<sup>95</sup> In mid-September 1710, during Queen Anne's War,<sup>96</sup> the British sent a contingent of approximately 2500 men to upstate New York to establish outposts at Lake St Sacrement (Lake George) and Lake Champlain. They were accompanied by a large contingent of Iroquois. However, the Iroquois became concerned that their English allies were becoming too strong (their strategic goal was to maintain the French and English at roughly equal strength), and they are alleged to have made a clandestine attack on their allies:

Four Iroquois cantons . . . had already declared in favor of the English; but these Indians were far from intending to help their allies to expel the French from Canada . . . their nation, lying between two powerful nations each able to exterminate them, and both interested in doing so, when they no longer needed their help, their whole attention should be devoted to keeping both always in the necessity of conciliating them, and consequently preventing either from prevailing over the other . . . In fact the Iroquois had no sooner joined the English army, than, believing it strong enough to take Montreal without their help, they thought only of means to destroy it, and resorted to the following. The army was encamped on the banks of a little river; the Iroquois, who spent almost all the time hunting, threw into it, just above the camp, all the skins of the animals they flayed, and the water was thus soon all corrupted.<sup>97</sup> The English, unsuspecting of this treachery, continued to drink this water, and it carried off so many, that Father de Mareuil,<sup>98</sup> and two [French] officers who went to Orange (Albany) to conduct him to Canada, observing the graves where the dead were buried, estimated the number at over a thousand.<sup>99</sup>

The severely reduced British forces abandoned their designs, burned their canoes and forts, and retreated. Of course, it is not clear that the casualties were a consequence of the alleged Iroquois action; however, it is plausible, particularly if the material dumped into the creek included viscera as well as hides, which could transmit serious intestinal pathogens. Note that this is the earliest alleged act of biological warfare recorded in the New World, by anyone.

<sup>94</sup> Levi-Strauss, C., *Tristes Tropiques* (Atheneum: New York, 1975), p. 49. He obtained his information from the testimony of descendants of the wealthy Brazilian landowners of the 19th century, who were candid about 'their grandfathers infamous deeds' but who wished to remain anonymous. Claude Levi-Strauss, Private communication with the author, Jan. 1996.

<sup>95</sup> The author thanks Elizabeth Fenn for bringing these incidents to his attention.

<sup>96</sup> This was one of the continuing skirmishes between France and Britain in the New World, extensions of their European conflict. It was in this war that Britain took Newfoundland.

<sup>97</sup> As indicated in the introduction the present author would not normally consider the pollution of water sources as biological warfare because of ambiguity regarding intent. In this case, however, it is clear that the intent was to transmit disease, since if the water became unpalatable as a result of the contamination, all the English would have had to do would be to move up- or downstream.

<sup>98</sup> A French Jesuit missionary being conducted back to Canada as part of a hostage trade.

<sup>99</sup> de Charlevoix, P. F. X., *History and General Description of New France, Vol. 5*, ed. and trans. J. D. G. Shea (F. P. Harper: New York, 1900), pp. 221–22, originally published in 1744.

Much later, in the summer and autumn of 1870, a devastating smallpox epidemic afflicted the Cree in Saskatchewan, Canada. Butler<sup>100</sup> offers the following description of the situation at the Hudson's Bay Company outpost of Fort Pitt (on the North Branch of the Saskatchewan River):<sup>101</sup>

In the immediate neighborhood of Fort Pitt two camps of Crees established themselves, at first in the hope of obtaining medical assistance, and failing in that—for the officer in charge soon exhausted his slender store—they appear to have endeavored to convey the infection into the fort, in the belief that by doing so they would cease to suffer from it themselves. The dead bodies were left unburied close to the stockades, and frequently Indians in the worst stage of the disease might be seen trying to force an entrance into the houses, or rubbing portions of the infectious matter from their persons against the door-handles and window-frames of the dwellings.<sup>102</sup>

Only three people in the fort came down with the disease, as most of the occupants had been vaccinated earlier in the summer. It is worth noting that Butler interpreted the Cree actions primarily as an attempt to rid themselves of disease, rather than to infect others. If this interpretation is correct, describing it as biological warfare may not be fully accurate.

