CHAPTER XIII

Antiseptics, Segregation, Leprosy and Plague

Besides the inculcation of general hygiene, 18th century medicine waged a definite campaign against disease by the use of the twin methods of disinfection and segregation. Neither of these methods was new, both, indeed, had their roots in the immemorial past, but in the 18th century they were first brought to some degree of scientific precision and applied with a considerable degree of success.

From the earliest times it had been believed that certain substances had the power of protecting from disease. Sweet smelling herbs and spices were in particular favour in the Middle Ages. The custom of sprinkling herbs in Court Houses as a protection against gaol fever survived long after its futility was known. The 18th century doctor carried herbs in the great knob of his cane as a protection against infection, though many of them in so doing were probably merely following custom. The fumes arising from the burning of these substances were held to be more effectual than the natural scent. The Arab physicians recommended burning spices and balsams and in 14th century Italy one of the measures taken against the plague was the burning of balsams and resins.[1] Fire was generally held to be a purifying agent and in the 15th and 16th centuries in times of plague it was customary to light great fires in the streets and also to burn all infected clothes. Infected houses were exposed to the air 40 days. It is said that the fumigation of infected houses and clothing was first brought into use by a Capucin monk at Genoa in 1657.[2] This invention obviated the necessity of destroying clothing, etc., a procedure which had always led to much concealment, and it also reduced the purification period for houses from 40 days to 24 hours. Many different substances were used for fumigation.

Mead writing in 1720 says that making hot fumes with benzoin, frankincense and storax was often recommended but he did not see any reason to expect their virtue " to destroy the matter of infection ", but he thought " it not improper to fume houses with vinegar, either alone or with nitre " by throwing these on a hot iron or tile. He condemned fumigation with mercury or arsenic as dangerous but thought smoke of sulphur, " which is found by experience to be very penetrating and to have a great power to repress fermentations . . . may promise some service this way." Mead was obviously no great believer in fumigation, he rather tolerated it as a harmless alternative to the burning of infected goods, to which he had a great objection as he believed contagion to be spread by the flying embers. During the 18th century, however, fumigation, particularly with sulphur, steadily gained ground. Lind was a great believer in it and laid down a regular routine in connection with typhus. Hale designed an apparatus for fumigating infected clothing with sulphur and this, or a similar apparatus was part of the equipment of the earliest fever hospitals. Houses were also fumigated and washed with lime. Howard is said to have discovered the antiseptic properties of ordinary limewash. Quick lime was first used in burying the victims of the plague in the 17th century.

It would seem, therefore, that fumigation can be traced to the burning of sweet herbs or balsams which originally may have had a religious or magical significance. In the 17th century or earlier this began to be replaced by the burning of substances giving noxious vapours. This may have been connected with the belief in infection as a living thing which would be destroyed by anything which destroyed other life. By experiment the 18th century selected nitre and sulphur, particularly the latter, as being both effectual and easy to handle.[3]

Closely related, both in practice and theory, to the use of antiseptics was the vigorous segregation of infected persons, by quarantine laws and by the provision of special institutions for persons suffering from certain infectious illnesses. Both developments were dependent for their successful application upon an advance in theory as to the nature of infection.

Primitive magic or animism held that all qualities were transferable from one object to another and that such transference could be hindered or fostered by certain actions. One of the most obvious ways of preventing the transference of an undesirable quality was to avoid all contact with the object possessing it. Here is the germ of the idea of contagion and its avoidance by segregation. All organized religions, with their teaching as to an all powerful God or-gods, tended to discourage this idea; disease, especially epidemic disease, came as a punishment from heaven and the only hope was to induce heaven by prayer, fasting and sacrifice to deign to remove the scourge. Modern research has shown, however, that the old animistic ideas have lingered in superstition and folk lore after thousands of years of condemnation by priests and law givers.[4] And the belief that contact with certain forms of illness was dangerous can never have disappeared completely, re-inforced as it must have been by practical experience.

