

1 A Tale of Two Diseases

Smallpox and Cowpox

In Jamaica in 1801, Lady Maria Nugent was seeking to start a family. Born in New Jersey in 1771, she was the daughter of Cortlandt Skinner, who raised a regiment to serve on the British side in the American War of Independence and sent his family as refugees to Britain. In late 1797, she married Sir George Nugent, fourteen years her senior, who after rising through the ranks in America served as commander of the British forces in the northern sector during the Irish Rebellion of 1798 and was appointed Governor of Jamaica in spring 1801. Though Britain was at war with France, and the Caribbean was a theatre of conflict, Maria went with her husband to assume the role of governor's wife. Amidst her pert observations of Jamaica, however, there began to appear in her journal, month by month, more sombre reflections and, at year's end, a confession of her 'misery that the dear name of mother will never greet my ear'. In early 1802, however, she became pregnant and, after an anxious confinement, gave birth to a healthy boy in October. A week later, she recorded her thanks to God for 'the great blessing' and 'the joy that now fills my heart'. She embarked on a note-book 'to keep an account of my dear baby's health, and know, from hour to hour, how he goes on, that I may be ready in case of any illness'. On 17 November, after reporting that her baby was 'prospering', she gloomily notes, 'but, alas, we must soon think of giving him the small-pox'.¹

Maria's statement is chilling and shocking. After her concern that she might never be a mother and anxieties about having her first child far from family and friends, the idea that she would give her baby smallpox appears perplexing and disturbing. It soon becomes apparent, of course, that she is referring to having him inoculated with smallpox. Over eighty years earlier, Lady Mary Wortley Montagu, the wife of another British official in foreign parts, had observed how Greek women in Istanbul inserted smallpox matter under the skin on a child's arm in the hope that the child would develop a mild case of smallpox which would then provide security against future infection. Trials of smallpox

¹ *Lady Nugent's journal: Jamaica one hundred years ago*, ed. Frank Cundall, 2nd ed. (London, 1934), pp. 65, 169, 171.

inoculation (variola) in England in the 1720s showed that inoculated smallpox was generally less severe than smallpox acquired casually. In the second half of the eighteenth century, it became a familiar practice in the English-speaking world. Since it was used extensively during the smallpox epidemic that raged during the war in America, it is likely enough that Maria herself had been inoculated. Still, the procedure involved some risk. A mild case of smallpox could not be counted on, and a small percentage of children died of inoculated smallpox, making it an awful decision for parents. As it was not usual to inoculate a neonate, the presence of smallpox in Jamaica was probably a determining factor. Sir George may have been especially resolute, but Maria's words suggest that it was a joint decision. The Nugents could call on medical men who were experienced in the procedure as it was extensively deployed on the plantations. Their physician found a child in Spanish Town with a mild case of smallpox and brought him or her to the house to provide fresh lymph for the operation. There followed an anxious fortnight. After being advised that her son's infection was approaching the critical time, Maria abandoned a ball to hurry to his side. Shortly afterwards, she was happy to report that her child was back in good health.²

Maria's anguish about smallpox inoculation is hardly surprising, but referring to the procedure as giving a child smallpox, though apposite, is very unusual. The likely explanation is that variolation was no longer the only option for smallpox prophylaxis. In 1798, the first year of their marriage, Edward Jenner published his thesis that inoculating cowpox was a much safer and just as effective means of protection against smallpox.³ Trials of cowpox (vaccine) in London in 1799 generated publicity and cowpox inoculation (vaccination) was introduced in the British army and navy in 1800. Seeking to start a family, the Nugents would have invested some hope in the new procedure, read reports of its success in Europe, and heard about attempts to establish the practice locally with imported vaccine. In 1803, Maria was pregnant again, giving birth to a daughter in October. The likely availability of vaccine evidently eased her mind. She reported that the doctor brought 'a nice little mulatto child, from whose arm my dear baby was vaccinated'. The outcome was disappointing, raising the concern that 'perhaps, after all, we must give her the smallpox'. Fortunately, a new supply of vaccine arrived in November. 'We agreed', Maria wrote in high spirits, 'to have the puncture made in her dear little leg; for if the present fashion for excessive short sleeves lasts till she grows up, it will not be becoming to expose a scar on the arm,

² *Nugent's Journal*, pp. 173–4, 177, 179.

³ Edward Jenner, *An inquiry into the causes and effects of the variolæ vaccinae, or cow pox, a disease discovered in the western counties of England, and known by the name of the cow pox* (London, 1798).

which I now see disfiguring many pretty young ladies'.⁴ The anguish of giving a child smallpox already seemed to belong to another age.

War on Smallpox and the World Arm-to-Arm

This book is the first full-length history of the spread of vaccination around the world in the early nineteenth century. The first generation of practitioners often saw themselves as making history by introducing, establishing and promoting the practice in their communities. In seeking a supply of vaccine, in sharing observations and insights about the new prophylaxis with colleagues, they were consciously or unconsciously participating in networks that, though locally based, were ultimately transnational. The promoters of vaccination certainly looked to developments elsewhere in the world for instruction and inspiration.⁵ Writing a history of vaccination at the end of the Napoleonic Wars, James Moore included a sketch of its global career, and popular histories of smallpox and smallpox prevention, usually ranging from the earliest times until the declaration of the eradication of smallpox in 1980, have tended to include a similar outline of its early spread around the world.⁶ Over the past fifty years, there has been an impressive body of scholarship on the history of vaccination, largely national and regional studies.⁷ More recently, there has been a growing recognition of the interest of the global dimension, especially the common and the distinctive challenges and responses to the problems of delivering vaccine and embedding the practice in different climes and cultures around the world.⁸ This book draws on an immense range of primary sources, published and unpublished, and builds on the available scholarship in a dozen languages, to present a richer and more comprehensive picture of the beginnings of vaccination, one that reveals the value of seeing the connectedness of developments around the world. The approach is more that of a general historian than a historian of medicine. An inspiration was the quality and richness of the documentation generated by the cowpox discovery and the

⁴ *Nugent's Journal*, pp. 231–2, 236, 240.

⁵ James Moore, *The history and practice of vaccination* (London, 1817), pp. 226–73.

⁶ E.g. Donald R. Hopkins, *The greatest killer: smallpox in history, with a new introduction* (Chicago, 2002), first published as *Peasants and princes: smallpox in history* (Chicago, 1983); Ian Glynn and Jennifer Glynn, *The rise and fall of smallpox* (London, 2004); Gareth Williams, *Angel of death. The story of smallpox* (Basingstoke, 2010).

⁷ Early leaders in the field were Yves-Marie Bercé, *Le chaudron et la lancette. Croyances populaires et médecine préventive (1798–1830)* (Paris, 1984) and Pierre Darmon, *La longue traque de la variole. Les pionniers de la médecine préventive* (Paris, 1986). More generally see the Select Bibliography.

⁸ John Z. Bowers, 'The odyssey of smallpox vaccination', *BHM*, 55 (1981), 17–33; Ann Jannetta, *The vaccinators. Smallpox, medical knowledge, and the 'opening' of Japan* (Stanford, CA, 2007); Andrea Rusnock, 'Catching cowpox: the early spread of smallpox vaccination, 1798–1810', *BHM*, 83 (2009), 17–36.

advent of early vaccination, and the insights and perspectives it offered on aspects of life that are otherwise rarely documented. Vaccination, like variolation before it, has to be seen not only as a medical and sanitary intervention but as a technology, a social and cultural practice and an emotion-laden rite of passage. This study seeks to explore how the new prophylaxis was not only shaped by the broader historical forces but was also constitutive of them. As some literary scholars have shown, for example, the enthusiasm for cowpox and the cult of Jenner reflect and inform the sensibilities of the age of Romanticism.⁹ The scale of the mobilisation in relation to vaccination in its first decade needs to be especially stressed. Millions of people around the world played their part in the vaccination revolution and experienced its emancipatory power.

The early global spread of vaccination involved more than the flow of information and a simple technology. It required the distribution of cowpox (vaccine) in a good state of preservation, its successful propagation on arrival, and measures to maintain the supply of vaccine. Even in England, cowpox was found only occasionally on dairy-farms, and from the outset the supply of cowpox lymph depended on the vaccination process itself, that is lymph drawn from the vaccine vesicle that had risen on the arm of a child vaccinated around nine days previously. Often enough, the previously vaccinated children would be put, almost literally, arm-to-arm with the next batch of children. It may be that many mothers found the use of vaccine that had passed through other children, without obvious harm, somewhat reassuring. To extend the practice and set it on the firm foundations, of course, required the collection and preservation of vaccine for future use. Cowpox lymph in its liquid state did not survive long, even when stored in a sealed glass bottle. The standard method for maintaining a supply of vaccine was to soak cotton threads in the cowpox lymph, allow the cowpox-imbued threads to dry, wrap them in paper, and perhaps even store them in bottles. In the early years of vaccination, packets of dried vaccine threads were dispatched from London and other centres of early practice in almost diasporic profusion. Dried vaccine wrapped in paper, however, had a short life span, especially in conditions of heat and humidity. There were remarkable successes, especially in sending dried vaccine to Vienna in 1799, but it proved surprisingly difficult to deliver vaccine in any form to France. There was a rapid address, in which practitioners around the world contributed, to the technical problems of storing and transporting vaccine. State-of-the-art solutions, like sealing lymph between sealed plates or in vacuum sealed capillaries, were expensive, not easily transported, and delivered only marginally better results than sending large numbers of threads

⁹ Tim Fulford, Debbie Lee and Peter J. Kitson, *Literature, science and exploration in the Romantic era: bodies of knowledge* (Cambridge, 2004), ch. 9.

in packets. As Andrea Rusnock has shown, the spread of vaccination was more than a matter of the world, in her happy phrase, simply ‘catching cowpox’.¹⁰

One method for delivering vaccine over long distances and in challenging environments was to move children under vaccination. It built on the routine practice of using a previously inoculated child as the source of vaccine for other children. As early as 1800, children were being taken to be vaccinated in towns where the practice was established and brought home to go arm-to-arm with other children. It was found that on a sea-voyage it was possible to maintain a supply of fresh lymph for delivery at the destination by the successive vaccination of young people who had not had smallpox. Within a few years, vaccination chains were being used to introduce and extend the practice in many parts of the world, most notably in the Spanish empire. Although it drew on the techniques used for storing and variolous matter, vaccination faced the new challenge of needing to have to hand a supply of a virus that was hard to find in England and not available at all in most other parts of the world. The maintenance and extension of the practice therefore depended on a higher level of organisation. The availability of vaccination as an option to the individual depended on other people adopting the practice. The spread of vaccination around the world required massive mobilisation, rarely coercive but often involving a degree of pressure and hustle. Millions of people were to be enlisted or dragooned into the war against smallpox. Unlike variolation, which kept smallpox alive, vaccination offered the prospect of a world free from smallpox.