## V. Biological warfare during the American Revolution

Elizabeth Fenn has documented<sup>103</sup> a number of cases of possible efforts by the British to communicate smallpox to the Continental Army. Several of these involved using inoculation (variolation): the practice of deliberately inoculating a susceptible person with matter from a smallpox pustule. This had been discovered to frequently lead to a much less serious case of the disease (for reasons that remain obscure), followed by lifelong immunity. However, although the disease is usually less severe when initiated in this way, it is communicable to others, and can thereby initiate an outbreak of fully natural and virulent smallpox. Thus variolation was always a controversial practice.

In April 1775 the Continental Army besieged the British forces in Boston. Smallpox was rampant in the city, and the British command apparently began inoculating all susceptible troops. Of course, this was probably prophylactic in nature, with the goal of reducing troop losses to smallpox. In striking contrast was the alleged inoculation of civilian refugees fleeing the city, which if done would have been a clearly offensive act. Several contemporary accounts described such action, and they eventually convinced General George Washington, who had initially been sceptical: 'The information that I received

<sup>100</sup> In April, 1870, Lieutenant-Governor Adams Archibald of Manitoba commissioned Lieutenant W. F. Butler to journey up the Saskatchewan River to ascertain the state of the rule of law, and the extent of smallpox. Butler left Manitoba in late Oct. 1870, and returned in late Feb. He was at Fort Pitt on the out-bound journey in mid-Nov. 1870. The events described by Butler in his report to Governor Adams occurred several months before he arrived at Fort Pitt, so he is clearly recounting stories told him by the fort inhabitants, rather than events he witnessed.

<sup>101</sup> Obviously this is not the same Fort Pitt discussed above, in Pennsylvania; unfortunately, the identical names invite confusion.

<sup>102</sup> Butler, W. F., *The Great Lone Land: A Narrative of Travel and Adventure in the North-West of America* (Samson Low, Marson, Low, & Searle: London, 1872), appendix, Lieutenant Butler's Report [to Lieutenant-Governor Archibald], p. 369.

<sup>103</sup> Fenn, E., 'Biological warfare in eighteenth century North America: beyond Jeffery Amherst', *Journal of American History*, in press.

that the enemy intended Spreading the Small pox amongst us, I could not Suppose them Capable of—I now must give Some Credit to it, as it has made its appearance on Severall of those who Last Came out of Boston'.<sup>104</sup> The Continental forces controlled the spread of the disease by quarantine and disinfection, and the biological attack, if such it was, seems to have had little effect.

When the British eventually evacuated, in March 1776, Washington suspected them again of deliberately spreading smallpox within the city, so as to infect the Continental Army when it entered. Indeed the disease was widespread, and rapidly infected the portion of the army that remained garrisoned in Boston, forcing the garrison commander, General Artemas Ward, to begin his own programme of troop variation.

There were also claims that during the siege of Quebec (winter, 1775–76) the British fort commander had inoculated civilians and sent them to mingle with the Continental troops. The documentation for this is confined to claims by surviving American troops, and so is only marginally credible, but it testifies at least to a widespread belief among the revolutionary forces that the British employed disease as a weapon. Regardless of how it was transmitted (there was an ongoing outbreak in the area, so there was ample opportunity for natural contagion), smallpox hit the northern Continental Army hard, and was among the factors leading to the failure to take Quebec, and to the disastrous retreat to Fort Ticonderoga.

Attempts to transmit smallpox to Continental forces also appear to have been made in the south. Many of the prominent revolutionaries were slave holders, and slaves who escaped during the hostilities often attached themselves to the British forces. In at least one case there is evidence of intent to distribute these refugees back to the plantations to encourage the spread of disease: General Alexander Leslie wrote to General Charles Cornwallis in July 1781 'About 700 Negroes are come down the River [to Portsmouth, Virginia] in the Small Pox . . . I shall distribute them about the Rebell Plantations'. While this is the only clear documentation of British intent that Fenn has discovered, she has found several other instances in which Continental forces suspected that Afro-American smallpox victims were being used to spread the disease; given the documentation of intent in one instance, the suspicions are credible.