Though the Greek medical writers knew certain diseases to be contagious they had no specific theories about contagion and they were inclined to associate epidemics with conditions of the atmosphere. As a matter of fact atmospheric conditions are important factors in the spread of many contagious diseases and the opinion of the ancients was therefore based on observed fact. Many historians believe that malaria was the scourge *par excellence* of Greek civilization; if this opinion is correct it would have favoured the idea of "bad air" as a cause of epidemic disease. Medical thought has always been much influenced by the nature of the disease which is attracting attention at the moment. Medieval thought, which believed in cocks producing serpents and mice being spontaneously generated in bags of corn, was not likely to have any ordered ideas about the production of disease; but with the dawn of the New Learning many curious minds turned to the problem. The Black Death and plague in general were so obviously infectious that the fact of infection began to be accepted in the case of certain diseases; and the brilliant hypothesis that disease was due to minute living beings was formulated out of due time.[5] The discovery of the parasite that causes itch, which

is large enough to be visible with a strong magnifying glass, made it easier to accept the idea that other diseases were caused by parasites of a smaller size, yet the idea remained barren, it bore no fruit in the field of practical medicine.[6]

The early 17th century held almost fanatically to the belief in infection, as the Plague Ordinances showed. The late 17th and early 18th century medical writers were inclined to return to the Greek idea that epidemics were due to climatic conditions and several long records were kept of health and weather conditions in order to prove a correlation. But again the pendulum swung and by the second half of the 18th century advanced medical opinion began to look on infection as the primary cause of epidemics. It was believed that infection was conveyed in effluvia that were given off by the sick person. Some authorities believed in minute particles which conveyed infection from one person to another, but it is not clear that these were thought of as living beings capable of reproduction. The infections of different diseases were, however, believed to be distinct and only capable of producing their own disease and to differ in their method of travelling from one person to another. Some could travel through the air, some such as the typhus could not, but could be conveyed by clothing or other infected objects. According to this theory there was nothing impossible in the plague infection making long journeys in a bale of cotton. The believers in "fomites"[7] frankly confessed that they knew very little about them except that it was possible to destroy them with fresh air, soap and water, heat and the fumes of certain "antiseptics". Practice rather than theory was the mark of the age. The 18th century medical writers on typhus and other fevers devote very little space to the theory of contagion and a great deal to directions as to fumigation and hospital management. It is not certain whether the doctrine of "fomites" is a faint and debased echo of Fracastor's brilliant teaching or whether it was invented anew to explain the observed facts. Pringle quotes Fracastor in another connection, so his work was known to him indirectly, if not directly. In any case it is clear that the practice of the 18th century in regard to infectious illness was based upon the

experience gained in dealing with plague and that this, in its turn, was derived from the ancient policy of the segregation of the leper, a policy which goes back to ancient times and had religious sanction, a sanction that was perhaps itself a survival of animistic belief.

Leprosy was a well known disease in medieval Europe and at one time there were as many as 95 religious hospitals for leprosy in Great Britain. There can be no doubt that a large number of the inmates of these hospitals, perhaps even the majority, were not lepers, since in the Middle Ages any disease which caused repulsive looking eruptions of the skin was apt to be called leprosy. Many modern medical authorities hold that a considerable proportion of medieval leprosy was in reality syphilis.[8] However, true leprosy undoubtedly existed in medieval Europe though to what extent it is quite impossible to say. During the 15th century the disease almost disappeared from the greater part of Europe, though it lingered in Scotland and Norway until the 19th century. Leprosy is due to a bacterial infection (*Bacillus leprae*) but the method of infection is still unknown. It may possibly be conveyed by the bite of insects or by food, many authorities have believed it to be associated with the consumption of putrid food, particularly fish.[9] Its extinction in Europe may have been due to the segregation of the afflicted persons or to some other factor; until we know the method of infection it is impossible to form an opinion, since the fact that the disease has been proved to be bacterial proves nothing as to the method of infection. Malaria is due to a bacterial infection but ordinary segregation would be useless to arrest it. The medical authorities who associate leprosy with putrid food, especially fish, are supported by the historical fact that a considerable amount of badly and insufficiently salted fish was consumed in the Middle Ages. Salt was a dear and rare article and was no doubt often used too sparingly. With the growth of commerce salt became easier to acquire and new sources of supply were discovered, inventions also appear to have been made in the process of curing fish. Anderson mentions an improved method of curing fish in the year 1220 and improvements in herring curing were made in Flanders in the 15th