As historians of medicine, health policy analysts, and philosophical patients have often observed, the language of wars and battles against diseases can have unfortunate connotations. It is noteworthy, though, that the use of military metaphors in medicine gained traction in the eighteenth century with the perception of smallpox as an invasive agent, and the idea that inoculation assisted bodily resistance. Although he confided his thoughts to a manuscript unpublished until modern times, Cotton Mather was probably not alone in imagining ‘unseen armies of numberless things, ready to seize and prey on us’, figuring smallpox as an enemy that the body needs to be ‘very strong’ to resist, and inoculated smallpox as attacking only the ‘outer works’ of the citadel.¹¹ The coincidence of the beginnings of vaccination with the Revolutionary and Napoleonic wars may have further encouraged the use of military metaphors in the new form of prophylaxis. Jenner, no enthusiast for the war, used them very often. In a letter to two ladies inoculating cowpox in Wales, he congratulated them on opening ‘the vaccine campaign so successfully’ and

¹⁰ Rusnock, ‘Catching cowpox’, 17–36.

¹¹ Cotton Mather, *The Angel of Bethesda*, ed. Gordon W. Jones (Barre, MA, 1972), pp. 47, 94, 112.

continued, 'May this species of warfare never terminate till you have driven from your country the most formidable foe that ever invaded it'.¹² The prospect of banishing smallpox led naturally to the language of war and conquest. In Napoleonic France, Minister of the Interior Chaptal wrote in martial tones about disputing 'every inch of ground with the enemy whom we wish to exterminate'.¹³ In embattled Britain, some of the most bellicose language was used not about smallpox itself, but about the men who sought to undermine confidence in vaccination and spread smallpox by inoculation. Jenner's cowpox discovery proved to be the occasion of the first great confrontation in Britain and elsewhere between expert opinion and popular denialism. Still, in promoting the new prophylaxis in an age of global warfare, Jenner could be presented as a humanitarian hero, who saved lives rather than sacrificed them.

This history, then, is a story of humanitarian endeavour. From the outset, cowpox was presented as a boon to mankind, both a providential blessing and fruit of the Enlightenment. It was obvious that just as smallpox was a near universal affliction so there was no reason to doubt that cowpox would be a universal panacea. The moves to make vaccine available more broadly, in terms of geographical range, and more deeply, in terms of social reach, were by no means wholly philanthropic. There were material interests at play in protecting colonial enclaves and plantation economies as well as in projecting images of western superiority and imperial paternalism. Closer to home, the need to propagate a supply of vaccine, the economic benefits of suppressing smallpox and the reputational return on aristocratic and professional philanthropy were important motives for sponsoring vaccination. A harder edge was only revealed when popular prejudice and apathy made it hard to maintain the supply of vaccine on which the practice depended. In general, the enthusiasm with which cowpox was promoted, and the delight in what was seen to be a common good are all too apparent. The idea of vaccination as a humanitarian cause is most evident in the manner that, in a time of war, no advantage was taken to restrict access to information about the practice, and considerable efforts were made to make it available across enemy lines and among peoples of different races and religions. Even in the age of war and imperial rivalry, cowpox found in English dairies and propagated on English children was sent both to Austria, Britain's ally, and France, its mortal foe. From Vienna, vaccine lymph was communicated through intermediaries to Moscow and Bombay, and provided the stock for vaccination in the Russian empire and British India, passing through the

¹² W. W. Francis and L. G. Stevenson, 'Three unpublished letters of Edward Jenner', *JHM*, 10 (1955), 359–68, at 361–3.

¹³ *Circulaires, instructions et autres actes émanés du Ministère de l'intérieur, ou relatifs à ce département de 1797 à 1830 inclusivement*, 2nd ed. (Paris, 1821), 1, p. 309.

bodies of Europeans and non-Europeans, Christians, Moslems, Hindus and animists. From Paris, vaccine was made available in Spain, and three years later a Spanish expedition was launched to carry vaccine, by the successive vaccination of children, across the Atlantic, through South America and across the Pacific. Vaccination discloses connection and trust even in an age of imperial conflict and exploitation. Between 1800 and 1805, millions of the people around the world came together, almost literally, arm-to-arm. For the first time, smallpox's empire was brought within bounds and the means became available, given sufficient resource and application, to eradicate it. In a letter to Jenner in 1806, President Thomas Jefferson assured him that he had 'erased from the calendar of human afflictions one of its greatest'.¹⁴

The study considers the first phase in the history of vaccination, which saw the introduction and the establishment of the practice, the wide acceptance of the potential of the new prophylaxis and millions of people vaccinated. By the last decade of Jenner's life, however, the initial momentum had been lost. The early expansion of the practice had been carried forward with a great deal of enthusiasm and after the first few years it proved hard in many places to make vaccination a routine practice. Some governments provide support and some even sought to make it compulsory. Pockets of anti-vaccination sentiment were often inflamed rather than soothed by medical hectoring or government pressure, especially when the populace had little trust in the elite. By the 1820s, medical men were starting to acknowledge that vaccination did not provide life-time protection and that periodic revaccination might be necessary, making it more difficult to promote. The main problem, then as perhaps now, was not active denial of the value of vaccination but complacency and apathy. The success of vaccination in the first decade of its adoption had played a part in suppressing the disease and, in turn, in making it less feared and less pressing. Lady Nugent may not have been untypical as a parent in moving from fear of smallpox, anxious acceptance of the calculated risk of giving smallpox by inoculation, to expectation of the availability of vaccination and the less serious concern about the vaccination mark. It would be all too easy and all too common for parents to move to the next step and not to assign vaccination any priority at all. Thomas Jefferson's vision of smallpox eradication would be realised only slowly. There were advances, punctuated and then accelerated by smallpox epidemics, through the nineteenth and early twentieth centuries in the western world. It would take a well-funded international campaign to suppress smallpox in its last redoubts in the 1970s, making it possible for the WHO to formally announce the global eradication of smallpox in 1980. 'Future nations will know by history only that the

¹⁴ John Baron, *The life of Edward Jenner*, 2 vols. (London, 1827 and 1838), 2, p. 95.

loathsome smallpox has existed', Jefferson pronounced in 1806.¹⁵ It is to that history that it is now necessary to return.

The Rise of Smallpox

Smallpox (*orthopoxvirus variola*) is known to be an ancient disease. It flourished in the civilisations in the Fertile Crescent and the Indus Valley three thousand years ago. The first historical record of a disease clearly identifiable with smallpox occurs in China in the second century CE. It was neither distinctly described nor named in the Greek or Roman world, but the plague that swept westward from Persia into the Roman empire in 166–172 CE was probably smallpox.¹⁶ In China, clinical descriptions of the disease date back to the fifth century CE. Five centuries later, the Persian physician known as Rhazes offered a description of the disease that remained influential in Europe into the seventeenth century. Over this period smallpox gained in profile throughout the Old World. The growth of population and the locking together of systems of trade and empire from the twelfth century made it possible for smallpox to become endemic in core regions, especially in China, India and the Middle East, and to circulate with increasing frequency through large areas of Asia and Europe. It was carried along the caravan routes across the Sahara and on Arab dhows down the east coast of Africa, eventually gaining hold in the African kingdoms on the savannah grasslands either side of the Equator. In Europe, it was believed that smallpox came from the Arab world at the time of the Crusades. During the later middle ages, it appeared more regularly in the more densely settled regions and became increasingly associated with children. Though a nasty disease, distinguished by fever, pain and, above all, its 'pox', it was probably milder than it later became. In the sixteenth century, the arrival of syphilis in Europe brought a new scourge often described as the 'great pox'. The English term 'smallpox', and its equivalents in other languages, was then applied to the more persistent and troubling of the lesser poxes. By this time, however, the *variola* virus was not only spreading more rapidly, but also acquiring a new virulence.

Smallpox arrived in the New World not long after Columbus, proving a potent ally of the Spanish conquistadors in the conquest of the Aztec empire. Scholars have generally assumed high rates of infection and mortality in 'virgin-soil populations' in Mesoamerica and South America.¹⁷ The size of the original population of Mexico, the scale of the demographic collapse and the role of smallpox in the devastation, however, are matters of some debate.

¹⁵ Baron, *Life*, 2, p. 95. ¹⁶ Vivian Nutton, *Ancient medicine* (Abingdon, 2004), p. 24.

¹⁷ E.g. Alfred W. Crosby, *Ecological imperialism. The biological expansion of Europe, 900–1900* (Cambridge, 1993), pp. 200–1.

