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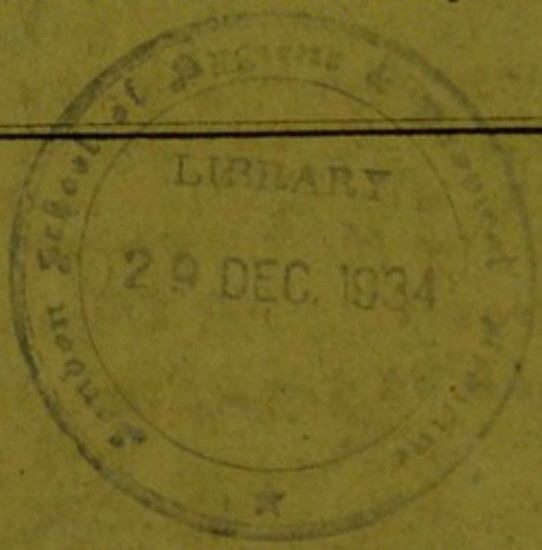
THE BUBONIC PLAGUE,

BY

E. H. HANKIN, M.A.



SECOND EDITION.

THE BUBONIC PLAGUE,

BY

E. H. HANKIN, M.A.

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ACTERIOLOGIST TO THE NORTH-WEST PROVINCES
AND OUDH AND TO THE CENTRAL PROVINCES.

WITH A PREFACE BY

Professor HAFFKINE, C.I.E.

SECOND EDITION.

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PREFACE.

THE need of a popular account of plague at the present time is patent.

Much opposition to plague measures and concealment of the disease is due to the want of knowledge as to the danger that one is trying to guard the people against. Professor Hankin, with the lucidity of style proper to his writings, has given an account of plague outbreaks as they have affected people ignorant of the nature of the disease, and has shown how the terrors of plague are aggravated by that ignorance.

A feeling of surprise, or perhaps even of irritation, may arise because Europeans so largely escape the plague, while natives of India suffer. In this tract it is shown how the ancestors of the European suffered more severely than do now the natives of India,—in part at least also because of their ignorance of the nature of the malady.

Besides abandoning the localities attacked, and disinfection, the measure which is discussed in the book with detail, is the anti-plague

inoculation. The author of the tract has su ceeded in describing the results of this measu in a manner which will be plain to the meane intellect. He has avoided a theoretical disc sion of the subject, but has represented it that practical form in which it concerns t public.

The tract may attract criticism by what has omitted. The author's wish has been avoid, so far as possible, matters about whi doubt or discussion may arise. Theories as the propagation of the plague, which, howe probable, may be regarded as not definit established, have been scrupulously exclud His object has been to write a pamphlet circulation of which may tend to dimin unreasonable opposition to what are genera admitted to be necessary or advisable measu

Scarcely any other remarks are called with regard to a book by a writer whose na and work is so well known in every town India.

W. M. HAFFKINE

BOMBAY:
The 4th January 1899.

AUTHOR'S PREFACE.

I was once talking to a fakir of high position, who had used his influence to good effect in persuading his neighbours to submit to the measures that were necessary in dealing with an outbreak of plague. He asked me whether it was not true that some sahib had taken the poison out of a cobra and put it into the head-works of the Bombay water-supply, and that in this way the plague had been produced and had spread so rapidly over the town. I informed him that plague was not a water-borne disease as was cholera, and that hence his theory was not likely to be true. His belief in this ridiculous story was due to ignorance, and not to lack of intelligence. The incident suggested to me the advisability of writing a pamphlet in which plague should be described in simple narrative form, suitable to the intelligence of the leading men in native communities whose co-operation during plague outbreaks is so valuable to Government.

In the historical part of this pamphlet, I have made extensive use of "The Great Pestilence," by

Gasquet, Creighton's "History of Epidemics in Great Britain," and an old translation o Boccaccio's Decameron.

Besides from my personal experience, information as to the plague in India has been obtained from the published official reports on the plague in Bombay and other official publications. I have also quoted from an interesting and valuable paper by Colonel Hutcheson, Inspector General of Civil Hospitals, North-Western Provinces and Oudh, which he communicated to the Indian Medical Congress of 1894, and which is published on page 304 *et seq.* of the Transactions. I have taken the quotation from the *Bhagavati Purana* on p. 22; from an address delivered to the Graduates of the University of Madras on the 25th March 1898, by Colonel King, *I.M.S.*, Sanitary Commissioner for Madras. This pamphlet has been printed and published by Addison & Co., Mount Road, Madras. It will well repay study by those interested in the traces of sanitary effort discernible in various Indian caste customs. My information as to a probable source of the plague in Bombay is taken from a paper by Dr. Simond, entitled "La Propagation de la Peste," published in the "Annales de l'Institut

Pasteur" for October 1898. For information relating to plague in the town of Hubli, I am indebted to valuable reports by Captain Meyer and Major Collie, *I.M.S.*, communicated to the Bombay Medical and Physical Society in February and April 1898.