century. There is no reason to suppose that the death rate from leprosy was ever high and in any case the extinction of the disease in England is outside the period covered by this book. The importance of leprosy from the public health aspect lies in its influence on the development of preventive medicine, since it was the first disease in respect of which vigorous segregation was practised. Leprosy is a very repulsive disease and it is not surprising that, in the days when all illness was ascribed to the displeasure of Heaven, the leper was considered in a peculiar degree accursed of God. Plagues and pestilences showed the Almighty's displeasure with a whole community but the slow agony of leprosy implied personal moral guilt. Since many so called lepers probably were in reality the victims of venereal disease it may also have been noticed that "leprosy" often followed loose moral conduct. Natural abhorrence of so loathsome an illness and impatience with the long drawn out agony no doubt made friends and relatives easily acquiescent in the terrible verdict, "Unclean." God had cursed the leper and set him apart "outside the camp" and those who ignored the sentence ran the danger of sharing the curse; observed cases of infection would fortify this belief. The stern Mosaic Law had not troubled about the fate of the leper, but Christianity, whose Founder called sinners to repentance, coupled with the ancient sentence of expulsion the provision of shelter and sustenance. The provision of Lazar Houses became a popular form of Christian charity and with the dawning belief in infection this provision began to have a hygienic as well as a religious significance. The idea of segregation, originally religious and superstitious, resting on a belief in moral guilt and the danger of sharing a curse, took on a new aspect. The provision of special institutions for the segregation of persons suffering from one infectious disease being hallowed in the popular conscience as a religious act, it was easier to adopt the same system in regard to another disease. When the Venetian authorities (about 1484) took the momentous step of providing special pest houses the name Lazarettos clearly showed the origin of the idea.

True plague was extinct in England before the main period

of this study. But no account of the Public Health in England in the 18th century could be complete without some discussion of the reasons for the absence of plague, which had been such a terrible scourge in previous centuries. Moreover it was in connection with plague that improved methods of disinfection and segregation were developed and their apparent success in combating this dread disease encouraged their application to other epidemics.

In the Middle Ages the term plague was applied to any epidemic disease which caused great mortality. Probably many of the visitations of "plague" were typhus, others may have been influenza or, in fact, any type of infection which would spread rapidly and fatally in the absence of all hygienic and medical knowledge. By the 18th century the term plague was limited to the so called Oriental, Levantine or Bubonic plague. It is now known that the pneumonic plague is the same disease in a different form. It is probable that the Black Death was true plague in its pneumonic variety. True plague is primarily a disease of rats and the *Bacillus pestis* is conveyed from rat to rat by the rat flea. When the plague reaches epidemic height among the rat population and consequently numbers of rats are killed by it, the rat flea, which normally only bites rats, is driven to seek other hosts, including man, and these infected fleas convey plague to their new hosts. The bubonic plague is not normally spread from man to man but from rats to man and it may be spread from place to place by infected ships' rats or by fleas in merchandise. The Indian Commission on Plague held the last to be the most important method. It is also possible that bugs and lice can carry plague. The pneumonic variety can be air carried from man to man, especially in damp weather.[10] The connection between rats and plague was noticed even in ancient times. The episode recorded in I Samuel, chapter vi, shows evidence of such observation. The possibility of the conveyance of plague by bales of merchandise was well recognised in the 17th and 18th centuries; witness in the oft quoted case of the village of Eyam in the Peak district to which plague was conveyed in 1665 by a packet of clothes from London which resulted in the death of 260 of the inhabitants.

