killed proportionately about as many people in the 17th century as tuberculosis does now. Of course such a death rate is not immaterial, but the death dealing properties of the plague were exaggerated by its localization in time and place. Its chief importance was that it greatly added to the unhealthiness of the towns and cities already terribly unhealthy from other causes. It must also have seriously hampered the development of industry and commerce, since cities were practically in a state of siege during an outbreak. Graunt says that copies of the Bills of Mortality were bought in Plague time " so that the Rich might judge of the necessity of their removal and Tradesmen might conjecture what doings they were like to have in their respective dealings ". During the Plague of London the entry of English ships and manufactures was forbidden at most Continental ports.[27] Further, had the plague not been extinguished its incidence would have been very different in the 18th and 19th centuries from what it was in the 17th. From the method of infection the bubonic plague is only likely to be carried between commercial centres. In the isolated economic life of the 17th century many places were normally cut off from commercial intercourse and occasional fairs and markets could be easily adjourned in plague times. It would have been very different in the new order of things with developed commerce, industry and transport, the plague death rate of London might easily have become that of the whole country.[28]

Indeed it is difficult to believe that the modern territorial division of labour could have fully developed if subject to the serious interruptions of the plague. The disappearance of plague was both directly and indirectly one cause among many of the material advance in the 18th century. Moreover, its abolition not only removed a nightmare of horror from the life of Europe but encouraged the hope of a successful warfare against other epidemic disease. Rightly or wrongly it was believed that plague had been banished by the conscious effort of man and it was hoped that this victory might be followed by others no less startling. The methods employed against other diseases were not, however, slavishly imitative but adapted in the light of experience to the problems at issue.

CHAPTER XIV

Smallpox in the 18th Century

It was natural that the idea of prevention should be early directed towards the most virulent disease with which 18th century Europe was afflicted.

Smallpox is a highly contagious disease yet strangely enough the fact was not recognised until modern times; indeed the Arabian physicians believed that it was due to a poison naturally incident to birth. Sydenham (1624–1689), who introduced a cool regimen which much lessened the death rate among smallpox patients, did not realize that the disease was contagious. The explanation seems to be that an attack of smallpox, in the vast majority of cases, confers a life immunity from the disease; further, it was endemic, so that most persons were attacked in early childhood and therefore a very large proportion of the adult population was immune from infection. Before the 19th century smallpox was essentially a scourge of infancy and early childhood, moreover an endemic scourge, though no doubt mysteriously altering in frequency and severity as do measles and scarlet fever at the present day. The introduction of vaccination conferred immunity on a considerable proportion of the child population, but for some years the necessity for revaccination was not realized; therefore from time to time during the 19th century epidemics of smallpox occurred which mainly affected the non-protected adult population, hence the idea that smallpox is an epidemic disease mainly affecting adults. This, however, is the artificial result of vaccination and the preventive method which preceded it.[1] It must be repeated, for the fact is of supreme importance from the standpoint of population, that smallpox is naturally endemic in Europe and that children and infants are extremely susceptible to it. The ravages of the disease among the infant population before the 19th century are attested by all authorities. One writer

calls smallpox " the poor man's friend who happens to be burdened with a large family ".[2] A Dr. Watt [3] says, " taking an average of several years I found that more than half of the human species died before they were ten years of age and that of this half more than a third part died of Small Pox so that nearly one fifth of all that were born alive perished by this dreadful malady." [4] Haygarth of Chester made the same estimate, as did also an anonymous writer for Leeds in 1791. This writer believed that in Liverpool this proportion was exceeded.[5]

In Warrington in the year 1773 the total number of deaths was 473 of which 211 died of smallpox, all the victims being under the age of nine; of these 211 no fewer than 133 were under 2 years of age. These figures are almost certainly for a year of exceptional mortality but they suggest that practically all the adult population had suffered from the disease in childhood.

Haygarth in his survey of Chester in 1778 ascertained that only 1 in 14 inhabitants of Chester had not had smallpox. He calculated that 1 in 20 persons were incapable of infection. In the Chester epidemic of 1777 out of 136 who died only seven had reached the age of seven.

