Discussion Point

Should Remaining Stocks of Smallpox Virus be Destroyed?

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There has been much recent debate about the destruction of the last remaining stocks of smallpox virus preserved in specialist laboratories in Atlanta and Moscow.[1] This debate has been carried out exclusively by virologists and microbiologists, the specialists who clearly are most qualified to decide the fate of one of the world's most deadly viruses.

However, one voice not yet heard in the debate is that of the medical historian. Familiarity with the history of smallpox, cowpox and vaccinia raises a number of questions and worries, and in this paper, I want to briefly consider some of the issues raised by the medical historical evidence.

One potential problem that has already been raised is the survival of smallpox virus in corpses buried in the permafrost,[2] and the possibility that a new epidemic may be triggered by the accidental disturbance of such corpses. That this worry is not purely theoretical is indicated by an event that occurred in an English village in the eighteenth century:

> The following very singular occurrence happened in the year 1759 at Chelwood a village near Pensford (Somerset); the sexton of the place opened up the grave in which a man, who died of the smallpox, had been interred near 30 years before. The coffin was of oak, and so firm, that it might have been taken out whole; but the man forced his spade through the lid, when there issued a most nauseous stench. The person who was to be buried being of eminence, most of the inhabitants of the village attended the funeral: in a few days afterwards, 14 persons were seized with the smallpox in one day; and in three days after, all but two in the whole village, who had not had it, were seized in a like manner. It is remarkable, the disease was so favourable, that no more than two persons died of it.[3]

The ability of smallpox virus to survive underground for long periods of time is also indicated by the practice of one Scottish inoculator at the end of the eighteenth century. The inoculation of smallpox – variolation – had been practiced in Britain since at least 1721, and an amateur inoculator by the name of John Williamson had preserved smallpox virus in the following fashion:

> He ... keeps it a long time before he puts it to use – sometimes seven or eight years; and, in order to lessen its virulence, he first dries it in peat smoke, and then puts it underground, covered with camphor.[4]

This suggests that smallpox virus survived for long periods underground, and along with the above evidence, indicates that the possibility of accidentally

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[1] *Nature,* 366, (23/30 December I993), 71I.
[2] Peter Lewin, 'Mummified, Frozen Smallpox: is it a Threat?', JAMA, *253,* (7 June 1985), 3095.
[3] Peter Razzell, 'Smallpox Extinction – a Note of Caution', *New Scientist* (I July 1976), 35.
[4] *Ibid.*

triggering a smallpox epidemic through the disturbance of a corpse dying from the disease is not just a theoretical one.

But there is perhaps a greater problem arising from another source. In order to understand this danger, it is necessary to briefly consider the history of vaccination, and the source of the early vaccines used by Jenner and his supporters. After a few trial experiments with the cowpox discovered in Gloucestershire, Jenner was forced.to resort to cowpox discovered in a dairy in Gray's Inn Road, London. This had been discovered by one of his supporters, Dr William Woodville, Director of the London Smallpox Hospital. Woodville had conducted trials with this strain of cowpox in the hospital, and in the process contaminated it with smallpox virus.

The vaccine that Woodville sent to Jenner 'was taken from the arm of Anne Bumpus, who had had an eruption of three hundred and ten pustules resembling those of smallpox.'[5] It is highly likely that this vaccine was derived from smallpox and not cowpox virus, and was subsequently attenuated through arm to arm passage, using sites of previous inoculations as a source of virus.

As a result of this and other experiences, Jenner came to believe that cowpox was nothing but smallpox, modified by passage through the cow. He had great difficulty in successfully inoculating cowpox into human beings, which is one of the reasons he relied on the 'vaccine' supplied by Woodville. Some historians have suggested that the cowpox that Jenner discovered amongst the Gloucestershire dairymaids was in fact originally derived from smallpox. Variolation was practiced in a large scale in Gloucestershire for three decades or more before Jenner discovered vaccination. (Jenner himself had been variolated as a boy and had practiced variolation as a country surgeon.)[6] It is possible that milkmaids who had *been* variolated, had transmitted smallpox virus to the cows they were milking, by scratching the itches on their arms and infecting the udders of the cows.[7]

The belief that cowpox was derived from smallpox was shared by a number of Jenner's contemporaries. When vaccines became too attenuated by arm-to-arm passage, it was thought necessary to find fresh stocks of cowpox to create new supplies of vaccine. Cows were successfully inoculated with smallpox by Ceely, Badcock, Thiele and Copeman in the nineteenth century, although Copeman believed it was necessary to attenuate the disease first by inoculating monkeys as an intermediary host.[8] Attempts to inoculate cows with smallpox have been less successful in the twentieth century, and even to this day. The exact relationship between smallpox, cowpox and vaccinia is not known.

Even the origins of current strains of vaccinia are unknown. Some current stocks of vaccine may have originated from smallpox virus; for example, the

[5] Peter Razzdl, *Edward Jenner's Cowpox Vaccine: The History of a Medical Myth* (Firle, 1977), 22.

[6] Peter Razzell, *The Conquest of Smallpox* (Firle, 1977), 69.

[7] Peter Razzell, *Essays in English Population History* (London, 1994), 48.

[8] *Ibid.*

strain of vaccinia preserved at the Lister Institute in London is reputed to have derived from a Prussian soldier with smallpox in 1870.[9]

Virologists have shown that smallpox, cowpox and vaccinia are similar in their basic structure, although they have slight genetic and other variations, making it impossible to determine their exact relationship. The similar structure of the three viruses is what we would expect, on the basis of the known historical relationship between them.

It is probable that some strains of cowpox and vaccinia were derived from smallpox, and therefore it is possible that a slight mutation in either of these two viruses could lead to the re-emergence of smallpox.[10] There is evidence chat cowpox has become more prevalent in Europe since the cessation of vaccination, and that cowpox – or closely related poxviruses – are to be found in monkeys, rodents and cats, and possibly other animal species. There is recent evidence that human beings have been infected by cowpox probably caught from contact with rodents and cats.[11]

The historical and virological evidence suggests great uncertainty about the future of pox viruses, and how they might affect man in the future. Given that some strains of cowpox and vaccinia have been derived from smallpox virus, it would in my opinion be premature to destroy the remaining stocks of smallpox. They may be required in future as a research aid to combat the resurgence of a disease chat has proved to be so fatal to man in the past.

[9] Razzell, *Edward Jenner,* 3.
[10] *Nature,* 366, 711.
[11] J. L. Burton, 'Of Mice and Milkmaids, Cats and Cowpox', *The Lancet*, 343, (8January 1994).