I owe my thanks to Professor Haffkine for having written a preface to this book, and for having kindly communicated to me extracts from official returns relating to the results of inoculation in the town of Hubli, on which extracts my account is based.

E. H. HANKIN.

AGRA, *January* 1899.

THE BUBONIC PLAGUE,

BY

E. H. HANKIN, M.A.

CHAPTER I.

THE PLAGUE IN EUROPE.

SOME years ago I wrote a tract, entitled "The Cause and Prevention of Cholera," in which I showed that anyone understanding the cause of the disease may take simple precautions against its spread, and also that the occurrence of outbreaks may be to some extent prevented by observance of certain ancient customs that exist among the people of India. This tract has now been translated into thirteen languages, and its circulation appears to have been of use in checking cholera. Government has adopted the plan therein suggested of hiring Brahmins to draw water for pilgrims in accordance with Hindu custom, and has introduced a similar arrangement on famine relief works with apparent benefit as indicated in the official reports on the famine. Similarly it is probable that a knowledge of the nature of plague will be of use in leading people to protect themselves against this terrible disease, and will

be the best preventative of the panic by which it is so often accompanied.

The present pamphlet is not an official publication. I merely express my own opinions. I shall make no reference to what might or might not be done by Government on the occurrence of plague, but shall merely describe the disease, and indicate what individuals may do to protect themselves from the risk that it presents.

It is sometimes believed that plague is due to *kismet*, and that one can no more protect oneself from plague than one can from an earthquake. The destruction of property in an earthquake is spoken of as *kismet*, because it is due to an unavoidable accident. But I shall show in this pamphlet that plague is not due to an unavoidable accident, but to certain causes which can actually be avoided, and that the infection of plague is actually avoided by the inhabitants of the Gurhwal Hills, who owing to their understanding its nature are able to take precautions that actually do limit its spread. Who needing a dose of medicine would prefer to talk of *kismet* instead of curing his indigestion? Surely it would only be the most ignorant of men, to whom such a trouble would be an unavoidable accident, and who therefore would describe it as due to *kismet!* Similarly with plague, to the ignorant it appears as *kismet*, but to the learned it is known to be due to causes that can be avoided and controlled. In serious

s in trivial affairs, it is right and necessary to use nowledge to protect oneself from danger, and eading this book will, I hope, give the knowledge nat is necessary to protect oneself from the danger f plague.

To indicate the effects of plague, I shall first escribe an outbreak that took place in Europe ome hundreds of years ago, when the people and he governments were alike ignorant of its nature. shall then describe the disease as it exists in he Gurhwal Hills in the Himalaya Mountains, here, as stated, the inhabitants understand its ature and without help from Government can take ecessary precautions for their safety. I shall hen discuss the cause of the disease.

In the year 1347, the country north of the Crimea in Russia was invaded by the Tartars. The Christian merchants who lived there collected themselves in the town of Gaffa on the sea coast. Among them was a notary named Gabriele di Mussis, who has left an account of the succeeding events from which the following information has been obtained. The Tartars following the fugitive Italian merchants laid siege to the city of Gaffa. Completely encircled by a vast army of enemies, the inhabitants were hardly able to obtain the necessaries of life, and their only hope lay in the fleet which brought them provisions. Suddenly "the death," as it was called, broke out in the Tattar host, and thousands were daily

carried off by the disease, as if arrows from heaven were striking at them and beating down their pride.

At first the Tartars were paralysed with fear at the ravages of the disease, and at the prospect that sooner or later all must fall as its victims. They then turned their vengeance on the besieged and in the hope of communicating the infection to their Christian enemies, by the aid of the engines of war, they threw the bodies of the dead over the walls into the city. The Christian defenders, however, held their ground, and committed as many of these plague infected bodies as possible to the waters of the sea. Soon the disease broke out among the defenders. The Christians then betook themselves to their ships and evacuated the town. Unfortunately they carried the infection with them in their ships, and these ships were the means of the introduction of the plague into many of the maritime towns of the different countries of Europe. Thus originated the most terrible outbreak of plague recorded, which since has become known to the history as the "Black Death."