These incidents described by Fenn, as well as the earlier use of biological attack by Captain Ecuyer at Fort Pitt and the approving correspondence between Amherst and Bouquet, suggest that the use of smallpox as a weapon may have been widely entertained by British military commanders, and may have been employed without scruple when opportunity offered, possibly on a number of occasions.

The French appear to have been generally uninterested in disease as a weapon. The present author is aware of only one allegation.<sup>105</sup> After the fall of Fort William Henry in 1768, during the French and Indian Wars, the French commander, General Louis Montcalm, repatriated British colonial captives to Halifax. A number were ill with smallpox, and his action was interpreted as an attempt to spread disease. If this was his intent, the strategy was a failure; the

<sup>104</sup> Letter to John Hancock, 11 Dec. 1775.

<sup>105</sup> Heagerty (note 49), p. 42.

outbreak burned itself out during the voyage, with the last to succumb being the French captors, who were then easily overpowered. The present author is aware of no allegations that the French deliberately spread disease among Native Americans.

## VI. Conclusions

The written record prior to the scientific understanding of the mechanisms of contagion suggests that biological aggression was uncommon, and probably very rare. The sporadic mentions of biological attack in siege warfare are insufficient to establish with certainty that the practice occurred at all, or if it did, how frequently. The rarity of descriptions of biological attack (four incidents mentioned over the course of four centuries) suggests that it was rare; that none of the accounts is corroborated allows the possibility that all are fictitious. While the paucity of records from these times, and the difficulty of access to those that exist, may partly explain the lack of corroboration and the rarity of mention, it is clear that the practice could not have been a common one. However, the present author is inclined to believe that at least some of these accounts are accurate. Certainly they attest to the fact that biological attack was part of the medieval imagination; it is hard to believe that it was not at least occasionally tried.

There is no hint in any of the accounts that the writers were aware of other descriptions of the practice. Each incident thus seems to describe a separate invention of the technique, implemented according to local conditions: dead animals at Thun L'Eveque, plague cadavers at Caffa and Reval, and battle casualties and refuse at Karlstein.

The record does establish beyond any reasonable doubt that biological attack on Native Americans occurred at least once. It is, however, insufficient to establish the frequency of the practice. On the one hand, it could be credibly argued that the lack of documentation suggests a nearly non-existent practice. There is only one well-documented occasion known in the four centuries of continuing colonization of two continents prior to World War I. Over the same vast temporal and geographical span there is a mere handful of additional mentions of such incidents, most of which lack convincing detail, are second- or third-hand, and are uncorroborated. The great majority of first-hand accounts of frontier life do not even hint at the practice, although many of them mention the ravages of disease on the Native Americans.<sup>106</sup>

<sup>106</sup> Original accounts examined by the author include: Abel (note 91); Baegert (note 88), pp. 379–99; Bancroft (note 61); Catlin (note 46); Cook, J. and King, J., *A Voyage to the Pacific Ocean Undertaken by the Command of His Majesty for Making Discoveries in the Northern Hemisphere to Determine the Position and Extent of the West Side of North America; Its Distance from Asia; and the Practicability of a Northern Passage to Europe Performed Under the Direction of Captains Cook, Clerke, and Gore, In His Majesty's Ships Resolution and Discovery in the Years 1776, 1777, 1778, 1779, and 1780* (Lord Commissioners of the Admiralty: Dublin, 1784); Davis (note 44); Gregg, J., *Commerce of the Prairies* (University of Oklahoma Press: Norman, Okla., 1954 [1844]); Hosmer, J. K. (ed.), *Winthrop's Journal 'History of New England' 1630–1649*, ed. J. F. Jameson, *Original Narratives of Early American History*, (Charles Scribner's Sons: New York, 1908); Kenton (note 45); Mather (note 55); McCoy (note 79); O'Callaghan (note 87); O'Callaghan (note 58); Pike, W., *Through the Subarctic Forest* (Edward Arnold: New York, 1896); Roosevelt, T., *Through the Brazilian Wilderness* (Charles Scribner's Sons: New York, 1914); Seton, E. T., *The Arctic Prairies* (Charles Scribner's Sons: New York, 1911); Volwiler (note 67), pp. 390–413; and Wagner (note 48). In addition, many older secondary sources are based almost entirely on original, often unpublished, primary documents (and frequently quote them lavishly). The silence with