In 1774 the deaths in Chester were 546 of which 334 were under 10 years of age and of these latter 202 died of smallpox.[6] According to the Carlisle Tables there were between the years 1779 and 1787 (inclusive) 238 deaths from smallpox out of a total population of 8,177. Of the victims 225 were under five years of age, the total living under 5 being 1,096 and the total deaths for the period of those under five being 709. These figures confirm the estimates of the mortality from smallpox quoted above, yet according to Heysham the smallpox had been considerably checked during this period.

Sir Gilbert Blane writing in 1819 says, " though the term plague carries a sound of greater horror and dismay, we should probably be greatly within the truth in asserting, that smallpox has destroyed a hundred for every one that has perished by the plague." He goes on to say that it is true that the last visit of the plague in London accounted for 70,000 victims but the recorded deaths from smallpox since that time were 300,000

and a like number of survivers have been afflicted with blindness, deformity, scrofula or broken constitutions. He quotes a statement in the Report of the Hospital for Indigent Blind that " two-thirds of those who apply for relief have lost their sight by the small pox ".[7] Farr says, smallpox was " one of the most prolific causes of blindness in England. Of the 1,456 pupils received into the Liverpool School for the Blind between 1791–1860 no less than 250 are said to have been blinded by smallpox."

During the 18th century a determined effort was made to fight smallpox. The practice of inoculation was introduced from Constantinople by Lady Mary Wortley Montague about 1720. This practice is said to have been common in China from early times and a rude form of it known as " buying the small-pox " is also said to have been an ancient custom in many parts of Europe.[8] For, though the doctors did not know it to be infectious, the common people had observed that the disease could be conveyed from one person to another and that it was apt to be less fatal when sought after than when awaited. Probably the practice in Europe amounted to little more than exposing to infection by touch and mothers probably resorted to it from a desire " to get it over " in the same way that ignorant persons, even to-day, expose children to the infection of measles and scarlet fever.

Inoculation generally produced only a mild form of smallpox but occasionally it produced ordinary smallpox which sometimes proved fatal. The patient, however, was always infectious and the infected persons developed true smallpox, not the mild form to which inoculation normally gave rise. This was a grave disadvantage, moreover the early inoculators through over zeal made a very deep incision with very unpleasant and sometimes fatal results. Therefore, though inoculation when introduced in 1720 was tried successfully, first on condemned criminals and then on members of the Royal Family, a common course for new remedies, after a brief popularity the custom languished. About 20 years after it was revived again, a better technique was worked out and an attempt made to isolate inoculated patients. Inoculation became common among the well-to-do, and efforts began to be made to spread

it among the mass of the people. The Middlesex County Hospital was founded in 1746 on its present site as a hospital for smallpox and inoculation. One of the reasons for its foundation was that smallpox patients were not admitted to the general hospitals, moreover patients were to be admitted at all times and without letters of recommendation. The patients in the two parts of the Hospital (inoculation and natural smallpox) were kept strictly separate. The Hospital was not altogether a success, it followed the ordinary hospital rule of the time of excluding children under 7 years of age and thus excluded the majority of smallpox patients and precluded the greatest usefulness of inoculation. For inoculation of adults the necessary three or four weeks' residence at the hospital was a strong deterrent.[9] The subscribers to the Hospital were accused of keeping it for the use of their servants.[10] Though this was doubtless true it was not the whole truth. Most native Londoners must have passed through the fires of smallpox before they reached 7 years of age, the adult victims would have been mainly immigrants from isolated country places and a large proportion of these would have been servants. After all, what was a wealthy house-holder to do with some underling who fell ill of smallpox? The patient's fellow servants would not be willing to nurse him and the ordinary hospitals would not admit him; the smallpox hospital must have been a boon to a humane master. No doubt the inoculation patients were also largely immigrant servants who were compelled by their masters to endure the irksome, though necessary, confinement. The size of the Metropolis made it very difficult to adopt inoculation successfully among the mass of the people; in smaller places the plan was to have a general inoculation from time to time and every endeavour was made to inoculate everyone who had not either had the smallpox or been inoculated previously, the problem of infection being thus avoided. A general inoculation was usually held during a smallpox scare when it was easier to persuade the mass of the people to submit themselves or their children to the ordeal, for it must be remembered that a very large porportion of the inoculated would have been young