The first port at which they stopped was Constantinople. Shortly after their arrival the disease broke out, and inconceivable number of persons were destroyed. The son of the Emperor was carried off after a three days' illness. The Emperor himself wrote an account of the pestilence. He says that neither

regularity of life nor bodily strength was any preservation against it. The strong and the weak were equally struck down, and death spared not those of whom care was taken any more than the poor destitute of all help. He describes the sleeplessness and restlessness of some sufferers, and the plague spots that broke out over the body in most cases. The profound discouragement of the sick was especially sad to behold, and appeared to influence unfavourably the course of the disease. The Emperor states that those who recovered had no second attack, or at least none of a serious nature. Thus early in the history of our knowledge of the disease were facts observed indicating the possibility of a protective inoculation against plague.

But Constantinople was not the only town infected by the ships of the fugitives. After leaving Constantinople, the Italian merchants sailed to Messina in Sicily. A Franciscan friar, Michael Platiensis, thus describes the advent of the disease to this country :—"A most deadly pestilence sprang up over the entire island. It happened that in the month of October in the year of our Lord 1347, about the beginning of the month, twelve Genoese ships, flying from the divine vengeance which our Lord for their sins had put upon them, put into the port of Messina, bringing with them such a sickness clinging to their very bones that did any one speak with them he was directly struck with a mortal sickness from which there was no escape,

The one thought, he says, in the minds of all, was how to avoid the infection. The father abandoned the sick son; magistrates and notaries refused to come and make the wills of the dying; even the priests to hear their confessions. The houses of the dead were left open with their money, jewels, and valuables; if anyone wished to enter, there was no one to prevent him. The great pestilence came so suddenly, that there was no time to organise measures of protection; from the very beginning officials were too few, and soon there were none." "What shall I say more?" adds the historian: "So wicked and timid were the inhabitants of the town of Catania, that they refused even to speak to any from Messina, or to have anything to do with them, but quickly fled at their approach. Had it not been for secret shelter afforded by some of their fellow-citizens, resident in the town, the unfortunate refugees would have been left destitute of human aid."

Three plague-stricken vessels put into the port of Genoa in January, and their arrival was shortly followed by an outbreak of the disease. In this town it is stated that hardly a seventh of the population was left alive. Many houses were left unguarded, and persons engaged in stealing from these deserted houses soon learnt to their cost that the clothing and bedding of plague patients is capable of conveying the disease. Some Genoese merchants fled to Piacenza, and sold the merchandise

hey had brought with them. The purchasers nd their host, together with all his family, were uickly stricken with the sickness and died. The isease then spread throughout the town. The ortality became so great, that it was found neces- ary to dig trenches to receive the bodies of the ead. It frequently happened, says the historian hat a husband and a wife, a father and a son, nay whole families, were cast together into the same pit. Similar events happened in the neighbouring villages. It is related that one Oberto di Sarson who had come one day from an infected village to the church of the Friar Minor to make his will, called thither a notary, witnesses and neighbours. All these, together with others, to the number of more than sixty, died within a short space of time.

Another of the plague-stricken vessels brought the infection to Venice. From this town and Genoa the infection rapidly spread over the whole of Italy. The following is Boccaccio's account of the advent of the disease to Florence :—

"In the year of our Lord 1348, there happened at Florence, the finest city in all Italy, a most terrible plague : which, whether owing to the influence of the planets, or that it had been sent from God as a punishment for our sins, had broken out some years before in the Levant, and after passing from place to place, and making incredible havoc all the way, now reached the West, where, in spite of all the means that human foresight could

suggest, as keeping the city clear from filth, and excluding all suspected persons: notwithstanding frequent consultations what else was to be done; nor omitting prayers to God in frequent processions, in the spring of the foregoing year it began to show itself in a sad and wonderful manner: and differing from what it had been in the East, where bleeding from the nose is the fatal prognostic, here there appeared certain tumours in the groins or under the armpits, some as big as a small apple, others as an egg: and afterwards purple spots in most of the body, in some cases large but few in number, in others less but more numerous, both sorts the usual messengers of death. Some holding it best to live temperately, and to avoid excesses of all kinds, made parties and shut themselves up from the rest of the world, eating and drinking moderately of the best, and diverting themselves with music, and such other entertainments as they might have within doors: never listening to anything from without to make them uneasy. Others maintained free living to be a better preservative, and would baulk no passion or appetite that they wished to gratify, drinking and revelling incessantly from tavern to tavern, or in private houses, which were frequently found deserted by their owners, and therefore common to everyone, yet avoiding with all this irregularity to come near the infected. And such at this time was the public distress, that the laws human and divine were not regarded: for the officers to put them in force, being either dead, sick, or in want of persons