On the other hand, it has to be recognized that many individual actions, taken extemporaneously when the opportunity presented itself to contrive that infectious material fall into native hands, may have gone unrecorded. Such spontaneous actions are much more likely in the informal context of frontier warfare than in the more organized military structure of European siege warfare. Even if recorded, such incidents would have been described in the journals and letters of individual frontier people, of which few have survived, fewer still become part of the public historical record and even fewer come to the attention of the present author. The lack of written contemporaneous Native American accounts further reduces the likelihood of recollection. From this perspective, the few surviving records could be viewed as evidence for a pervasive practice of biological aggression, most instances of which escaped notice. Certainly this is a widespread view among Native Americans, whose traditions include many undocumented stories of such attacks.

It thus seems likely that biological aggression was one of the tactics that European soldiers, settlers and their descendants adopted occasionally. It was probably not common, but it most likely occurred more frequently than is reported in surviving accounts.<sup>107</sup> As with siege warfare, there were probably many independent inventions of the practice. The belief, held by many, that it was a pervasive practice is probably a result of the combination of rare actual attacks, threats of such attack and understandable suspicion regarding the aetiology of natural outbreaks.

The impact of the practice is also difficult to assess from the record. Given the great susceptibility of Native American populations to repeated epidemics of European diseases, it is unlikely that even frequent biological aggression would have had any great impact on the broad outlines of the history of the western hemisphere. The diseases that might have been successfully communicated to Native Americans were all raging back and forth across the hemisphere (hence their appeal and effectiveness as weapons), and deliberate infection was merely one of many possible routes of nearly inevitable contagion.

Nevertheless, any attempt to transmit infectious disease to the Native Americans would have constituted offensive biological warfare, regardless of its effectiveness. When successful, such attacks could have had major and tragic effects on those concerned—individual and collective tragedies that might otherwise have been avoided or delayed. Their nature and magnitude would have depended on the immediate circumstances; however, it must be accepted that if there were numerous acts of biological aggression, there were most likely at least a few in which the results were catastrophic for the victims. These probable consequences are a part of the already heavy ethical burden of European expansion.

In addition to at least occasional biological attack on Native Americans, the record strongly suggests that the British military used smallpox as a weapon against the Continental Army during the American Revolutionary War. The results are unclear but may have been militarily significant if the colonial suspi-

regard to biological aggression suggests that the practice is not mentioned in a voluminous body of surviving records.

<sup>107</sup> For a dissenting view, see Crosby, *Ecological Imperialism* (note 37), p. 345, fn 38. However, Crosby was probably unaware of much of the documentary material.



cions were correct about the origins of smallpox among the besieging troops at Quebec.

It is beyond question that the biological aggression described here is reprehensible to modern sensibilities. However, in medieval times, there was no generally recognized distinction between combatants and non-combatants. The laws of war applied only to knights and squires; merchants and peasants had no legal protection.<sup>108</sup> Furthermore, inhabitants of a city were considered to have forfeited any rights to humane treatment by their refusal to submit to the demands of a besieging force (their refusal being viewed as treasonous).<sup>109</sup> There were thus few legal or moral constraints on the ferocity of a besieging army; biological attack may have been legitimate within this context. Notably, none of the primary sources on these events appears to consider the methods described as warranting condemnation, suggesting that the practice of hurling biological material was within the range of unsurprising practices in siege warfare.