Early Spanish sources may have given undue emphasis to smallpox because of the visibility of the disease, and because the high susceptibility of the indigenous people could be presented as a providential mandate for European rule.¹⁸ It has been rightly observed that smallpox was ‘not a cloud of infection that descends from on high’ and did not move ‘with seven-league boots’.¹⁹ Still, even if less cataclysmic than has often been assumed, the epidemic in Mexico in the 1520s almost certainly involved higher mortality rates than in Europe.²⁰ Furthermore, it spread widely, though largely dependent on colonial commerce and penetration. In the mid-1520s it ravaged Peru, de-stabilising the Inca empire and making it more vulnerable to Spanish adventurism.²¹ There is little evidence of its spread northwards beyond central Mexico before the eighteenth century.²² Epidemic smallpox reappeared several times in Mesoamerica and South America in the sixteenth century. ‘They died by scores and hundreds’, a colonist reported of an epidemic in Peru in 1585, ‘Villages were depopulated. Corpses were scattered over the fields or piled up in the houses or huts’.²³ Over the course of the seventeenth century, it appeared more regularly and spread more widely, though with the colonial activity still providing the crucial links in the chain of infection. In the early decades of the eighteenth century, its lethal impact is well documented in the Jesuit missions in Paraguay, where there was a severe epidemic in 1738–40.²⁴ The importation of African slaves increased the opportunities for disease transmission. Brazil was especially exposed to infection brought on slave ships from west Africa.²⁵

By 1600, *variola* virus was entrenched in the heartlands of Asia and Europe. It was long endemic in the cities and flood plains of China, where it became largely a childhood illness. The peoples beyond the Great Wall, who were still highly susceptible to smallpox, lived in fear of the contagion, describing China as ‘a house on fire’.²⁶ In their campaigns in Ming China in the early

¹⁸ Francis J. Brooks, ‘Revising the conquest of Mexico: smallpox, sources and populations’, *Journal of Interdisciplinary History*, 24 (1993), 1–29.

¹⁹ Brooks, ‘Revising the conquest’, 12; Paul Kelton, *Cherokee medicine, colonial germs: An indigenous nation's fight against smallpox, 1518–1824* (Norman, OK, 2015), pp. 21–2.

²⁰ Robert McCaa, ‘Spanish and Nahuatl views on smallpox and demographic collapse in Mexico’, *Journal of Interdisciplinary History*, 25 (1995), 397–431; Mark Harrison, *Disease in the modern world: 1500 to the present day* (Cambridge, 2004), pp. 74–5.

²¹ Hopkins, *Greatest killer*, pp. 208–12. ²² Kelton, *Cherokee medicine*, p. 25.

²³ Hopkins, *Greatest killer*, p. 213.

²⁴ Robert H. Jackson, *Missions and the frontiers of Spanish America: a comparative study of the impact of environmental, economic, political, and socio-cultural variations on the missions in the Rio de Plata region and on the northern frontier of New Spain* (Scottsdale, AZ, 2005), pp. 337–8.

²⁵ Dauril Alden and Joseph C. Miller, ‘Out of Africa: the slave trade and the transmission of smallpox to Brazil, 1560–1831’, *Journal of Interdisciplinary History*, 18 (1987), 195–224.

²⁶ Hopkins, *Greatest killer*, p. 119.

seventeenth century, the Manchus saw the disease as a more formidable obstacle than fortifications and armies.²⁷ Crossing to Japan as early as the sixth century, smallpox became endemic in major population centres from the fourteenth century. The Dutch observed its heavy toll of children in Nagasaki in the 1640s. Even in the mountainous provinces of Honshu, where it reappeared every three or four years, it was becoming a disease of childhood.²⁸ In the seventeenth century, there were serious smallpox epidemics in the Philippines and the Indonesian archipelago.²⁹ On the western edge of the Eurasian landmass, smallpox was also appearing more often and with greater severity. It was becoming endemic in London, roaming the English countryside, and making forays into remote parts of the British Isles. After the Great Plague of London in 1665, smallpox displaced bubonic plague as the most feared scourge. Around this time, the author of *Medela Medicinæ* claimed that smallpox had been quite mild until about forty years earlier.³⁰ From the mid-seventeenth century, other European countries experienced epidemics of increasing virulence. An outbreak in 1736 is regarded as the first very severe epidemic in Sweden.³¹ The eighteenth century in Europe began and was to end in the shadow of smallpox.

Smallpox was also becoming fully global. In 1733, a student returning from Denmark unwittingly carried the virus across the north Atlantic to Greenland. The consequences were cataclysmic. In one settlement missionaries found no survivors other than a small girl and her infant brothers. After burying his neighbours, their father 'had laid himself and his youngest child in a grave of stones, bidding the girl to cover him with skins' and to share the remaining food with her brothers until help arrived.³² The expansion of the Russian empire east of the Urals facilitated the spread of smallpox from central Asia to the nomadic peoples of Siberia and across the Bering Strait to Alaska. In the late 1770s, smallpox was carried westwards from the British colonies and northwards from Mexico into the interior of North America, along the Mississippi-Missouri river system and across the Prairies. In the early 1780s the Hudson's Bay Company began to receive reports of the dreadful mortality spreading northward. In visiting Nootka Sound in 1792, George Vancouver

²⁷ Jiafeng Zhang, 'Disease and its impact on politics, diplomacy, and military: the case of smallpox and the Manchus (1613–1795)', *JHM*, 57 (2002), 177–97.

²⁸ Jannetta, *Vaccinators*, p. 19.

²⁹ Hopkins, *Greatest killer*, pp. 112–13; Peter Boomgaard, 'Smallpox, vaccination, and the *Pax Neerlandica*, Indonesia, 1530–1930', *Bijdragen tot de Taal- en Volkenkunde*, 159 (2003), 590–617, esp. 591–5.

³⁰ R. A. Anselment, *The realms of Apollo. Literature and healing in seventeenth-century England* (Newark, NJ, 1995), p. 174.

³¹ Peter Sköld, *The two faces of smallpox. A disease and its prevention in eighteenth- and nineteenth-century Sweden* (Umeå, 1996), p. 61.

³² Hopkins, *Greatest killer*, p. 52.

observed evidence of recent depopulation.³³ In the eighteenth century, smallpox was likewise extending its range in the southern hemisphere. Its spread through South America, especially through Brazil, was assisted by the importation of African slaves.³⁴ By the 1760s it was causing havoc as far south as Santiago in Chile. During this time, too, smallpox completed its conquest of Africa. The slave-trade brought it from the interior to Angola in the late seventeenth century.³⁵ European trade with Asia was responsible for the first outbreak at the Cape of Good Hope in 1713. Spanish and Dutch commerce and colonisation quickened and broadened the circulation of smallpox in the Philippines and the Indonesian archipelago. In the early 1780s, fishermen from Sulawesi may have brought *variola* to the northern coast of Australia. In 1789, a smallpox epidemic decimated the Aboriginal people living around the British colony at Sydney Cove.³⁶

The Experience of Smallpox: Fear and Fatalism

The *variola* virus generally entered the body through the mouth or nose. For around twelve days the virus multiplied, nesting in the lymph nodes and then spilling out into the bloodstream. It was only then that the carrier of smallpox felt unwell and became infectious. After a few days of high fever, sickness and lassitude, a rash appeared, usually on the face and the body's extremities. The rash developed into pustules which emitted a sickening smell as they suppurated (see Figure 1.1).³⁷ They frequently formed in the mouth and throat, making eating and drinking painful, sometimes impossible, occasioning a choking death. In more serious cases the pustules were so numerous as to run together, that is they became 'confluent'. After a week, they started to dry and form scabs. For two weeks from the first fever to the loss of the last scab, the patient was highly infective, spreading millions of infective particles from the pustules on his skin and sores in his throat into the immediate environment. In the 1780s, Dr Haygarth wrote in terms of particles of 'variolous poison' forming a miasma around the patient. He presented evidence that the chance of a susceptible person in close contact with a smallpox case becoming infected was rather less than was often imagined, not much

³³ Elizabeth A. Fenn, *Pox Americana. The great smallpox epidemic of 1775–82* (New York, 2001), pp. 227–31.

³⁴ Hopkins, *Greatest killer*, p. 179.

³⁵ P. Verger, *Trade relations between the Bight of Benin and Bahia from the seventeenth to the nineteenth century* (Ibadan, 1976), p. 577.

³⁶ Michael Bennett, 'Smallpox and cowpox under the Southern Cross: the smallpox epidemic of 1789 and the advent of vaccination in colonial Australia', *BHM*, 83 (2009), 37–62, at 43–50.

³⁷ J. R. Smith, *The speckled monster. Smallpox in England, 1670–1970, with particular reference to Essex* (Chelmsford, 1987), p. 15.



Figure 1.1 Variola (Smallpox). Plaster cast (Universitäts-Hautklinik Münster)

more than fifty-fifty. The *variola* virus, however, could also survive in fomites – for example, clothing and blankets – and sometimes – though Haygarth believed only rarely – spark an outbreak at some distance in time and space from a live case.³⁸

Few people in eighteenth-century Europe and Asia escaped smallpox. The fatality rate was variable, generally ranging between one in ten and one in five. If smallpox became ‘confluent’, the prognosis was bleak. Survivors would often be badly scarred and a few left blind or with their health otherwise seriously impaired. In addition to its impact on mortality, smallpox had a deleterious impact on life-chances, including marriage prospects.³⁹ It was dreadful to witness a loved one, especially a child, with the disease. Dr Eberhard Munch af Rosenschöld, a pioneer of vaccination in Sweden, observed that the suffering in a severe case had to be witnessed to be fully appreciated. ‘The face is terribly swollen and disfigured’, he observed, ‘the eyes are deprived of the light; the nose the air; the infected rattling throat thirsts after water and cannot swallow it’; the lungs exhale a rotten stench; the orifices of the body discharge noxious matter; the whole body is an abscess that cannot

³⁸ John Haygarth, *An inquiry how to prevent the small-pox and proceedings of a society for promoting general inoculation at stated periods* (Chester, 1784), pp. 18–31, 67–86.