o assist them, everyone did just as he pleased. A hird sort of people chose a method between these wo : not confining themselves to rules of diet like he former, and yet avoiding the intemperance of he latter; but eating and drinking what their ppetites required ; they walked everywhere with dours and nosegays to smell to : as holding it best o corroborate the brain ; for they supposed the hole atmosphere to be tainted with the stink of ead bodies, arising partly from the distemper self, and partly from the fermenting of the edicines within them . . . . . Divided as they ere, neither did all die nor all escape, but falling ick indifferently, as well those of one as of another pinion : they who first set the example by forsak- ng others now languished themselves without ercy. I pass over the little regard that citizens nd relations showed to each other : for the terror as such, that a brother even fled from his brother, wife from her husband, and what is more uncom- on, a parent from his own child." Boccaccio goes n to describe how the numbers of the dead soon ecame so great that it was impossible to bury them ll in consecrated ground. They were forced to dig renches, and to put them in by hundreds, piling hem up as goods are stored in a ship, and hrowing in a little earth till they were filled to the op. He states, that it is supposed that more than 00,000 persons perished in the city, whereas efore that time it was not known that the popula- ion reached that figure. " What magnificent

dwellings," he says, "what noble palaces were then depopulated to the last person! What families extinct! What riches and vast possessions left, and no known heir to inherit! What numbers of both sexes, in the prime and vigour of youth, whom in the morning either Galen, Hippocrates, or Æsculapius himself, but would have declared in perfect health, after dining with their friends here, have supped with their departed friends in the other world!"

In Sienna, says di Tura, so many died, that neither money nor position availed to procure porters to carry the dead to the public pits. "And I, Agneola di Tura," writes this author, "carried with my own hands my five little sons to the pit; and what I did many persons did likewise."

The Italian poet Petrarch gives an account of the disease in the town of Barma, where it is stated 40,000 persons perished. In reference to one of his acquaintances, Petrarch writes: "He was suddenly seized in the evening by the pestilential sickness. After supping with friends he spent some time in conversation with me, in the enjoyment of our common friendship, and in talking over our affairs. He passed the night bravely in the last agony, and in the morn was carried off by a swift death. And that no horror should be wanting, in three days his sons and all his family had followed him to the tomb!"

As already stated, the disease had been brought by three of the fugitive ships to the port of Genoa, where hardly a seventh of the population survived after the pestilence had done its work. As soon as the Genoese recognised that these ships were the source of their infection they compelled them to leave their port, and one arrived in Marseilles, in the country of France, still carrying the germs of the disease. In Marseilles the disease spread with such appalling rapidity, that in one month it is stated to have carried off 57,000 of the inhabitants of the town and neighbourhood. Fugitives soon carried the disease to other towns in France. The following account was given by a priest who witnessed the outbreak in Avignon:—

'The disease is three-fold in its infection; that is to say, firstly, men suffer in their lungs and breathing, and whoever have these corrupted, or even slightly attacked, cannot by any means escape or live beyond two days. Examinations have been made by doctors in many cities of Italy, and also in Avignon, by order of the Pope, in order to discover the origin of the disease. Many dead bodies have thus been opened and dissected, and it is found that all who have died thus suddenly, have had their lungs infected and have spat blood. The contagious nature of the disease is indeed the most terrible of all the terrors of the time, for when any one who is infected with it dies, all who see him in his sickness, or visit him, or do any business with him, or even carry him to the grave, quickly follow

him thither, and there is no known means of protection."

"There is another form of the sickness, however, at present running its course concurrently with the first ; that is, certain aposthumes appear under both arms, and by these also people quickly die. A third form of the disease like the two former, running its course at the same time with them, is that from which people of both sexes suffer from aposthumes in the groin. This likewise is quickly fatal. The sickness has already grown to such proportions that from fear of contagion, no doctor will visit a sick man, even if the invalid would gladly give him everything that he possessed; neither does a father visit his son, nor a mother her daughter, nor a brother his brother, nor a son his father, nor a friend his friend."

A doctor Guy di Chauliac has left an account of the disease in the town of Avignon. He describes the bubonic and the pneumonic forms of the disease, and notices that the latter form is the more highly contagious. He states that the pneumonic form lasted for two months. The other form was more prevalent during the remaining five months that the disease was present. He computes that hardly a fourth part of the population was left alive.

An account of the disease in Tournay is given by Gilles di Luisis, the Abbot of St. Martin's, who

itnessed the events; he describes: "I heard," he ays, "from many, about Christmas time, who pro- ssed to know it as a fact that more than 25,000 per- ons had died in Tournay, and it was strange that he mortality was especially great among the chief eople and the rich." In apparent contradiction o this statement, he goes on to say, "deaths were ore numerous about the market places, and in poor arrow streets, than in broader and more spacious reas. And wherever one or two people died in any ouse, at once, or at least in a short space of time, the est of the household were carried off. So much so, hat very often in one home ten or more ended their ives together, and in many houses the dogs and even ats died. Hence, no one, whether rich, in moderate ircumstances, or poor, was secure, but every one rom day to day waited on the will of the Lord."