Although by early colonial times the rights of civilians were more widely respected by Christians, they were often not extended to infidels. Furthermore, Indian attacks (on both Europeans and on other Native Americans) were of a savagery that was appalling to European sensibilities. Ambush was common, no quarter was given, women and children were enslaved or slaughtered, and male prisoners were commonly tortured to death. Europeans, not recognizing the complex and coherent cultural context of such behaviour, interpreted it as treachery and atrocity, and often concluded that it excused similar savagery on their own part.<sup>110</sup> Such a context provided latitude for biological attack to be considered.

The British use of smallpox against rebellious British colonists is less easy to understand, especially since it appears to have frequently used or targeted civilians. However, from the British point of view the rebellion was treasonous, and perhaps this provided justification. Regardless, the surviving records do not suggest any serious embarrassment or awareness of ethical problems with their activities; it appears that the British forces in colonial and revolutionary North America may have had little in the way of ethical restraint on their use of disease as a weapon. In this respect they may be anomalous; certainly the rebel forces considered the British actions perfidious.

Given this, it is surprising that biological attack has not been more common than the record suggests. Most likely it was restrained by utilitarian difficulty and hazard when cultural norms against it were weakened by exigency and self-interest.

The ethical and legal context in the 20th century is, of course, distinctly different from that which obtained earlier. Biological warfare has been rejected by

<sup>108</sup> Although the Peace of God movement asserted the right of women, children, clergy, the aged, the poor and agricultural workers to immunity from attack, this was not generally accepted nor widely observed.

<sup>109</sup> Stacey, R. C., 'The age of chivalry', eds M. Howard, G. J. Andreopoulos and M. R. Shulman, *The Laws of War: Constraints on Warfare in the Western World* (Yale University Press: New Haven, Conn., 1994), pp. 27–39.

<sup>110</sup> Selesky, H. E., 'Colonial America', eds Howard, Andreopoulos and Shulman (note 109), pp. 59–85.

the parties to the 1925 Geneva Protocol,<sup>111</sup> and that prohibition is argued by many to have become part of customary international law, binding on all nations.<sup>112</sup> Although the protocol applies only to wars between states parties to it, its moral authority certainly applies to civil conflict as well. Furthermore, the rights of civilians are now widely recognized, as is the responsibility of governments to protect their indigenous peoples (even though these rights and responsibilities are still often violated). Biological aggression as described here under siege warfare and during the American Revolution would certainly, if it occurred in the 20th century, be a violation of the Geneva Protocol and customary law, and a war crime for its indiscriminate targeting of civilians. Practices described on the American frontier in the 18th and 19th centuries would in addition constitute genocide,<sup>113</sup> and would violate the Genocide Convention.<sup>114</sup>

Although there is now an explicit prohibition against biological warfare, the technical accomplishments of the past 100 years have vastly expanded the opportunities for effective use of microbes as weapons. For most of human history, attempts to transmit infection were necessarily rare and clumsy. They probably rarely worked and, when they did, they were probably redundant with natural routes of transmission. Lack of knowledge of mechanisms of contagion precluded rational design of methods of biological attack. The apparent rarity of the practice suggests that it was powerfully restrained; certainly ignorance of the workings of the powers being harnessed must have been an important restraint.

The revolution in microbiology transformed the state of ignorance of the mechanisms of contagion to one of sophisticated understanding. Over the period 1880 to 1900 the microbial aetiology of infectious disease was proven, the agents of virtually every common bacterial disease of importance (of both humans and domestic animals) identified and studied, and their mechanisms of transmission elucidated. With this came the unanticipated opportunity for systematic design and improvement of biological weapons, and the century closed with a brief flurry of research that augured ill for the coming one. Research in the early 1890s in Germany by Messner<sup>115</sup> and in the USA by Captain Louis

<sup>111</sup> Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, signed at Geneva 17 June 1925, entered into force 8 Feb. 1928. The text of the protocol is reproduced on the SIPRI Internet web site at URL <<http://www.sipri.se/cbw/docs>>.