³⁹ Peter Sköld, ‘The beauty and the beast – smallpox and marriage in eighteenth and nineteenth-century Sweden’, *Historical Social Research*, 28 (2003), 141–61.

be touched. A brown scab forms over the body and face, he continued, and it is no longer possible to discern humanity in the monstrous form. The patient's loved ones can do no more than pray for the suffering to end, and sometimes the patient survives, sadly deprived of all that Nature provides for the enjoyment of life.⁴⁰

The nature of smallpox was poorly understood. According to the classical paradigm associated with Galen (130–210), it arose from an imbalance of humours. In the tenth century, Rhazes explained it as the product of the blood's inherent tendency to ferment and expel waste matter through the pores of the skin.⁴¹ According to this theory, smallpox was innate and ineluctable, with the severity of the disease varying according to the individual's state of health and circumstances. Major outbreaks of smallpox were explained not by contagion but by an 'epidemic constitution' in the environment. The Renaissance saw a re-engagement with the classical tradition but also some criticism of Galen. The arrival of plague and syphilis in Europe provided new challenges, practical and theoretical, and prompted new thinking about epidemic disease. Girolamo Fracastoro (1478–1553) attempted to bring analytical rigour to understandings of contagion. Associating specific diseases with specific seeds, he proposed three modes of infection, namely from person to person, through fomites and through the air, which served as a medium for 'disease-specific *seminaria*'.⁴² Still, many physicians prior to the late eighteenth century regarded smallpox as innate. Even the iconoclastic Dr Thomas Sydenham (1624–89) allowed contact with a prior case of smallpox only a precipitating role in the disease. This thinking survived the early introduction of inoculation: the procedure was initially explained as a means of provoking the body to purge itself of the poison of smallpox. Awareness that there were peoples in the world who had no or only recent experience of smallpox, however, made it hard to sustain the notion that the disease was innate. Growing experience with inoculation likewise sharpened the focus on infection and the idea of a specific disease agent. Cotton Mather, who championed inoculation in Boston in the 1720s, imaginatively presented the seeds of the 'variolous miasma' as an invading army. Given the limited power of microscopes, of course, there could be no more than the haziest intimations of microbial pathogens until the late nineteenth century. It was not until the 1930s that the *variola* virus and *vaccinia* virus were seen under a microscope and not until several more decades more that progress began to be made towards an understanding of the immune system.⁴³

⁴⁰ Sköld, *Two faces*, p. 77. ⁴¹ Hopkins, *Greatest killer*, p. 9.

⁴² Vivian Nutton, 'The seeds of disease: an explanation of contagion and infection from the Greeks to the Renaissance', *MH*, 27 (1983), 1–34, esp. 28–30.

⁴³ Glynn and Glynn, *Rise and fall*, ch. 13.

There was no cure for smallpox. All that could be done was to ease the patient's path through the disease. On Galenic principles, Rhazes recommended purging through the application of 'heat'. Common to both Asian and European medical cultures, this therapy remained remarkably resilient, persisting into modern times. Physicians were not called in for smallpox cases and some confessed their lack of experience in managing it. 'It is no slight reflection the world makes', Dr Gideon Harvey wrote in 1696, 'that motherly women, nurses and midwives, by their petty inspection of diseases of their family and of those whom they neighbourly go to visit' gain more knowledge of smallpox than 'a whole herd of doctors'.⁴⁴ Dr Sydenham was unusual in taking time to observe smallpox patients and experiment with new therapies.⁴⁵ His advocacy of a cool regimen proved controversial and only gradually won acceptance. The fierceness of the debate was stoked by the professional stress of dealing with smallpox in elite families. In Britain, the house of Stuart was largely destroyed by smallpox, with two of Charles I's children felled by the disease and his granddaughter, Mary II, falling victim to a rare and horrific case of haemorrhagic smallpox in 1694. Smallpox took a heavy toll on all of Europe's ruling families. Among the Bourbons, Louis XIV lost his eldest son to smallpox in 1711 and several of his great-grandchildren, including Luis I of Spain and Louis XV of France, died of the disease. Especially significant was the death of the Habsburg Emperor Joseph I from smallpox in 1711. This changed the course of the War of the Spanish Succession and set the stage for the extinction of the house of Habsburg in the male line.⁴⁶

If medical theory played down contagion, common sense did not. Among nomadic peoples, the response to smallpox was often flight, sometimes leaving infected family members to look after themselves. The phenomenon was observed in a range of contexts, including among the Khoikhoi in Cape Colony in 1713 and, by the botanist Carl Linnaeus, among the Saami of northern Sweden.⁴⁷ In the more settled parts of Europe and Asia, responses were more varied. For people living in more populous districts, engaged in agriculture or manufacturing, flight was not an option. The best hope was to keep smallpox out. Rural communities might escape smallpox for long periods, but then suffer an epidemic with high levels of mortality in all age groups. In cities and large towns, where smallpox was endemic, poorer families had little real prospect of shielding their children from contagion

⁴⁴ Gideon Harvey, *A treatise of the small-pox and measles: describing their nature, causes, and signs, diagnostick and prognostick, in a different way to what hath hitherto been known* (London, 1696), pp. 1–2.

⁴⁵ Hopkins, *Greatest killer*, p. 33. ⁴⁶ Hopkins, *Greatest killer*, pp. 43–4.

⁴⁷ George McCall Theal, *History of South Africa 1691–1795* (London, 1888), p. 59; Sköld, *Two faces*, p. 190.

and, in an environment of high infant mortality, banked on early exposure delivering lifelong immunity. According to Dr Haygarth, country-dwellers were more anxious about smallpox than townsmen, many of whom had some immunity.⁴⁸ Most people in the early modern world accepted smallpox with a degree of fatalism but believed that it was best to get it over as a child. As an English observer wrote, smallpox 'is found to be safer [in childhood] than in riper years'.⁴⁹ Perversely, the more successful parents were in shielding a child, the greater the risk of a severe case in later life, a point that helps to explain the many high-profile deaths. For poorer folk, the death of an older child, on the verge of contributing to the family income, added economic loss to the emotional pain. Peasants in Livonia had a saying that 'It is better for a child to die when it ought to die rather than first eating a lot of bread and then dying'.⁵⁰

Few people in eighteenth-century Europe could wholly avoid smallpox. The Genevan physician Jean-Antoine Butini claimed in the 1750s that less than five per cent of adults died without having had smallpox.⁵¹ The scourge hung like the sword of Damocles over all who escaped it as children. On recovering from smallpox in 1716, the thirteen-year-old Duke of Chartres, son of Philippe of Orleans, Regent of France, was overjoyed at having put it behind him.⁵² It was a custom for French aristocratic women to go into seclusion with husbands who fell ill with smallpox. In 1716, the young Duchess d'Olonne accepted her fate stoically, informing her relatives: 'I shall surely take smallpox and die of it; but one must do one's duty'.⁵³ Physicians sometimes expressed concern that people were too reckless in visiting the sickrooms of loved ones and friends. Fear of contagion, on the other hand, was socially inhibiting. In 1724, a clergyman refused a desirable position in London because he had not had smallpox, only to die of shock when his son, who had accepted the post, took the disease fatally.⁵⁴ Belief that smallpox was innate led some people to believe that their own anxiety would provoke the disease.⁵⁵ After her mother's smallpox death, Isabella of Parma had premonitions that she would share her fate. She indeed died of smallpox in 1763, shortly after her marriage to the future Emperor Joseph II. Given the smallpox toll in the house of Austria in the

⁴⁸ John Haygarth, *A sketch of a plan to exterminate the casual smallpox*, 2 vols. (London, 1793), 1, p. 186.

⁴⁹ *GM*, 7 (1737), p. 561.

⁵⁰ Erich Donnert, *Johann Georg Eisen (1717–1779). Ein Vorkämpfer der Bauernbefreiung in Rußland* (Leipzig, 1978), pp. 120–1.

⁵¹ Léon Gautier, *La médecine à Genève jusqu'à la fin du dix-huitième siècle* (Geneva, 2001), p. 387.

⁵² *Journal du marquis de Dangeau*, vol. 16, ed. E. Soulié and L. Dussieux (Paris, 1839), p. 457.

⁵³ *Journal du marquis de Dangeau*, 16, p. 475. ⁵⁴ *Weekly Journal*, 17 April 1725.

⁵⁵ David E. Shuttleton, *Smallpox and the literary imagination 1660–1820* (Cambridge, 2007), pp. 28–31.

1760s, a level of anxiety about the disease would seem wholly appropriate. For Count Kaunitz, Austria's chief minister, however, the phobia was pathological. After witnessing the Empress Maria Theresa's suffering in 1767, he wrote that he was 'so keenly affected by the thought of this illness that since then I have not been able to hear its name without shuddering, to the point that I am at once seized with shortness of breath and a general trembling which give me considerable pain'. He issued a circular ordering his staff never to speak of the malady in his presence.⁵⁶

Belief that smallpox was inevitable or nearly so encouraged parents to consider exposing their children to the disease at an opportune time. Allowing a child's contact with a sibling who was ill with smallpox was not unknown in seventeenth-century England. Dr Sydenham made a point of exposing children of relatives and friends to mild cases of the disease.⁵⁷ In 1695 Anne Finch, Countess of Nottingham, encouraged her daughter to visit and kiss her infected brother.⁵⁸ This sort of arrangement is also recorded in Holland, Germany and France in the 1760s.⁵⁹ In addition, there were some traditional practices, quasi-magical, that involved the transference of smallpox, usually through scabs, from one person to another in the hope of a milder case. In 1673 Thomas Bartholin, a Danish physician, wrote that he knew 'more than a few people who have bought smallpox for themselves'.⁶⁰ The growing profile of inoculation elicited reports of similar customs across Europe.⁶¹ According to Dr Perrot Williams, it was an 'immemorial custom' in southwest Wales for parents to procure smallpox scabs, in return for a coin or token, to press into the hands of their children.⁶² Unknown to most medical men, 'buying the smallpox' may have been a practice surviving from a time when the disease was less severe. In eighteenth-century Europe, it does not appear to have been practised on any scale.

⁵⁶ Derek Edward Dawson Beales, *Joseph II: in the shadow of Maria Theresa, 1741–1780* (Cambridge, 1987), p. 142.

⁵⁷ Richard Blackmore, *A treatise upon the small-pox* (London, 1723), pp. 110–11.

⁵⁸ *Correspondence of the family of Hatton, being chiefly letters to Christopher Hatton*, 2 vols., ed. E. Maunde Thompson (London, 1878), 2, pp. 211–12.

⁵⁹ Augustin Roux, *Mémoire sur l'inoculation de la petite verole . . .* (Amsterdam, 1765), p. 9; Willibrord Rutten, 'In de schaduw van de pest: Reacties op pokkenepidemieën in de Republiek in de zeventiende en achttiende eeuw', in W. de Blécourt, W. Frijhoff and M. Gijswijt-Hofstra (eds.), *Grenzen van genezing: Gezondheid, ziekte en genezen in Nederland zestiende tot begin twintigste eeuw* (Hilversum, 1993), pp. 172–202, at 190.