From the infected towns in France and Italy, the disease spread over all the countries of Europe within the next three years. Clyn, a monk, saw it in Kilkenny, in Ireland, in 1349. In his account of the disease, he says:—"For many died from carbuncles and boils, and botches which grew on the legs or under the arms; others from passion of the head, as if thrown into a frenzy; others by vomiting blood." It was so contagious, he says, that those who touched the dead, or even the sick, were infected and died, and both penitent and confessor were borne together to the same grave. Such was the fear and horror of it that men scarce

dared exercise the offices of pity, namely, to visit the sick and bury the dead.

The disease was brought to Weymouth, in England, in August 1348. From that place it spread rapidly throughout the country. An account of it was left among others by Geoffrey de Baker, a clerk of the Abbey of Osney near Oxford. Of this disease, he says, few of the first rank died, but of the common people an incalculable number, and of the clergy and cleric class a multitude known to God only. It was mostly the young and strong who were cut off, the aged and weakly being commonly spared. The historians speak of whole villages being left desolate, and of numbers of houses, both great and small, as left empty and falling to ruin.

The following figures are given by Proust of the mortality produced by the Black Death :—

100,000 deaths in Venice and in London.

70,000 in Sienna.

60,000 in Florence and Avignon.

50,000 in Paris.

The order of Capuchin monks lost 126,000 of its members in Germany.

The order of Minorite monks lost 300,000 in Italy.

In Germany there were 1,200,000 deaths.

Italy lost half of its population.

The plague is supposed to have destroyed ,000,000 out of the 105,000,000 inhabitants of irope.

From this short account of the Black Death, ich I have given for the most part in the very words eye-witnesses of the event, it is obvious how much ore serious it was than the present outbreak has en in India. We now know that plague can be ught by living in an infected place without any ntact whatever with a plague patient. The in- bitants of Europe at that time did not know this. ey often observed that people were attacked with gue who certainly had never seen a plague patient. explain this fact they assumed that the contagion s often conveyed by persons who had been infect- but in whom no symptoms of the disease had yet veloped, and, as already shown, they believed that rely talking to such a person was sufficient to nvey the infection. The same mistaken belief ded to the distress in the great plague of London 1665. Hence it was that doctors, through fear contagion, in so many cases refused to see or escribe for plague patients; hence it was that usands of persons attacked by plague were left die without help or assistance from their relations friends. Now-a-days, on the other hand, we know at speaking to a person from an infected locality not of itself likely to convey the disease. Now know that the patient is not the chief source danger in an epidemic of plague, but the fected house or place in which he contracted the

disease. Never in India has a doctor or official deserted his duty from fear of plague. I have seen English ladies visiting plague hospitals in Bombay, having no fear of catching the disease, because they did not live in houses where men or rats were being attacked. In Bombay, instead of plague patients being left to die as happened in the Black Death, they were treated by doctors or brought to hospitals where they were tended and nursed by their own friends and relations. These relations, as long as they remained in the hospitals, did not catch the disease, which would probably have been their fate if they had stayed in their infected houses. It was only among the most ignorant classes in Bombay that it ever happened that a plague patient was deserted by his friends and left alone to die.

But the ignorance of the people of Europe during the Black Death not only added to the terrors of the plague itself, but it also was the cause of great cruelty to the Jews who then lived in Europe. Owing to their religion and habits being different from those of the Christians, they were distrusted and hated by the latter. When the plague came and whole families were being destroyed in a way that is done by no other disease, a suspicion was spread that it was due to the Jews having poisoned the wells. Some Jews were thereupon caught and tortured. One of them under the stress of the torture, though innocent, confessed that he had poisoned the wells. A great persecution of the

ws then began. Thousands were killed. In e town 2,000 of them were put upon a scaffold d burnt. In other places the Jews were entirely stroyed as a precaution against the spread of gue! In the countries of Europe, in which these ocious cruelties were enacted, there is still a tred of the Jews, which hatred we are probably ht in regarding as the only surviving effect of e Black Death on the present day society of rope. Neither in England nor in India does any ch feeling exist towards the Jews, either among ndus, Mahomedans or Christians. On the con-ry, under the auspices of the Government of dia a learned member of this race, Professor affkine, has carried out researches on the nature plague, and it is chiefly to the results of his work at individuals must look for protection against e disease. How this is the case, will be shown a later chapter of this pamphlet.

CHAPTER II.

THE PLAGUE IN INDIA.