It is an extremely interesting question, both historically and medically, whether plague was ever endemic in Western Europe. Bateman says "besides these examples of extensive epidemic pestilence the limited appearance of the disease is frequently introduced in the bills of mortality within the same period (i.e. between 1593 and 1665) in fact there are few annual bills within that period in which some instances of death from the plague are not enumerated". But though the symptoms of the bubonic plague are extremely well marked, the buboes or tumours (really swollen glands) from which its name is derived being recognisable by the most ignorant, yet, unless descriptions of the illness have survived, it cannot be certain that the illness so designated is true plague, since the term originally had a wider connotation. The London outbreaks of the 17th century are authenticated by the writings of Willis and Sydenham and probably most epidemics in the 17th century so designated are true plague, while by the 18th century the limitation of the term is thoroughly well established. But though the physicians of the 17th century may have kept the term plague for one well recognised disease, it is by no means certain that the ignorant compilers of the Bills of Mortality did so, any death by a mysterious and sudden illness may have been called "plague". For the same reason the death rate may have been exaggerated in epidemic years. On the other hand, in epidemic years when extremely inconvenient quarantine laws were in force, there were strong reasons for concealing deaths from plague and for this reason Graunt believed that the deaths between 1603 and 1625 were underestimated by one-quarter. With regard to the entries in non-epidemic years they may have referred to true sporadic cases which would always be possible in a port. The 18th century medical writers and administrators held firmly to the theory of re-infection from the East and the name Oriental or Levantine plague embodies this belief upon which the whole elaborate structure of quarantine regulations was based. The fact that all recorded outbreaks of plague started in ports or trade centres supports this theory. Short says, "When the Plague made sad havock in London and some maritime places it scarce troubled the English

Continent," which moreover seems also to suggest that even the crude quarantine methods of the 17th century had some measure of success. Indeed in 1665 Scotland, which had extremely stringent quarantine regulations, escaped infection. The author of the Great Plague of London believes that plague was endemic in that city in the 17th and previous centuries. He, perhaps, attaches too much weight to the medical nomenclature of the time. To the present writer the weight of evidence appears to be in favour of periodic re-infection from the East, at any rate in the 17th century; but the question is one that cannot be answered with certainty.

Plague gradually died out in Western Europe during the 17th and early 18th centuries, the last great epidemic in France was in 1720–22. The last visitation in England was the Plague of London, the final remnants of which are believed to have been destroyed in the Great Fire.[11] The causes of the elimination of this disease in Western Europe at first sight are somewhat mysterious. It is doubtless true that the Fire of London was a factor in ending a particular visitation of the plague, probably by destroying the rats which carried the infected parasites. But the Fire of London in 1666 can hardly account for the reduction of plague throughout Western Europe and for its final cessation in France in 1722.

Some medical historians believe that there was a natural decrease in virulence in plague during the 18th century[12]; against this view there is the recorded terrible mortality of the local outbreaks in the south of Europe. For instance that of Marseilles and Toulon in 1720 with 91,000 deaths, that of Messina in 1743 with 70,000 deaths, that of Cyprus in 1759 with 70,000 deaths,

It has also been suggested that the retreat of the disease was due to an alteration in the rat population. In this connection it is significant that the old English black rat (*mus rattus*) was ousted by the so-called Norwegian or brown rat (*mus decumanus*) early in the 18th century. The black rat is small and friendly and, like the mouse, lives in houses. The brown rat is sly and fierce, its home is in sewers, docks, slaughter houses and granaries

in towns; in the country in ricks, hedges and ditches. The brown rat, is, therefore, less likely to convey infection to man since he avoids him as far as possible. Why the brown rat should have made a successful invasion of this country in the 18th century is unknown. Conditions were certainly becoming, at any rate in London, less favourable to the black rat and more favourable to the brown. The new brick houses erected after the Fire gave less good harbourage to vermin of all kinds than the old rotting, timbered ones. While, on the other hand, the erection of docks and warehouses, due to the development of trade and the building of closed-in sewers gave suitable environment to the brown rat. In Bombay, at the present time, the brown sewer rat is displacing the black house rat in the Europeanized parts of the city, while the black rat holds its own in the Easternized suburbs.[13] This change in the rat population may well have been an important factor in the retreat of plague in the 18th century. Another favourable factor was the introduction of the sea route to the East.