⁶⁰ Geneviève Miller, *The adoption of inoculation for smallpox in England and France* (Philadelphia, 1957), p. 43.

⁶¹ E.g. Pierre Louis Gandoget de Foigny, *Traité-pratique de l'inoculation* (Nancy, 1768), p. 29; Sköld, *Two faces*, p. 230.

⁶² *The correspondence of James Jurin (1684–1750)*, ed. Andrea Rusnock (Amsterdam, 1996), pp. 129–31.

Exotic Practices and Western Borrowings

In Asia, there were more sophisticated forms of smallpox prophylaxis whose origins are likewise lost in the mists of time. The peoples of central Asia may have pioneered the prophylactic practices that subsequently spread eastwards, southwards and westwards. By the eighteenth century, there were robust traditions of inoculation in China, northern India and parts of the Middle East. In China, the practice of insufflation is first described in medical texts in the sixteenth century.⁶³ Described in poetic language as ‘planting the heavenly flowers’, this mode of communicating smallpox involved blowing processed smallpox dust through a pipe into the nostril of the patient. The Manchu warlords who conquered China quickly adopted the practice. Prior to his death from smallpox in 1654, the first Emperor of the Xing dynasty barred from the succession anyone still susceptible to smallpox. His successor Xangsi (K’ang Hsi), a smallpox survivor, promoted insufflation in and around the imperial capital.⁶⁴ ‘Although it is an act seemingly going against nature’, a Chinese scholar wrote in 1727, ‘it has great merits for the people in the world’.⁶⁵ It is hard to be sure how extensively and routinely it was used in China. According to a contemporary Chinese text, the procedure was not practised in Beijing in the late eighteenth century.⁶⁶ In India, smallpox inoculation first gained profile in the seventeenth century. In the hands of specialists and somewhat ritualised, it involved a puncture on the arm or forehead and the insertion of smallpox matter in a manner not unlike that observed in Istanbul.⁶⁷

Around 1700, Europeans became active in collecting knowledge from all corners of the globe, especially the *materia medica* of Asia.⁶⁸ The increasing severity of smallpox encouraged interest in exotic forms of prophylaxis. Peter the Great of Russia reportedly sent medical men to China to learn about insufflation.⁶⁹ Two reports of the Chinese practice reached the Royal Society in England early in 1700.⁷⁰ There was curiosity in London, too, about inoculation in the Ottoman empire. Emanuele Timoni, a native of Chios and

⁶³ Hopkins, *Greatest killer*, pp. 109–10; Joseph Needham, *Science and civilisation in China*, vol. 6: part 6, ed. Nathan Sivin (Cambridge, 2000), pp. 134–40 and 169–74.

⁶⁴ Zhang, ‘Disease’, 181–2. ⁶⁵ Needham, *Science in China*, 6: 6, pp. 137–8.

⁶⁶ Chang, Chia-Feng, ‘Aspects of smallpox in Chinese history’, Unpublished PhD thesis, University of London, 1996, p. 142.

⁶⁷ Ralph W. Nicholas, *Fruits of worship: practical religion in Bengal* (New Delhi, 2003), pp. 175–6.

⁶⁸ Hal Cook, *Matters of exchange. Commerce, medicine, and science in the Dutch Golden Age* (New Haven, 2007).

⁶⁹ Needham, *Science in China*, 6: 6, p. 149. The evidence for the dating is a little suspect: Renate Burgess, ‘Thomas Garvine – Ayrshire surgeon active in Russia and China’, *MH*, 19 (1975), 91–4.

⁷⁰ Miller, *Adoption*, pp. 48–9.

graduate of Padua, was asked about the procedure on a visit to London in 1703. Encouraged by Dr Skraggenstierna, physician of Charles XII of Sweden, he wrote a brief account of *variolarum insitio* ('grafting smallpox') that was subsequently published in the *Ephemerides* of the Leopoldine Academy in 1715. He also sent a copy to Dr Woodward, secretary of the Royal Society in London, that was translated into English for publication in the *Transactions*.⁷¹ According to Timoni, inoculation originated in Circassia and Georgia, was introduced in Istanbul about forty years earlier, and had been used to treat thousands of people without mishap in the previous eight years. He describes the procedure as involving a slight incision with a needle or lancet on the arm or leg, the insertion of smallpox matter taken from a healthy child, and bandaging the incision for several hours.⁷² Dr Woodward sought further information from the British consul in Smyrna, who in turn encouraged Dr Jacob Pylarini, who had been taught by a Greek woman and assisted in an inoculation in 1701, to write his own report. Published in Venice in 1715 and translated for the *Transactions* in 1716, Pylarini describes the inoculator as scratching the skin and then applying lymph on the forehead, cheeks and chin. This mode, sketching out a cross, presumably reflects Christian usage. In a dissertation on inoculation in 1722, Antoine Le Duc, a native of Istanbul, adds the detail that the Greek woman who inoculated him, along with 3,000 others, requested the payment of wax candles as an offering to the Virgin Mary.⁷³

By this time a few children from western Europe had been inoculated. Among the first Britons were two sons of Mr Hefferman, secretary of Sir Robert Sutton, the British ambassador to the Ottoman empire, who were inoculated before their return home in March 1716 and were made available for inspection by medical men in London.⁷⁴ Lady Mary Wortley Montagu, whose husband succeeded Sutton in the post, was presumably aware of the occurrence. One of the brightest women at the Hanoverian court, she had good reason to be interested in prophylaxis. After losing her brother to the disease in 1713, she declined to lease a house in London that had stood empty after a lady and her child died there from smallpox. 'I know tis two or three years ago', she wrote, 'but tis generally said, that infection may lodge in blankets etc. longer than that'.⁷⁵ She was seriously ill with smallpox in 1715 and was badly scarred. In a poem about her trauma, she described how she became 'A frightful spectre to myself unknown!'⁷⁶ Travelling with her husband and

⁷¹ Miller, *Adoption*, pp. 55–9.

⁷² Emanuel Timoni, 'An account, or history, of the procuring the small pox by incision, or inoculation; as it has for some time been practiced at Constantinople', *PTRS*, 29 (1714), 72–84.

⁷³ Miller, *Adoption*, pp. 59–63. ⁷⁴ Miller, *Adoption*, p. 51.

⁷⁵ Isobel Grundy, *Mary Wortley Montagu* (Oxford, 1999), p. 80.

⁷⁶ Grundy, *Montagu*, pp. 100–2; Smith, *Speckled monster*, p. 19.

son to Istanbul in 1717, she observed the practice of smallpox inoculation and declared her intent to bring it 'into fashion' in England.⁷⁷ In spring 1718, she took the bold step of having her only son inoculated by an old Greek woman, with Charles Maitland, her surgeon, in attendance.⁷⁸ Back in London, she awaited an opportunity to have her daughter inoculated. In April 1721, with smallpox spreading 'like a destroying angel', she asked Maitland to undertake the procedure.⁷⁹ She readily agreed that two physicians should be called to attend the child and 'be eye-witnesses of the practice, and contribute to the credit and reputation of it'.⁸⁰ Though the first inoculation in Britain was not reported in the newspapers, news of the success of the procedure spread rapidly among the chattering classes.

In a remarkable conjuncture, smallpox inoculation was introduced in another part of the English-speaking world at this very time. British slave-traders, who had reason to be attentive to pockmarks on slaves, presumably noted the scarification marks on some of them, and may have pondered their significance. In Boston, Massachusetts, Dr Cotton Mather, a Fellow of the Royal Society, learned about the African practice of smallpox prophylaxis from an African slave or servant named Onesimus. Asked whether he had ever had smallpox, Onesimus replied that he had 'undergone an operation that gave him something of the smallpox' and showed the marks on his arm. After making enquiries of merchants and other Africans in Boston, Mather learned more about smallpox prophylaxis in Africa and was confident that it provided security against subsequent infection. After reading Timoni's account in the *Transactions*, he reported his findings to Dr Woodward in London and declared his intent to make a trial of the practice when smallpox next broke out in Boston, adding that if we could 'hear that you have done it before us, how much would that embolden us!'⁸¹ A serious smallpox epidemic in May 1721 provided the incentive for Zabdiel Boylston, Mather's surgical colleague, to make a trial of inoculation, beginning with his own children. The bold initiative outraged many people. Dr William Douglass argued that the practice was unsafe and was fuelling the infection. Over summer, Boylston inoculated fifty-eight people, seemingly with success, but then one of his patients died. The arrival of a report of the success of a formal trial of inoculation in London did little to settle minds.⁸² The controversy continued to rage in Boston, and indeed fed popular anxieties about the practice in Britain. In 1722, Boylston's detailed account of his inoculation activity in Boston, in which he cogently

⁷⁷ Miller, *Adoption*, p. 69. ⁷⁸ Grundy, *Montagu*, p. 162. ⁷⁹ Grundy, *Montagu*, p. 209.

⁸⁰ Miller, *Adoption*, p. 72.

⁸¹ *Selected letters of Cotton Mather*, ed. Kenneth Silverman (Baton Rouge, LA, 1971), pp. 213–14.

⁸² Arthur W. Boylston, *Defying providence. Smallpox and the forgotten eighteenth-century medical revolution* (North Charleston, 2012), pp. 53–7.

argued for its utility, proved an important foundation for the practice on both sides of the Atlantic.