DURING the past five hundred years, and indee so far back as history relates, only on three occa sions has there been an outbreak of plague that ha spread through a great part of the country of India The first of these outbreaks was in the year 161 and lasted for six years. Its appearance in Agr (where it remained for three years) was describe by the Emperor Jehangir in his diary. He describe the mortality among rats that so often preceded th outbreak among human beings. He states that "a last everyone became so terrified, that if a perso was attacked, no one would go near him, and h was left alone to either die or recover as fate willed." The next outbreak was in 1685, and lasted for seve years. The third outbreak began in Bombay i 1896, and still continues.

In Europe, on the other hand, when plague wa introduced at the time of the Black Death, it remained for about three centuries, sometimes smouldering or

early disappearing, at other times breaking out in evastating epidemics. In the town of London lone, for instance, during this time there was a erious epidemic on an average once every fifteen ears. Indeed, it is a fact that during these three enturies but few years elapsed in which some cases f plague were not recorded. At the end of this eriod, after a specially severe outbreak in London, he disease suddenly disappeared both from London nd from the whole of Europe. This disappear-nce of the disease is a remarkable fact, for which o adequate reason can be suggested. Improve-ent of the sanitary condition was gradual; dis-ppearance of the plague was sudden. But plague as since been introduced into certain parts of urope. For instance, in the year 1720, it was nported into Marseilles from the East, and pro-uced an epidemic of terrible severity. Judged by e proportion of the inhabitants attacked, it was teen times as severe as the Bombay outbreak f 1896-97.

In the district of Gurhwal, in the Himalaya ountains, plague at the present day occurs equently as used to be the case in Europe. The rst outbreak in Gurhwal, of which authentic cords exist, was in 1823. Since then twenty-four her outbreaks have occurred. Owing to this equent occurrence of plague, the inhabitants nderstand what precautions are necessary. On e appearance of the disease, they immediately

desert their villages, and live in the jungle. They do not return until at least a month after the occurrence of the last case. These fugitives are not allowed to enter other villages by their inhabitants, as these latter well understand the risk of allowing the entry of persons coming from infected places. The inhabitants of Gurhwal, not only desert their villages when human beings are attacked, but even segregate themselves if they notice a mortality among the rats. It is now known that plague attacks both men and rats, and the death of rats is a sign of the infection of the locality. If, on the occurrence of plague, the inhabitants neglect these precautions, they are likely to suffer severely from the disease. As an illustration of this, I may quote the account of an outbreak in the village of Semi, which was published in the "North-West Provinces Government Gazette" of the 22nd May 1897. Before the outbreak the village contained 24 inhabitants. Assistant Surgeon Babu Govind Dass was sent to make an investigation. The following is his account:—

"The outbreak began in the house of Padhan: one middle-aged man got fever, but the attack was not so sharp as to lay him down, as he was seen going about. This man noticed the enlargement of the glands of his armpit, but did not tell this to his neighbours, lest on hearing about the outbreak they may all go away to the jungle leaving him alone there to die unattended. His wife who was nursing him got fever, and died within 24 hours.

Her sudden death led the neighbours to suspect the outbreak, and her husband was obliged to give out the real cause. Soon it began to manifest itself in others. On the 25th February the Officer in Charge of the Oklimath Dispensary reported five dead, two recovered, and two still suffering. The inhabitants were then dispersed in the jungle. There they had been only a few days, when a party of four men pretending to perform some religious ceremony to prevent further spread of the disease, went over to them, and got them together, and performed some religious ceremony, and on the assurance that so long as they remained in their company they would not be attacked by the disease, they made them return home unnoticed by the patwari. No sooner they returned in their village than the disease began to show itself amongst them with much severity and by the 8th March, five more died." It follows from the Assistant Surgeon's account that, in spite of a second dispersal, the whole of the party, that had believed in the religious ceremony and accompanied the charlatans back to the village, were within a few days carried off. Some of the villagers, however, who had left the place at the first dispersal and had not been persuaded to return, have remained free of infection. Thus owing to the inhabitants deserting their usual and useful custom of dispersing, and believing in a foolish superstition, no less than 17 deaths occurred in a total population of 24 individuals. The Assistant Surgeon,

having completed his investigations, burnt the village, with the consent of the surviving inhabitants, and no more cases occurred.