<sup>112</sup> Thomas, A. V. W. and Thomas, Jr., A. J., *Legal Limits on the Use of Chemical and Biological Weapons* (Southern Methodist University Press: Dallas, Tex., 1970).

<sup>113</sup> At least one incident is described in this century. In 1967 Brazilian Minister of the Interior General Albuquerque Lima commissioned Attorney-General Jader Figueiredo to investigate charges against SPI, the Indian Protection Service. The Figueiredo Report (over 5000 pages, in 20 volumes), released by General Lima in 1968, charged SPI with rampant illegal activity, including mass murder and biological aggression on a number of occasions over a period of 8 years. Land speculators and SPI agents were charged with introducing smallpox, measles, influenza, and tuberculosis into tribes of the open savannas and scrublands of the Matto Grosso, coveted as grazing land, from 1957 to 1963, and tuberculosis into tribes of the northern part of the Amazonian basin in 1964–65. Davis, S. H., *Victims of the Miracle: Development and the Indians of Brazil* (Cambridge University Press: New York, 1977), p. 11. The present author has been unable to determine the outcome of this report; over 100 SPI officials were indicted, but whether they were brought to trial is not clear.

<sup>114</sup> Convention on the Prevention and Punishment of the Crime of Genocide. Open for signature in Paris, 9 Dec. 1948; entered into force 12 Jan. 1951. United Nations, *Treaty Series* (United Nations: New York, 1951).

<sup>115</sup> Anon., 'Einundzwanzigster Congress der deutschen Gesellschaft für Chirurgie, vol. 1. Die chirurgische Bedeutung der neuen Feuerwaffen' [21st Congress of the German Surgery, vol I, The surgical implications of the new firearms], *Deutsche Medicinische Wochenschrift*, vol. 18 (1892), p. 594.

Lagarde<sup>116</sup> (both military physicians) showed that bacteria on the surface of a bullet (vegetative cells as well as spores) could survive the blast of a firearm discharge, the heat of friction with the barrel and the air, and the heat and pressure of impact. Experiments with sterile targets and contaminated bullets showed bacterial contamination of the target surface and of the bullet track, and animal experiments showed that bullets contaminated with pathogenic bacteria (including anthrax spores and vegetative cells) could cause fatal infections of otherwise non-lethal wounds. While this work was probably motivated largely by interest in the mechanism of contamination of gunshot wounds, with the hope of better infection control, the conclusions nevertheless invite application to offensive use. Other experiments showed that bacteria and their spores could survive a high-explosive blast, and thus could in principle be disseminated in bombs or artillery shells.

Fortunately, there seems to have been no effort to exploit the possibilities suggested by this ominous work. The conclusion that cartridges are sterile, or nearly so, as they leave the factory (a result of the heating and cleaning that are part of the manufacturing process) seems to have distracted medical attention away from bullets as agents of contamination. Biological warfare did not attract scientific and military attention until World War I, and even then the attention was desultory at best in all countries except Germany and perhaps France.<sup>117</sup> Widespread consideration of biological warfare did not occur until the 1930s. Thereafter there was a steady increase in the technical sophistication of the methods designed to wage biological warfare, although, fortunately, they have rarely been used.

It is to the restraint of such technical capacity that the ethical and legal developments mentioned above have been directed. As the other chapters in this volume show, this has not been completely successful. Clearly, an abiding issue in biological arms control is how to encourage restraint when it is at odds with perceived national interest.

<sup>116</sup> Lagarde, L. A., 'Can a septic bullet infect a gunshot wound?', *New York Medical Journal*, vol. 56 (1892), pp. 458–64; and Lagarde, L. A., 'Septic bullets and septic powders', *Medical Record*, vol. 47 (1895), pp. 784–85.

<sup>117</sup> See chapter 3 in this volume.