In Britain, the inoculation of Lady Wortley Montagu's daughter encouraged the Royal Society to seek opportunities for experimentation. Caroline, Princess of Wales, proved a persuasive advocate. At her request, George I granted a pardon to six condemned felons conditional on their submitting to inoculation in a trial supervised by the Royal Society.⁸³ In August 1721, Maitland successfully inoculated three male and three female convicts at Newgate.⁸⁴ In the meantime, Dr Richard Mead made a trial of insufflation, the distinctive mode of prophylaxis in China, finding that the inhalation of smallpox dust occasioned a more severe response than inoculating smallpox on the arm.⁸⁵ Eager to see more trials prior to the inoculation of her own children, Princess Caroline offered to pay for the inoculation of poor children in Westminster. In spring 1722, royal physicians inoculated five orphans and exhibited them to the public and, in a further experiment, a child was inoculated with lymph from one of the inoculated children.⁸⁶ After George I indicated his willingness to leave the decision to his son and daughter-in-law, the stage was set for the inoculation of his grandchildren. In April 1722, Princesses Amelia and Caroline passed safely through the procedure.⁸⁷ Despite the recent death of the Earl of Sunderland's son following inoculation, many elite families were encouraged by the royal family's example to adopt the practice.

Elite endorsement by no means allayed ethical and medical concerns. Although leading churchmen took the line that it was not a sin to accept a surgical procedure that could save their children's lives, the Reverend Edmund Massey, an influential preacher, condemned it as an impious affront to Providence.⁸⁸ Dr William Wagstaffe broke ranks with his medical colleagues in the Royal Society to express bewilderment that 'an experiment practised only by a few ignorant women, amongst an illiterate and unthinking people, should of a sudden . . . so far obtain in one of the politest nations in the world, as to be received into the royal palace'.⁸⁹ Drawn into the controversy, Lady Montagu championed the practice in a letter written under the guise of a 'Turkey Merchant', but castigated 'the knavery and ignorance' of doctors for making a deep incision with a lancet rather than pricking the skin with a needle, and

⁸³ Grundy, *Montagu*, pp. 211–12. ⁸⁴ Miller, *Adoption*, pp. 84–5.

⁸⁵ Miller, *Adoption*, p. 86.

⁸⁶ Geneviève Miller, 'Smallpox inoculation in England and America: a reappraisal', *The William and Mary quarterly*, third series, 13 (1956), 476–92, at 478–81.

⁸⁷ Miller, *Adoption*, pp. 96–7.

⁸⁸ Miller, *Adoption*, pp. 130–1; John Wilmot, *The life of John Hough, successively bishop of Oxford, Lichfield and Coventry, and Worcester* (London, 1812), p. 321.

⁸⁹ Grundy, *Montagu*, p. 216.

imposing on the patient an expensive regimen of preparation and aftercare.⁹⁰ The critical issue was the risk involved in a procedure that was tantamount to fighting fire with fire. The promoters of inoculation argued that, if one's house were on fire, a sensible person would take the risk of jumping from the window. Francis Howgrave, an apothecary and critic of inoculation, conceded the point, but asked, 'Did ever any man leap out of a window at Charing Cross for fear of a fire at Temple Bar?' In any case, he continued, 'smallpox is the fire you are to avoid, and [inoculation] is leaping out of the frying pan into the fire'.⁹¹ Steadily, this aspect of the debate moved from rhetoric and trading anecdotes to attempts at statistical analysis. In 1722, Thomas Nettleton of Halifax acknowledged that one of the sixty-one patients he had inoculated had died, but observed that the mortality rate among people who caught the disease naturally was one in five. For him, it was a matter of applying merchant's logic: 'state the account of profit and loss to find on which side the balance lies . . . and form a judgement accordingly'.⁹² James Jurin, secretary of the Royal Society, began to collect data on smallpox and smallpox inoculation from across England and calculated that one in seven or eight cases of natural smallpox proved fatal but only one in ninety-one people inoculated died.⁹³ It was countered that the people who were inoculated were more generally people in otherwise good health, and that some might have avoided smallpox entirely. There was also the danger that smallpox inoculation posed for the broader community. Many Bostonians and many Londoners believed that the practice increased the number of smallpox cases, added to the contagion and increased the overall mortality.

Britain's experiment with inoculation was followed with interest in continental Europe. Dr Johann Eller, who claimed to have acquired the technique from a Greek friend and inoculated a child in Paris in 1719, made a demonstration of the practice, at the request of the Prince of Anhalt-Bernberg, in Bernberg in 1721.⁹⁴ The dynastic connection between Britain and Hanover increased the profile of inoculation in northwest Germany. Dr Johann Georg Steigherthal, George I's physician, was involved in the trial at Newgate, and Dr Matthias Boretius, a German visitor to London in 1721, witnessed the trial and published an account of it.⁹⁵ In early 1723,

⁹⁰ Diana Barnes, 'The public life of a woman of wit and quality: Lady Mary Wortley Montagu and the vogue for smallpox inoculation', *Feminist Studies*, 38 (2012), 330–62, at 351–2.

⁹¹ Francis Howgrave, *Reasons against the inoculation of the small-pox* (London, 1724), pp. 43–4.

⁹² Andrea Rusnock, "'The merchant's logick': numerical debates over smallpox in eighteenth-century England," in E. Magnello and A. Hardy (eds.), *The road to medical statistics* (Amsterdam, 2002), pp. 37–54, at p. 38.

⁹³ Andrea Rusnock, *Vital accounts. Quantifying health and population in eighteenth-century England and France* (Cambridge, 2002), pp. 53–4.

⁹⁴ Miller, *Adoption*, pp. 67–8. ⁹⁵ Miller, *Adoption*, pp. 81, 84–5.

J. E. Wreden began inoculating in the electorate of Hanover, setting the scene for the inoculation there of the eldest son of the Prince of Wales in 1724.⁹⁶ The early inoculations in Germany, with less than optimal outcomes, failed to overcome the hesitancy and prejudice that was nourished by some adverse reports from Britain. Initially, France looked a promising field for the new prophylaxis. Philippe of Orleans, Regent of France, showed interest in sponsoring a trial. The royal physician prepared the ground and Dr Jean Delacoste, a Huguenot exile in England, returned to France eager to introduce the practice. In autumn 1723, a murderous smallpox epidemic in Paris helped the cause for a time. Reports of the controversy in Britain and America, however, stiffened the opposition of the old guard in the Faculty of Medicine, and the death of Philippe of Orleans in December deprived the practice of a potential patron.⁹⁷ For a time it looked as if the duchy of Lorraine might embrace prophylaxis. Duke Leopold and his wife, a sister of Philippe of Orleans, lost three children to smallpox in 1711, and then his eldest son in 1721. Although he was in correspondence with Lady Montagu and commissioned a French translation of Timoni in 1725, he seemingly made no move to introduce the practice.⁹⁸

By the late 1720s inoculation was losing ground in Britain. Some aristocratic and professional families continued to have their children inoculated but there was little or no extension of the practice. In the 1730s, it was even neglected in the British royal family. The future George III, born in 1738, caught the disease accidentally when he was five years old.⁹⁹ Geneviève Miller has argued that the notion that inoculation lapsed between 1728 and 1740 was a ‘historical myth’ promoted by Dr James Kirkpatrick, who wished to associate the practice’s revival in Britain with his success with the procedure in South Carolina in the late 1730s and his championship of it on his return.¹⁰⁰ He was by no means, though, the only or earliest witness to a decline of interest from the late 1720s. Dr John Andrew, who practised inoculation on a small scale in the provinces in the 1730s, observed that the practice ‘was in decline in London’.¹⁰¹ Asked about inoculation early in 1738, Bishop Hough of Worcester replied that ‘the method loses ground, even in this country’.¹⁰² In claiming that the practice remained in good repute, Miller refers to three

⁹⁶ Miller, *Adoption*, pp. 177–8. ⁹⁷ Miller, *Adoption*, pp. 180–92.

⁹⁸ Pierre-Joseph Buc’hoz, *Lettres périodiques curieuses, utiles et interessantes: Sur les avantages que la société économique peut retirer de la connoissance des animaux, pour servir de suite aux lettres sur les végétaux*, vol. 2 (Paris, 1769), p. 13.

⁹⁹ *The letters of Horace Walpole, Earl of Orford*, vol. 1, ed. Peter Cunningham (London, 1857), p. 277.

¹⁰⁰ Miller, ‘Reappraisal’, 476–92.

¹⁰¹ John Andrew, *The practice of inoculation impartially considered* (Dublin, 1765), p. xii.

¹⁰² Wilmot, *Bishop Hough*, pp. 321–2.

physicians who wrote positively about inoculation in the 1730s. Their books were published early in the decade, however, and none refer to inoculations after 1727. Dr Lobb, the best informed of the three, declared that he only recommended inoculation when infection was otherwise inevitable.¹⁰³ Though Miller was right to point out that smallpox was less of a threat in the 1730s, there were certainly significant outbreaks, including in Bury St Edmunds in 1733, the only English town in Miller's brief list of places where inoculation activity is documented. Far from supporting Miller's case, the response to smallpox in Bury would seem to undermine it: a well-reasoned proposal to use inoculation to suppress the outbreak was strongly opposed, and only three people were inoculated.¹⁰⁴

A recognition of the decline in inoculation in Britain in the 1730s makes it easier to understand its failure to make early headway on the continent. While Voltaire championed inoculation in his *Letters from England*, first published in French in 1734, his fellow-countrymen were becoming more circumspect. In opposing the practice in 1740, Julian Ofray de La Mettrie, physician and *philosophe*, observed that the English had wisely abandoned it.¹⁰⁵ In presenting the decline of the practice as a 'myth', Miller does less than justice to the American contribution to its revival in the 1740s. Although they carried only occasional notices of individuals inoculated in London, British newspapers in the 1730s reported the inoculation of hundreds of people during smallpox outbreaks in Philadelphia and Charleston in North America, and in Barbados and St Kitts in the Caribbean.¹⁰⁶ The inoculation of large numbers of workers and slaves served to extend the social range of the practice and brought improvements in efficiency and outcomes.¹⁰⁷ The decision to inoculate children admitted to the new Foundling Hospital in London in 1744 and the establishment of the Smallpox and Inoculation Hospital in 1746, signal events in the revival of inoculation in Britain, need to be seen in the context of the use of inoculation on large population groups on the other side of the Atlantic.

¹⁰³ Thomas Fuller, *Exanthematologia* (London, 1730); Thomas Dover, *The ancient physician's legacy to his country* (London, 1732), pp. 87–90; Theophilus Lobb, *A treatise of the small pox* (London, 1731), pp. 184–5.