Besides the three widespread outbreaks of plague, already mentioned, two or three smaller outbreaks of plague are known to have occurred in India, as the Gujerat Plague in 1812—21, and the Pali Plague in 1836-37. It is probable that other outbreaks have occurred in old times, for in the ancient books of the Hindus, directions for conduct in time of plague are given. The following is a quotation from the *Bagavathi Purana* :—

The Goddess said :—

"On the order of Brahma, myself, Indra, and other gods will visit the people of various villages. Thus visiting village after village, and putting to death all the wicked people, will at last go to Brahma. Intelligent people understanding my approach will always do virtuous actions, will study the Shastras, and will ever be very careful. On the moment, rats fall from the roof above, jump about and die, they will at once leave their houses with their friends and relations and will go to a plain. There they will do all rites, will utter Mahamarika mantrams (prayers), and will recite stotrams (verses) . . . . . In the forest where there is water convenience they will sit . . . . . They will have the image of the deity before them and will show dupam (incense) and dipam (sacred lamp), and will perform puja (prayers) every day systematically

according to the Shastras. Homam will be performed on fire with cooked rice mixed with saffron powder, ghee, and with sacred twigs in the midst of Brahmins, relations, friends, and servants. ..... After praying to the Goddess with great faith in the above manner, they will sit for meals with their relations, always thinking of the deity. After some days, if crows come and sit on their temporary dwellings, they will start to their original home after performing Kaka Santhi (a ceremony to the crows). They themselves well adorned will start with their family and innumerable Brahmins on an auspicious day, and in an auspicious hour. In their homes Brahmins will be requested to recite Vedas and to perform Santhi Homam (a ceremony in which incense is burnt on the sacred fire)."

Thus in one of the most ancient sacred books of the Hindus, it is stated that on the occurrence of plague, even among rats, the house should at once be vacated. The description indicates the rats falling from their nests in the roofs of thatched houses, jumping about on the floor, and dying, exactly as occurs to-day in plague-infected villages. On arriving at the place of temporary encampment, the family are enjoined to recite verses and hymns, which Hindus can only do after taking off the clothes and bathing. It is further enjoined that they should perform prayers every day, which among the Hindus can only be done after bathing, and that they should burn incense in the presence of

friends, relations and servants. That this fumigation should be extended to the servants is a most unusual point in Hindu religious ceremonies, and interesting as plainly in accord with some modern practices in combating plague. For it is recognised that whatever precautions in the way of cleaning or disinfecting may be required for those who have come in contact with the patients, should also be applied to everyone who has lived in the house. After a sufficient interval, the family returns to the house well adorned, a condition which is likely to necessitate a general washing of the family clothes and linen. On arrival at the house certain religious ceremonies have to be carried out in the presence of the sacred fire. According to Hindu custom such ceremonies can only take place after the house has been purified by white-washing and leeping. Whether or not the passage quoted is an interpolation, it can scarcely be doubted that the writer was acquainted with the nature of plague.

On the appearance of plague, should it be regarded as *kismet*, and should one take no precautions, or should one follow the rules above quoted from ancient Shastras? That it is advantageous and wise to follow such rules, is proved by the following examples.

Adjoining the town of Sukkur is a quarter known as Gharibabad. This was inhabited chiefly by poor people, about a thousand in number. The plague appeared among them, and raged with such

violence that within sixteen days 400 of them had been attacked. The survivors (601 in number) then left the town, and went and lived in grass-huts in an open space. One person was attacked on the day after arrival, but after this they all remained in good health.

On one occasion plague appeared among the Railway porters and their families, who were living near the Railway Station at Igatpuri. As no grass-huts could be quickly obtained, they were sent to live in railway waggons ; and as soon as this had been done, the disease came to an end.

In many other cases too numerous to mention, it has been observed that when plague has appeared in a house, the surviving inmates can be saved if they go away and live in huts outside the town or village.

Thus both the ancient sacred books of the Hindus, and the ancient custom of the inhabitants of the Gurhwal Hills, show how the ravages of plague may be greatly checked by simple precautions.

Though it is easy for the inhabitants of villages to take such precautions, for the inhabitants of towns to do so, is often inconvenient. Dwellers in towns are often engaged in factories or Government offices, and hence by reason of their urgent business are not able to follow closely all the rules of conduct laid down in the Shastras. Hindus who

travel by rail are often unable to commence their journey at the time advised by the astrologer, because the trains run according to time-tables, instead of starting at auspicious hours. For dwellers in towns, it will often be difficult to move into huts, in the country as ordained in the sacred books when threatened by the danger of plague. Mahomedan merchants having much property and many subordinates may find similar difficulties. For these persons it will be advisable to take advantage of modern knowledge, when plague threatens, as will be described in the next chapter, though it must be admitted that the ancient customs above described are well worthy of respect.

CHAPTER III.

THE CLAUSE OF PLAGUE.