The weight of evidence, however, suggests that it was the improved quarantine regulations which really conquered this dread infection. To those familiar with the corruption and ineptitude of most public administration in Europe in the 18th century this may seem an incredible proposition, but Plague was a word to conjure with, it roused the corrupt and inefficient officialdom of the 18th century to drastic action, in which action the support of the population was assured. The horror which a disease inspires is not necessarily in proportion to its death dealing powers, it is dependent on the repulsiveness of its symptoms, and on the rapidity with which it kills, since, though the fear of sudden death may be illogical, it is very deep seated and has religious sanction. Familiarity breeds contempt, therefore an epidemic disease is more feared than an endemic one; also the death rate of an epidemical disease is more noticeable. An illness which recurs every 25 years and kills say, $\frac{1}{5}$th of the population in one year attracts more attention than one which kills say, $\frac{1}{125}$th annually. The rapidity with which an infection spreads and the rate of mortality among the infected will also be factors in the degree of dread which

a particular epidemic will inspire. The plague stands out pre-eminent in the possession of these qualities. It was epidemic in Europe, recurring in the 17th century roughly about once in every generation, its symptoms were horrifying, it killed quickly, it spread rapidly and it slew a large proportion of those attacked.

The 18th and early 19th century writers attached great importance to proper quarantine regulations for plague. Mid 19th century writers poured scorn on these methods and thought that quarantine had had nothing to do with the extinction of the disease.[14]. The reason probably was that Asiatic cholera, which was the scourge of the mid 19th century and which was only introduced into Europe in the '30's, was not contagious in the narrow sense, but was spread through the pollution of food and of water, the latter in particular. The general introduction of water drainage, often into rivers which were a source of water supply, caused this disease to spread rapidly and ordinary quarantine, if the hospitals used the common drain, was, of course, quite ineffective as a preventive once the infection was introduced into a country. It was typical of a certain lack of elasticity in early Victorian thought to condemn a method as ineffectual for all disease, because it had been found to be ineffectual for one. It was typical of the practical 18th century mind that it found the correct method of combating three great scourges, not by any application of general theory but by the correct observation of facts. There was one great advance in practice which probably contributed largely to the success of the measures against plague. The old method had been to shut the victims of the plague into their own houses, placing a mark upon the door forbidding all exit and entry; this not only condemned all the inmates to almost certain death, but placed a premium upon concealment and evasion. Attempts were also made to avoid all communication with infected districts; this policy also led to evasion. As early as the 15th century the Venetian authorities established plague "lazarettos" to which victims were removed[15] and in the 16th century substituted quarantine for prohibition of movement. This enlightened policy gradually

spread to the rest of Europe. Mead recommended it in his "Short Discourse on Pestilential Contagion (1720)" written by command during a scare caused by the outbreak of plague at Marseilles. The period of 40 days was chosen for quarantine, not from medical observation, but possibly through association with Lent, and the fortieth day was also considered a critical one in disease.[16]

The Venetian Government not only established quarantine regulations for persons coming from infected ports but invented the system of Bills of Health carried by captains of ships. Letters of Health written by the Consuls of the various nations trading in the Levant first became customary about 1665. Percival[17] the younger ascribes the extinction of plague to the establishment of lazarettos and quarantine on the Venetian model. An 18th century writer says, "Plague now seldom gains admittance into other European sea ports" (i.e. other than Constantinople) "and even if imported, the wise precautions and regulations adopted by quarantines, check its irruption: this is a most important improvement in the police of modern states".[18]