¹⁰⁴ Miller, *Adoption*, p. 137; Sloane MS. 4053, item 163, BL.

¹⁰⁵ Julien Offray de La Mettrie, *Traité de la petite vérole avec la manière de guérir cette maladie* (Paris, 1740), p. 9; Kathleen Wellman, *La Mettrie: Medicine, Philosophy, and Enlightenment* (Durham, NC, 1992), pp. 93–4.

¹⁰⁶ *Daily Gazetteer*, 6 December 1737; *Weekly Miscellany*, 14 July 1738; *Daily Post*, 18 July 1738; *London Evening Post*, 15–17 March 1740.

¹⁰⁷ Larry Stewart, 'The edge of utility: slaves and smallpox in the early eighteenth century', *MH*, 29 (1985), 54–70.

The Broader Disease Environment, Human and Animal

Smallpox was not the only threat to life and well-being in the eighteenth century and the level of the threat varied over time and place. In England, it was endemic in London and other large cities and towns, but there were still villages, not especially remote, that managed to escape it for a decade or so. The London bills of mortality show that the proportion of deaths attributed to smallpox was one in eight in 1725, but did not reach that level again for two decades. During an epidemic in 1752, however, it was responsible for one in six deaths.¹⁰⁸ In parishes across England, there were peaks in mortality that were specifically identified with smallpox in registers of births, marriages and deaths. For a village untroubled by smallpox for a decade or more, and a high proportion of the population consequently at risk, an outbreak could be devastating. Even in larger population-centres where smallpox was endemic, its destructive force ebbed and flowed with epidemics, some associated with high mortality, others relatively mild. The ‘speckled monster’ was evidently much less menacing in the 1730s than in earlier and subsequent decades. During this time, too, food prices were relatively low and average standards of living were on the rise. Broader cultural changes, including growing awareness of the role of contagion, the value of sanitary measures and personal cleanliness, may likewise have proved helpful in the fight against disease in Britain and elsewhere. It is important, then, to consider smallpox and smallpox prophylaxis in the context of the larger disease environment.

From 1348, bubonic plague was the source of most concern in western Europe. It prompted much of the new thinking about contagion and experimentation with measures to contain outbreaks, notably quarantine and sanitation.¹⁰⁹ The Great Plague in London of 1665 and the epidemic in Marseille in 1720, however, proved to be the last outbreaks in their respective countries. It remained a dreadful menace in eastern Europe, north Africa and the Middle East, with Russia experiencing a major epidemic as late as the 1770s. As the decades passed, however, the retreat of the plague was a source of quiet satisfaction in the western world, giving grounds for hope that other diseases might be controlled and banished. In the meantime, smallpox and other crowd diseases were becoming more salient. Typhus was a major source of morbidity and mortality in large towns and other places, like army camps, prisons and ships, where people were crowded together. It was not seen as a single entity, attributable to a single disease agent, but observed as a range of environmentally determined fevers. Even less understood was the

¹⁰⁸ Miller, *Adoption*, appendix C.

¹⁰⁹ Mark Harrison, *Contagion. How commerce has spread disease* (New Haven, CT, 2012), chs. 1 and 2.

identity and infectiousness of tuberculosis, described by reference to its symptoms as the wasting disease or consumption. There were soon other major killers on the loose, notably yellow fever and cholera, which took advantage of the increase in global commerce from the late eighteenth century. In this context, it was smallpox's misfortune to be so readily identifiable. Though superficially like measles and chickenpox, its symptoms and *sequelae* clearly marked it out in typical cases. Like the bubonic plague, it acquired a distinct cultural identity.¹¹⁰ Some features of the disease, including its genetic stability, its lack of a non-human reservoir of infection, and its visibility at the infective stage, proved advantageous to humanity in its struggle to contain it. Above all, the fact that people took smallpox only once allowed survivors to nurse the sick and made it worth considering the advantages of acquiring the disease by artifice.

Europe's understanding of infection was informed, too, by observing non-human diseases. From Antiquity through to the Renaissance, the observation of plants and animals enriched and challenged medical understandings. Few people living on the land needed to be told to take rotten apples out of a barrel or that a sick animal might infect the herd or flock. The specificity of diseases was most evident when considered across species: there were pests that attacked some plants and animals but not others.¹¹¹ The observation of outbreaks of animal disease in Europe – which arose from the very conditions, namely the increase in population, commerce and communication, that spread infection among humans – offered insights on the nature of disease, patterns of infection, and modes of containment that could be applied more generally. In the early eighteenth century, Europe was under siege from a deadly cattle disease, known as the cattle plague or rinderpest. Spreading eastward from the Steppes, it decimated herds in northern Germany and Italy in 1711 and France and the Netherlands in 1713–14. The mortality was on an epic scale: the Netherlands lost some 300,000 head of cattle.¹¹² After a lull in the late 1720s and 1730s, the disease reappeared in the 1740s and 1750s. Aware of the economic costs, governments responded with rare energy and resource. Regulations to isolate infected animals and limit the movement of herds showed a practical understanding of the aetiology of the disease. Although it was generally described as a plague, many people saw a likeness to smallpox. In 1711 Bernardino Ramazzini, professor of medicine at Padua, stressed the similarities in appearance and aetiology.¹¹³ Familiarity with smallpox

¹¹⁰ Shuttleton, *Smallpox and literary imagination*, esp. introduction; Catriona Seth, *Les rois aussi en mouraient. Les Lumières en lutte contre la petite vérole* (Paris, 2008), pp. 28–34.

¹¹¹ Lise Wilkinson, *Animals and disease. An introduction to the history of comparative medicine* (Cambridge, 1992), p. 26.

¹¹² C. A. Spinage, *Cattle plague. A history* (New York, 2003), pp. 104–11.

¹¹³ Wilkinson, *Animals and disease*, p. 41; Spinage, *Cattle plague*, p. 111.

doubtless encouraged the insight that cattle surviving an outbreak were safe from subsequent infection. Familiarity with smallpox inoculation prompted an English physician, Daniel Layard, to make a trial of inoculating cattle with cattle plague in the 1740s. Though it proved more feasible in England to suppress cattle plague by quarantine and culling, Layard's publication of his researches in 1754 attracted interest in the Netherlands. In experiments in 1755 and the late 1760s, Pieter Camper, professor of medicine at Groningen, unfortunately killed more animals by inoculation than he saved. In the mid-1770s, however, Gerd Reinders, a dairy-farmer, drew on best practice in smallpox inoculation to use only lymph from cows that had survived the disease and, after achieving promising outcomes, formed a society to extend rinderpest inoculation. The use of inoculum from mild cases likewise proved successful in Mecklenburg and led to the large-scale inoculation of cattle in the district, supported by insurance schemes to spread the risk.¹¹⁴ By the end of the eighteenth century, though, the threat of rinderpest in western Europe receded and the practice fell into abeyance.

Costly in economic terms, animal diseases received serious attention and provided opportunities for speculation and experimentation. The recognition of similarities between human and animal diseases led to speculation, too, that transferring a disease from an animal might protect a human from a cognate human disease. Veterinary science, of course, was even less well developed than medical science. Animal distempers were less precisely named and described than human diseases, and observations were less well documented and integrated into systems of knowledge. If the challenge presented by cattle plague in the early eighteenth century intrigued some medical men, comparative pathology brought as much confusion as clarity. The cattle plague was variously described as a plague, a pox or a sort of typhus. In his papers to the Royal Society in the 1750s, Daniel Layard simply named it 'the distemper among horned cattle'. There were other contagious livestock diseases that were also a matter of high concern. Foot-and-mouth disease was highly communicable and appeared in severe epidemics. Though rare in Britain, *clavelée* or sheep-pox was a serious menace to flocks in the foothills of the Alps and Pyrenees. Its seeming affinity to smallpox made it an additional focus of interest. There were many other livestock ailments that were insufficiently common or serious to attract close attention, including several pustular conditions on the teats of cows, known generally in England as 'cowpox'.

Cowpox is not attested before the 1760s, and only then in retrospect. Though known to dairy-farmers in parts of England and western Europe, it appeared only sporadically and caused little apparent distress to cattle. It could

¹¹⁴ C. Huygelen, 'The immunization of cattle against rinderpest in eighteenth-century Europe', *MH*, 41 (1997), 182–96.

be communicated to dairy workers, occasioning a local lesion and swelling, but rarely warranting professional attention. One apparent property of cowpox attracted attention. Some people believed that cowpox infection protected them against smallpox. Edward Jenner was among a small number of practitioners who started to look closely at the correlation between cowpox infection and insusceptibility to smallpox. From the 1770s, he collected evidence of cases and examined the progress of the disease on cattle and humans. A careful observer, he saw it was necessary to distinguish between the several forms of cowpox communicable to man. One that is now known as pseudo-cowpox is a parapoxvirus that has no prophylactic value, while another, still known as cowpox, is an orthopoxvirus that provides protection against smallpox but produces a very severe reaction.¹¹⁵ There is no certainty as to the identity of the cowpox that Jenner used, with one longstanding argument being that it was modified smallpox.¹¹⁶ As Derrick Baxby and others have shown, however, extant strains of *vaccinia*, all of which have been used for some time, show no recent affinity either with smallpox or modern cowpox.¹¹⁷ Baxby's speculation that *vaccinia* was derived from horsepox, extinct in Europe, has recently received strong support from the genomic sequencing of a sample of the disease from Mongolia.¹¹⁸ Interestingly, Jenner himself believed that the source of his 'cowpox' was a pustular disease on the legs of horses. Given the wide host range of *vaccinia* it is very conceivable that a similar virus was the infective agent of both Jenner's cowpox and horsepox. To add to the confusion, since the horse and the cow were merely the incidental hosts of the virus, it is probable that the natural reservoir of the ancestor of *vaccinia* was a rodent or other small mammal in occasional contact with them.¹¹⁹

The Uses of Inoculation

From the outset, inoculation was more than a surgical procedure. It was originally called 'grafting' in England, a direct translation of '*insitio*' or '*inoculatio*' in Latin. The term, used in horticulture, commended itself as a description of the process of cutting into a trunk and inserting matter. Early

¹¹⁵ Frank Fenner, Riccardo Wittek and Keith R. Dumbell, *The orthopoxviruses* (San Diego, CA, 1989), pp. 187–8.