children. Many hospitals and dispensaries and most maternity institutions performed free inoculation. In Carlisle in 1785 there was a free general inoculation which was announced by the Town Crier and there are numerous records of general inoculations at various places between 1780 and 1800, several at Carlisle, also at Chester, Leeds, Liverpool and many smaller places. A most determined effort to fight smallpox was made at Chester by Haygarth. He was impressed by the success of quarantine and pest houses in the case of plague and thought that the same methods could be applied to other diseases.[11] The difficulty in the case of smallpox was the tender age of most of the patients which seemed to make hospital treatment impossible and, as Haygarth said, even had the mothers consented to part with their infants "no one could be so inhuman as to propose it". Thus do ideas of humanity vary in different periods; an age which welcomed factory employment for children was shocked at the inhumanity of children's hospitals, not altogether unreasonably. The sufferings of many a mother parted from her sick child or of many a nervous sick child parted from its mother, though not recorded in any Government report might, if adequately described, be not unmoving. The plea that the removal was for the ultimate benefit of the child and of the community and that most children did not suffer were the very arguments raised in favour of factory employment. In all ages men close their eyes to that which it is uncomfortable to contemplate.

Haygarth, therefore, drew up a scheme for isolating the smallpox patient in his own home. A Small-Pox Society was founded at Chester in 1778, rewards were paid to informers who gave information as to the existence of the illness. The inspector of the society then visited the infected house, gave precise instructions as to the rules to be followed in order to prevent the spread of infection. A reward was paid to those who followed the rules and a further reward in cases where it was proved that no one had been infected by the patient. Those whose social position precluded their acceptance of a money reward but who carried out the Society's instructions, were gratified by having their names published in a roll of honour

in the Society's Reports. The Society also strenuously advocated inoculation.[12]

A controversy as fierce as that which later raged round vaccination raged round inoculation and upon much the same grounds, though with a good deal more to be said upon the side of the opposition. Inoculation was attacked for its danger, since a certain proportion of persons died as a result of it, because it spread smallpox to other persons, because of the danger of conveying the infection of other diseases, particularly venereal diseases. It was attacked on religious grounds, as an impious interference with the beneficent plans of the Almighty and in fact upon every conceivable pretext, reasonable or unreasonable. Its defenders, among whom numbered most of the progressive and eminent of the medical profession, replied that the death rate from inoculation was very small, especially with proper methods, and the danger of conveying other diseases, again if proper precautions were taken, was remote. As to infection, inoculated patients should be isolated, but in any case the smallpox infection was so diffused that practically everyone was exposed to it.

An interesting account of inoculation, particularly as practised at the London Small-Pox Hospital, was presented to the Royal Commissioners of Health of the Kingdom of Sweden by a Dr. David Schultz, who studied the question in London for about a year and had evidently been sent to England by the Swedish authorities for that purpose. He pronounced strongly in favour of inoculation and his report, the English translation of which was published in 1758, gives an interesting account of the technique of inoculation as then practised. It was laid down that persons should only be inoculated when in good health and preferably when smallpox was not epidemical. The difficulty was that many persons only presented themselves for inoculation after they had actually been exposed to infection and deaths due to this infection were ascribed to inoculation. To avoid this the physicians at the London Small-Pox Hospital enforced a period of residence before inoculation. The patients at this hospital wore proper hospital dresses and " their own are fumigated with brimstone according to Dr. Hale's advice,