The enforcement of quarantine for plague was assisted by the organization of the Levant trade, which was of an official or semi-official character. The Ottoman Government gave trading privileges not to individuals, but to the regulated companies which themselves stood in a quasi-official relation to their own governments. One of the duties laid upon the companies was the carrying out of the quarantine laws. Since the companies had many enemies, clamouring for the abolition of their privileges, and since the necessity for quarantine regulations was a strong argument for the retention of these privileges, the companies had good cause to carry out the charge faithfully. When in 1743 a proposal was brought forward in Great Britain to throw open the Levant trade, the Turkey Company in its defence stated that "the latitude given by the Bill in exporting and importing renders impracticable the restraints that may be necessary to obviate the dangers of infection". In the Act of 1754 which threw open the membership of the Company to any British subject upon a payment

of £20 and upon taking the oath of allegiance and of obedience, it was specifically stated that the quarantine regulations were to remain in force.

The French trade with the Levant was strictly regulated. The French Levant Company was under government control and all the trade had to be conducted through Marseilles. Though at one time Dunkirk and Rouen gained the privilege of importing goods direct it was only upon payment of an excess duty of 20%. In 1701 the deputies of the trading towns of the West petitioned against the privileges of Marseilles and among other arguments the petitioners stated that "the pretence of contagious distempers ought not to be made use of against the towns of the ocean to exclude them from this trade". The deputies of Marseilles said in their reply that whatever their rivals might say as to the small danger "of bringing the plague into France, it is almost certain they could not avoid it . . . the contagious distemper never ceasing to be in the Levant and Barbary . . . because in those countries they take no precautions to avoid it, these gentlemen having neither experience, nor proper places for purging the merchandizes from that evil which cleaves to them (as is found true at Marseilles, where oftentimes several die of the plague during the quarantine) would infallibly give the plague to France, which they of Marseilles avoid, by rules which are more rigorously observed there than in any city in the world".[19]

A description of the quarantine methods of the late 18th century will be found in Howard's Lazarettos (1791). He describes the plague lazarettos "as effectual for the prevention of the most infectious of all diseases". At Marseilles the quarantine was 20 days for ships with a clean bill and 31 days for ships with a foul one. In Malta the corresponding periods were 18 and 80 days. Bales of cotton goods were opened and exposed to the air. A foul bill meant that plague had been reported at the port from which the vessel came; most ports did not receive a ship upon which plague had actually occurred. Howard mentions Leghorn as an exception, this port had three Lazarettos and received ships which had the plague and they were not "chased away or burnt" as in many places. This is a tribute

to the humanity and good sense of the Jewish merchants who ruled this port and incidentally illustrates the degree of general horror inspired by the plague.

Under the Act of Geo. III, Chapter 26, British ships coming from the Levant with a foul bill were compelled to perform quarantine either at Malta, Ancona, Venice, Messina, Leghorn, Genoa or Marseilles. British ships were only given a clean bill if no case of plague had been reported in Smyrna for 40 days. British merchants complained very much of these regulations, they alleged that the Greeks often gave false information that plague was raging in order to benefit themselves and the Dutch and that the cotton was often spoiled when the bales were opened at the quarantine stations. They further alleged that half the cotton manufactured in England was purchased through Holland, France and Italy and that since these nations, particularly the Dutch, did not strictly carry out quarantine regulations, the British merchants were exposed to very unfair competition.[20] Perhaps this impediment to trade was one reason for the rapid development of the American sources of the cotton supply. Howard seems to have thought that the quarantine regulations were carried out fairly thoroughly except in Venice, where, though there were elaborate regulations, there was such "remissness and corruption" in their execution "as to render the quarantine almost useless".