¹¹⁶ Peter Razzell, *Edward Jenner's cowpox vaccine: the history of a medical myth* (Firle, 1977).

¹¹⁷ Derrick Baxby, *Jenner's smallpox vaccine: the riddle of vaccinia virus and its origin* (London, 1981).

¹¹⁸ José Esparza, Livia Shrick, Clarissa R. Damaso and Andreas Nitsche, 'Equination (inoculation of horsepox) and the potential role of horsepox virus in the origin of the smallpox vaccine', *Vaccine*, 35 (2017), 7222–30; Clarissa R. Damaso, 'Revisiting Jenner's mysteries, the role of the Beaugency lymph in the evolutionary path of ancient smallpox vaccines', *The Lancet. Infectious Diseases*, 18 (2018), e55–63.

¹¹⁹ Baxby, *Jenner's vaccine*, p. 168; Fenner, Wittek and Dumbell, *Orthopoxviruses*, ch. 6.

modern Europe witnessed significant advances in horticulture through grafting, and even fanciful speculation as to its use on animals as well as plants. In 1659, Joseph Sharrock, a churchman fascinated by horticulture, humorously dismissed calls ‘to apply ourselves by these rarer ways of insition to the improvement of animal bodies’.¹²⁰ The conception of ‘grafting’ as improving on nature provided figurative support for the idea that inoculation of smallpox from a milder case reduced the natural severity of smallpox. In 1783 Gadso Coopmans, physician and classical scholar at the University of Franekar in the Netherlands, made the idea the centrepiece of a long Latin poem on smallpox entitled *Varis, sive Carmen de variolis*. Inspired by Fracastoro’s *Syphilis*, it tells of a shepherd named Lycidas and his sweetheart Amaryllis. A malicious nymph named Varis sought to seduce Lycidas, and smarting from his rejection of her inflicted a disease that took away his good looks. His sweetheart likewise took the disease and died in agony. The disease then traversed the world, killing some and leaving others badly scarred. Eventually a pious old man turned to Apollo for aid. The oracle replied: ‘A fruit loses its sourness when a graft has been implanted in another tree’.¹²¹

In the 1720s, inoculating smallpox was promoted as a protection against casual infection. Early supporters of practice sought to demonstrate its relative safety and utility, embed the new procedure in medical practice, and allay ethical and religious objections. The basic task was to demonstrate the value of the procedure. If it was revealed to be beneficial, medical men would make it available and people could adopt it in good conscience. The clinical trials showed it to be reasonably safe. In the first major use of medical statistics, data was presented to show that the case-fatality rates of inoculated smallpox were significantly lower than for casual smallpox. In terms of understanding how inoculation worked, the priority was to fit the practice into the existing humoural paradigm rather than unsettle it. The assumption was that smallpox was innate and that a range of factors, including infection, caused it to break out. Inoculated smallpox could be seen as acting in this fashion, provoking ebullition and serving to ‘deplete’ the body’s store of variolous poison. Still, the growing familiarity with inoculation served to advance understandings of infection. Inoculation made it possible to establish the moment of infection and demonstrate the specificity of the disease. In the 1720s, Cotton Mather sought to explain the milder nature of inoculated smallpox by reference to the inoculation of the disease on an outer limb.¹²² As Geneviève Miller observed,

¹²⁰ Ken Mudge, Jules Janick, Steven Scofield and Eliezer E. Goldschmidt, ‘A history of grafting’, *Horticultural Reviews*, 35 (2009), 437–93, at 466.

¹²¹ D. Sacré, ‘An imitator of Fracastorius’s *Syphilis*: Gadso Coopmans (1746–1810) and his *Varis*’, *Humanistica Lovaniensia. Journal of Neo-Latin Studies*, 45 (1996), 520–38.

¹²² Mather, *Angel of Bethesda*, ed. Jones, p. 112.

inoculation had the capacity ‘to provide the capital to the column of evidence supporting the doctrines of contagion and specificity’.¹²³

The success of smallpox inoculation gave rise to attempts to inoculate other human diseases as well as animal diseases. It was a matter of some interest whether inoculation could be used to prevent the bubonic plague, but the disappearance of plague in western Europe left no opportunity to experiment. During a plague epidemic in the Russian empire in 1770–2, however, medical men in Moscow and Bucharest made a serious trial of inoculation as a form of plague prophylaxis. Though the inoculated patients survived, they can have derived little benefit from the procedure, given that it was possible for people to contract plague, a bacterial rather than a viral disease, more than once.¹²⁴ A more obvious candidate for inoculation was measles, a disease that sometimes took a heavy toll of children. Since it produced no vesicles, though, it was hard to obtain matter for inoculation. Francis Home rose to the challenge by turning to ‘the magazine of all epidemic diseases, the blood’. In experiments in Edinburgh in 1759 he reportedly succeeded in producing milder cases of measles by inoculating blood from infected patients.¹²⁵ In 1774 Dr Cook, his pupil, followed up on this practice, recommending the tears of patients as the inoculum, and John Hunter, Jenner’s mentor, also experimented with measles.¹²⁶ No one thought the operation worthwhile. The infective agent was hard to obtain and the resulting illness was only slightly milder than natural infection. Inoculation was nonetheless increasingly recognised as a valuable tool in pathology. It offered insights into the interaction between infections: when smallpox and measles were inoculated together, for example, the two diseases came out separately, one ahead of the other. John Hunter sought to establish the relationship between gonorrhoea and syphilis by inoculating a patient’s penis with gonorrhoea and monitoring for signs of syphilis. Unfortunately, he accidentally communicated both diseases, presumably through a contaminated lancet, and his ill-founded conclusion that syphilis was an advanced stage of gonorrhoea misled several generations of practitioners.¹²⁷

Above all, inoculation remained an invaluable tool for investigating smallpox itself. According to Dr Haygarth, the ‘truth’ of the proposition that smallpox was caused by infection only ‘is proved, beyond all possibility of doubt, by the daily practice of inoculation’.¹²⁸ There was still little

¹²³ Miller, *Adoption*, p. 259.

¹²⁴ John T. Alexander, *Bubonic plague in early modern Russia: public health and urban disaster* (Oxford, 2002), pp. 293–5.

¹²⁵ Francis Home, *Medical facts and experiments* (London, 1759), pp. 266–88.

¹²⁶ *Town and Country Magazine*, 6 (1774), 300–2.

¹²⁷ Wendy Moore, *The knife man. The extraordinary life and times of John Hunter, father of modern Surgery* (London, 2005), pp. 192–8.

¹²⁸ Haygarth, *Inquiry*, p. 13.

understanding of the process of infection. The infective agent was understood, in a loose way, as a poison. Haygarth imagined variolous particles being absorbed in the atmosphere. Inoculation allowed precision with respect to the timing of infection and the number of days before the disease broke out. With no conception of the immune system, it was assumed that the patient became insusceptible to subsequent smallpox by the purging of variolous matter. Still, many medical men used the metaphor of resistance and some took their cue from the great Dr Boerhaave, who felt that smallpox 'left some positive and material quality in the constitution' that prevented subsequent infection.¹²⁹ On a more practical level, close attention to groups of patients undergoing the disease provided opportunities to experiment with different regimens and introduce them in anticipation of the fever. Some inoculators gained facility in diagnosing natural cases of smallpox before the disease broke out, enabling them to prescribe medicines earlier and to better effect.¹³⁰ The handling and storage of smallpox matter provided insight on the length of time it remained infective, a crucial point practically and epidemiologically. Variolation often proved useful as a test of susceptibility to smallpox. People who were unsure whether they had had smallpox as a child might have themselves inoculated to set their minds at rest. It was used sometimes to establish a diagnosis in uncertain cases in which chickenpox was assumed but smallpox needed to be ruled out. In a ghoulish experiment conducted by Dr George Pearson to test whether a pregnant woman could infect a child with smallpox in utero, a dead foetus reported to have pockmarks was exhumed from a graveyard, and the pocky matter used in the inoculation of a young girl.¹³¹

Crucially, smallpox inoculation laid the foundations for cowpox inoculation. During the eighteenth century, practitioners gained experience and made significant improvements in the technical aspects of inoculation, including making a lighter incision or puncture on the outer limb, inoculating fresh lymph taken from mild smallpox cases, and devising methods for storing variolous matter, all of which helped to set the scene for the success of vaccination. In addition to the key elements of the procedure, the broadly-based culture of inoculation in Britain provided a common frame of reference that allowed the new prophylaxis to be recognised, assessed, and communicated by medical men and a broader constituency of interest. Most basically, it was inoculation that revealed that some people who had been previously exposed to cowpox resisted smallpox infection, and provided, in early trials

¹²⁹ Arthur M. Silverstein and Alexander A. Bialasiewicz, 'A history of acquired immunity', *Cellular Immunology*, 51 (1980), 151–67, at 161.

¹³⁰ Michael Bennett, 'Curing and inoculating smallpox: the career of Simeon Worlock in Paris, Brittany and Saint-Domingue in the 1770s', *French History and Civilization*, 7 (2017), 27–38.

¹³¹ George Pearson, *Observations on the effects of variolous infection on pregnant women* (Reprint from *Medical Commentaries*, 19, no date), pp. 9–10.

of cowpox, the means of testing the resistance to smallpox of people who had been vaccinated. Most of the critical developments in smallpox inoculation, of course, took place in the late eighteenth century. Chapter 2, then, begins with the revival of the practice in Britain in the 1740s and 1750s and then focuses on the significant development of the practice and its rapid expansion, in terms of social reach and geographical range in the last quarter of the eighteenth century. This expansion in Europe and the Americas provided a platform for the new prophylaxis and generated enthusiasm for the potential of a practice that offered both the individual and the community safety from smallpox. It both anticipated and, in turn, gave momentum to the rapid global expansion of vaccination in the early nineteenth century.