in a chest constructed for that purpose ". Patients were inoculated 20 or 30 at a time, doubtless to facilitate isolation. The actual process of inoculation consisted of passing a cotton thread through a pustule, the thread was then dried by the fire and kept in a wooden box. A healthy person was chosen from whom to take the matter, usually a child, " to avoid venereal taint ". The incision for inoculation was made with a lancet either on the arm or leg but bad sores often resulted from a leg incision or from a too deep one. " Nowadays a superficial incision with the lancet on the arm " Schultz says was considered correct " and the least sign of blood is a sufficient mark that the incision is deep enough ", the infected thread was then laid on the wound, bound to it and left at least two days or until infection appeared.[13] These details are quoted to show firstly the detailed study which had been devoted to perfecting inoculation—as a modern medical writer says, it " had well nigh attained the status of a modern preventive injection ",[14] and secondly how vaccination was the offspring of inoculation. The fame of Jenner is sufficiently established to be able to bear that due honour should be paid to his predecessors. Jenner's work was built upon a two-fold prepared basis, first the fact that immunity from smallpox could be obtained by an artificially conveyed infection and secondly the technique of conveying that infection. His work consisted in allying this two-fold knowledge with the popular " superstitition " that a person who had had " Cowpock " would not catch " small-pox ". Like most discoverers in the scientific sphere Jenner's work consisted in recognising a relation between facts which had appeared unrelated and in proving that relationship by a long series of experiments.

Vaccination was a very much safer and easier process than inoculation and its adoption was therefore widespread, but it had to fight severe opposition from the first, especially among Jenner's own countrymen. All the arguments against inoculation were used against vaccination, while from the opposite side it was assailed by inoculators who did not believe in the new process. It was soon proved to be a less certain preventive than inoculation, it was more likely not " to take ".

For highly susceptible persons it was not always a complete protection and in any case it did not confer the life immunity which inoculation as a rule gave. It was some years before the necessity of re-vaccination was recognised and the many cases of adults being infected by smallpox after infant vaccination were a great blow to popular faith. The medical profession soon pronounced in favour of vaccination though for some years doctors continued to inoculate at the request of patients. Inoculation continued for many years in country districts and the two methods existed side by side. The doctors, however, became more and more adverse to inoculation but when they refused to inoculate their patients simply resorted to amateur inoculators who had the additional attraction of cheapness.

A writer on the subject describes the position of affairs in the district of Chichester as late as 1822. The last general inoculation took place in the Chichester district in 1806 but during an epidemic in 1812 considerable numbers were inoculated in some parts of the district. Vaccination was mainly confined to the children of the upper and middle classes. In 1821 a small epidemic is said to have been turned into a bad one by some women inoculating their own children; there were over 100 cases and a panic ensued with a demand for inoculation. This demand the surgeons of Chichester refused except in some 50 cases, with the result that the population flocked to the amateurs, especially to a farmer named Pearce of Boshum. This man was quite a celebrity, at a charge of 2s. 6d. he inoculated over 1,000 persons in this one epidemic; he had inherited his lancet from his father, who, Pearce boasted, had inoculated over 10,000 persons of whom not one had died. Pearce, or his father, had by observation arrived at the conclusion "that the small pox matter, by uninterrupted transmission from one body to another by inoculation, becomes eventually . . . *as weak as water*; and that the resulting disease is always proportioned to the particular strength of the virus: and he accounts for the great mildness of the late epidemic in this manner—the first case of the disease having originated from a stock of effete virus". No doubt the absence of mortality

was due to acting upon this theory but the medical writer's only comment was that Pearce was quite uninstructed and his ideas of smallpox, "are mixed up with falsehood and fallacy." This writer would have been very crushing to any dairymaid who had talked nonsense to *him* about cowpock preventing smallpox.

Pearce had three rivals, a knife grinder, a fishmonger and a whitesmith, who travelled over the country and between them inoculated over 1,000 persons. In view of this extra professional rivalry many surgeons relented and inoculated their patients.[15] It is clear why it ultimately became necessary to prohibit inoculation. Medical opinion favoured vaccination but was often forced to yield to popular demand, otherwise their patients would have resorted to amateurs, which was not only a monetary loss to the doctors but a source of additional danger to the community. Inoculation by a skilled surgeon with proper precautions as to isolation was one thing, inoculation by a fishmonger with no such precautions was another. As medical opinion became more and more adverse to inoculation the danger from amateurs became greater and inoculation was made a felony in 1840. Vaccination was made compulsory in 1853.