Alexander Russell, who was for many years the doctor attached to the English factory at Aleppo, has left a detailed description of the measures taken against the plague by the foreign colony in that city. When the existence of plague was proved the foreign merchants isolated themselves and "an almost total stagnation of trade immediately follows".[21] This practice seems to have been general in the Near East and in itself was a great safeguard for Europe. It is true that the natives often managed to conceal the existence of plague, but with a virulent outbreak concealment was impossible. Patrick Russell, brother to Alexander, though he says that "Bills of Health are not entitled to that degree of credit they ought to have" yet held the opinion that "the Maritime States of the Mediterranean furnish sufficient proof of the utility of Lazarettos . . . in almost

all instances the causes of failure have been traced to negligence . . . or to clandestine infraction of the regulations of quarantine ".[22] This same writer relates how in 1743, when the plague was raging at Messina, a British man of war, the Scipio, was performing quarantine in the Thames. A clerk and the boatswain left the vessel and were tried by courtmartial for the offence. The Clerk was committed to the Marshalsea for six months and the boatswain was condemned to death. The general evidence is, that though the quarantine regulations were normally carried out with a good deal of slackness, yet a virulent outbreak of plague at any spot led to very drastic enforcement of quarantine in other places. For instance, the serious outbreak of plague in 1720 in France, generally ascribed to the folly of the physicians in Marseilles who had failed to act drastically, though it spread to Toulon, was effectively checked by a national cordon.

When special regulations were drawn up by Blane to prevent the importation of plague from Egypt upon the return of the army to this country, these measures were successful, mainly owing to the fear this disease inspired, a fear which still lingers in popular memory. During the influenza epidemic of 1918 it was whispered that the illness was really " the plague " ; this rumour was surely a faint echo of the old horror.

The apparent death rate from the plague justified this horror. Howard mentions an outbreak in Spalato in 1784 which caused 1,201 deaths out of a population of 12,200. In 1743–4 Messina was almost entirely depopulated by plague, 70,000 persons perishing. In 1779 about 100,000 were destroyed in Constantinople.[23] The Plague of London in 1665 is said to have destroyed 70,000[24] persons, i.e. about one-sixth of the population of London which was then probably about 400,000. In 1605, two thousand and sixty-five died in Bristol, that is, probably about a quarter of the population.[25] In Manchester there were 1,000 deaths in 1605 and the same number in 1645. We do not know the population at these dates but it was estimated at 8,000 in 1717 and had no doubt increased since 1645. In fact, death rates of 25% do not seem to have been uncommon, but, though the plague often lingered for several

years, it was most fatal at the first outbreak and the greater number of deaths were usually at the beginning of the epidemic. Short says, " the Plague that began in *London* in 1602, was not quite out before 1611 ; and that which broke out in 1637 was not extinct before 1647. In the first year died of it above 10,000, in the last 3,597." Up to 1665 the plague seems to have returned very roughly every 20 years and each outbreak to have lingered about 5 years. Petty said plague recurred about once in 20 years and commonly killed about one-fifth of the inhabitants. Graunt estimated that 25 years in a century were plague years in London and states that there were outbreaks in 1593, 1603, 1625, and 1638.[26] Short said that in Freiburg plague returned five times in a century and in Augsburg about the same.

If we accept the mortality as 20% to 25% the killing power of the plague was equal to an annual mortality of 10 to 12½ per 1,000, the higher estimate being almost equal to the total mortality at the present day! London rates do not seem, however, to have reached these figures. Graunt extracted the deaths from plague as recorded in the Bills of Mortality and found them to equal 81,549 between the years 1604–59. He estimated the population as 400,000 and he calculated that the deaths from plague were underestimated by one-quarter. On this basis the annual death rate from plague in London was about 4½ per 1,000. Moreover, in the 17th century the plague never spread all over the country, it was confined to ports, trade centres and trade routes and a few places accidentally infected, the death rate for the whole country was therefore very much less than this figure. If we take it that only one-fifth of the population were exposed to plague the death rate would only be a little over 2 per 1,000 per annum. Again if we accept the figure of 70,000 for the deaths in the last visitation of plague to London, add 30,000 for deaths in other places, which is a liberal allowance, and take this as the total of deaths for 25 years the annual death rate for the estimated population is under 1 per 1,000. Mr. Bell believes, however, that the deaths in London alone numbered 110,000, which is the not unusual proportion of 25 % of the population. But even if we estimate the deaths throughout the country at 200,000 the plague only

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