Opinions differed as to whether the death rate from smallpox increased or decreased during the 18th century. One writer says, "the fatality of smallpox has been lessened by the cool regimen, inoculation and regulation".[16] But Robertson (1827) held that smallpox was gradually on the increase during the 18th century and was only effectively checked by the introduction of vaccination. It seems probable that the realization of the highly contagious nature of the illness and imperfect attempts at quarantine tended to make the disease more epidemic in character; such epidemics naturally attracted more attention than a fairly steady annual incidence. The more successful treatment and the fact that the age of attack was often postponed probably raised the proportion of recoveries.

Great controversy also arose as to whether inoculation increased or decreased the death rate from smallpox. The truth seems to be that in small centres of population, where it was possible to inoculate at the same time all those who

had not had smallpox, the method was successful. For instance, according to Howlett, in the parish of Great Chart near Ashford in Kent, burials between the years 1688–1708 were 192 ; of these almost a hundred had died of smallpox, whereas from 1760–1780 only 4 or 5 died of that disorder. This diminution was ascribed to inoculation : " no register can, as yet, properly inform us of the thousands that have been preserved by this salutary practice for these 20 years past all over the kingdom. As they have been chiefly infants and *young people* they are *ordinarily* too young to die, and scarce yet old enough to marry ; but they are latent in society, and will greatly swell *both* registers in due time ".[17]

Blane, however, held that inoculation increased the deaths from smallpox even in rural areas, but he, like Robertson quoted above, was writing at a time of acute controversy between the supporters of inoculation and those of vaccination. In large centres of population where it was not possible to inoculate every unprotected person and where often no proper measures were taken to isolate the inoculated persons these became centres of infection and caused severe epidemics of the illness. But without inoculation such epidemics would have undoubtedly occurred though not necessarily at the same period, also there is a good deal of evidence that inoculation was only resorted to in times of epidemics.

It is true that the London Bills of Mortality show an increased mortality from smallpox after 1770 and that contemporaries ascribed this to inoculation. But on general grounds this increase seems incredible. All the evidence points to the incidence of smallpox being at a maximum previous to 1770 in all centres of population. According to the Bills the mortality in London was lower than in provincial centres where reliable records were kept. This is extremely unlikely.[18] The probability is that the mortality from smallpox was grossly underestimated in the London Bills but that after 1770 there was a nearer approach to accuracy. Lettson estimated that the deaths from smallpox in London were more than double those shown in the Bills of Mortality, he also said that since the Society for General Inoculation had been established in

London in 1775 not one patient had died nor was there any proof that the natural smallpox had been aggravated by it.[19]

Heysham records in detail the efforts made at Carlisle to deal with smallpox by inoculation and the degree of their success. In 1779 there were 300 cases and 90 deaths (86 of these victims were under 5) and during the same period several hundreds were inoculated in the neighbourhood of Carlisle without one resultant death. In 1781 again there were 19 deaths from the disease and great numbers of inoculations in the town and the neighbouring villages. In 1782 there were 30 deaths and in the autumn of 1783 the disease was again prevalent and of so fatal a kind that the monthly committee of the dispensary recommended a general inoculation which accordingly took place in November. Great numbers availed themselves of this and Carlisle was totally freed from smallpox in two months and there were only 19 deaths.

In 1783 Heysham says, " the number of persons affected with the natural smallpox in Whitehaven, within the last six months, has been almost incredible, and it is a melancholy truth, that scarcely one in three survived." In 1785 the disease was introduced into Carlisle by vagrants. Again there was a free general inoculation, which was announced by the Town Crier. There were 91 inoculations at the expense of the dispensary and rather more by the general practitioners. There were no deaths among the inoculated but there were 39 among the natural cases and all the victims were under five. In 1787 the disease was again very prevalent and again there was an inoculation. There were 30 deaths from the disease, 28 under five and all under 10.[20]

It is doubtful whether inoculation on balance increased or decreased the death rate from smallpox in large centres, but in small centres and rural districts it most probably decreased it. The introduction of vaccination[21] (1798) and the widespread dissemination of the practice enormously reduced the death rate not only in this country but throughout the civilized world.

Heysham said in 1813, " Since 1800 when the practice of vaccination was introduced into Carlisle, I have reason to believe

that not one person has died of smallpox." In 1814 the disease was introduced by a vagrant, there were 12 or 14 cases and 2 deaths but by a recourse to vaccination the disease was soon checked.[20] As has been seen, these happy results were not general or permanent owing to inefficient vaccination, to ignorance of the necessity of periodic re-vaccination and, most of all, to prejudice against the practice. Nevertheless the results of vaccination upon the death rate were sufficiently astounding, as the figures in the appendix show.

The Carlisle figures, which seem absolutely reliable, show an average annual death rate of 3·64 per 1,000 at a period when the disease, according to most contemporary authorities, had been checked. The figure for the Liberties of London 1771–80 was 5 per 1,000.[22] Smallpox was endemic in all towns but the case was different in the country where isolated places might escape infection for a number of years, though when the disease did arrive they suffered severely. It is not safe, therefore, to apply the town death rate to the whole country though it would apply to villages near towns or situated on lines of communication. We have fairly reliable figures for Sweden which show an annual average death rate from smallpox in that country for the period 1774–1798 of 2 per 1,000. A large proportion of the population of Sweden lived in isolated villages and the incidence of the disease must almost certainly have been higher in England. A guess of an annual death rate of 2·5 to 3 per 1,000 perhaps would not be far from the truth. There is much evidence, however, that this rate was considerably higher prior to the last quarter of the 18th century. In estimating the importance of smallpox from the point of view of population it must never be forgotten that its victims were mainly under 5 years old. According to the Carlisle figures the death rate from smallpox of those under 5 was 28 per 1,000, a figure equal to the total death rate for this age period for the years 1876–1885. For the years 1906–1915 the *total* death rate for this age period was only 16 per 1,000. Napoleon showed a true appreciation of values when, in reply to a request for the release of some English prisoners presented in the name of Jenner, he answered, "I can refuse nothing to this man."

CHAPTER XV

The Anti-Typhus Campaign and the Fever Hospital Movement

Typhus. (*Synonyms:—Contagious, Spotted, Camp, Gaol, Hospital Ship, Nervous and Putrid Fever.*) Another definite campaign was the one waged against typhus. Typhus is an acute fever and though the parasite which causes it has not yet been discovered, the carrier has been proved to be the human body louse. Until the 19th century the diagnosis of typhus was confused with that of typhoid and of relapsing or recurrent fever.[1] The distinction between typhus and typhoid after a long series of researches, beginning in the early 18th century, was at last firmly established by Still in 1837. Relapsing or recurrent fever was only established as a separate disease in 1843; before that date it was believed to be a mild form of typhus; a so-called mild form of typhus fever, probably relapsing fever was very prevalent in England during the epidemic of 1826–7 and also in the '40's. Since both diseases are carried by lice they are likely to occur together and from the point of view of preventive medicine their distinction was not of great importance. The case mortality of relapsing fever is from 4 to 14%, that of typhus from 10 to 50%. Unlike most epidemic disease typhus flourishes especially in the temperate zone since the virus does not develop in the louse in high temperatures. Epidemics are favoured by any circumstance favourable to the breeding of lice.[2]

Probably much of the so-called plague of the Middle Ages was typhus. It appears to have been endemic in most centres of population in the 18th century and most probably had been so during previous centuries. It seems probable that under-fed persons have less resistance against this disease. The pestilence which follows famine is generally typhus, though this may not be entirely due to the under-fed conditions of the victims of famine but to the tendency of famine-stricken