FROM the earliest times people have ascribed outbreaks of plague to some supernatural cause, or at least have sought to explain them by some unusual or wonderful event. It was once thought that plague visitations were due to some corruption of the air produced by an effluvium from the tail of a comet. It happened, however, that plague outbreaks occurred in years when no comet was present in the heavens to which they could be ascribed. It was then thought that plague was due to some corruption of the air produced by the decomposition of filth. Hence it was attempted to combat plague by the opening of doors and windows. At the time of the recent outbreak in Bombay, some people thought that it was due to something unusual in the monsoon, or to an abnormal dampness of the soil or air. Similarly, during the outbreak in Canton, in 1894, it was thought to be due to the season having been exceptionally dry.

But such views were arrived at without due knowledge of the facts of the case, and theories are of little value without facts. Let us therefore begin by examining the facts that are known as to the history of the plague before its arrival in Bombay.

There is a mountainous district in China, called Yunnan, where plague is so frequently present, that as in Gurhwal, the inhabitants desert their villages as soon as they notice a mortality among the rats. As a rule, owing to the difficulties of the route, there is little or no communication between Yunnan and the neighbouring Chinese State of Quansi. But in the year 1892, while plague was prevalent in the former country, some military caravans travelled from thence to Quansi, through about 150 miles of difficult mountainous country. Some of the inhabitants of Yunnan were employed as mule-drivers in these caravans. The destination of these caravans was the Chinese cantonment of Lieng-Cheng. After their arrival at this cantonment, some of the mule-drivers, on being discharged, visited the town of Long-Cheou, which is ten miles distant. While staying in this place they were attacked with plague. From these mule-drivers the infection spread, first through the town, and then to the cantonment. On the approach of winter the epidemic ceased after two neighbouring villages had become infected. On the return of summer, the disease re-appeared in the town and cantonment

but not in the villages, and it was less severe than when it first appeared. But the infection broke out in the Chinese town of Pakkhoi, which is situated at about 150 miles distance. This happened in the year 1893. In February of 1894, it reached Canton, where it is estimated to have caused 100,000 deaths within two months; that is to say, if these figures are true, it was about five times as severe as the outbreak in Bombay. At the commencement of April 1894, it reached Hong-Kong, carried by some of the numerous fugitives, who came there from Canton. In this town it raged during the summer months, and appeared to come to an end in October or November of that year. There was a second outbreak of plague in Hong-Kong which began in December of 1895. In the spring of 1896, the disease was carried by shipping to the island of Formosa, and in September of 1896, it was found to exist in Bombay.

The only other place in which plague is known to have existed shortly before its appearance in Bombay, is the district of Beni-Cheir in Arabia, where there was a small outbreak during 1895.

Thus in other places plague is a disease that is carried from town to town by human intercourse. If this is so for other towns, why not also for Bombay? The disease may have been brought to Bombay either from Hong-Kong or from Beni-Cheir. But the Bombay outbreak is one that has

shown a power of spreading similar to that posseessd by the Hong-Kong outbreak, while, apart from the question of Bombay, the Beni-Cheir outbreak has shown no such power. Hence, of the two possibilities, it is more probable that the Bombay plague came from Hong-Kong.

When the plague began in Bombay, some of the inhabitants thought that it was a judgment from God, sent because some of the women had begun to wear bracelets of foreign manufacture instead of bracelets of the pattern used by their ancestors. These bracelets are said to have been brought from Hong-Kong, and hence there may be a basis of fact in what otherwise appears to be a childish fancy.

Though we can thus form an idea how plague is carried from one place to another, there are many questions regarding the spread of the disease to which no answer can as yet be given. For instance, no one can explain why, when brought to Bombay by human agency, it should forthwith produce a severe outbreak, while, when brought by the same means to Calcutta, it should have produced an outbreak so mild that it might have escaped detection had not the doctors been on the watch. No one can say why plague should last only a few weeks in some places, as Jeddah, while in other places it lasts for years. Neither can one say, why in such places it should break out in some years and

ot in others. Such questions are beyond the apacity of the science of the present day to solve.

Though, therefore, we do not yet know why in ne place many men, in another place few men fall ictims to the disease, we know with complete ertainty the cause of the disease in an infected ndividual.

The most striking and general symptoms of lague are that the patient suffers from fever, nd that certain glands become enlarged and ainful. These glands are generally those present n the groin or armpit. If the disease has a material ause, we may well expect to find it in the part f the body that is most affected. When the plague roke out in Hong-Kong, Professor Kitasato, a ative of Japan, was sent by the Government f that country to study the disease. He examined he contents of the glands of persons dead of lague. He found that these contents consisted of thick mass in which were innumerable quantities f minute rod-like bodies, which bodies have now een recognised as plague microbes. The plague icrobes are vegetables so minute that thousands an be placed on the point of a pin. In my pamhlet on cholera, I stated that the cholera microbe s so small that if 60 of them are placed in a row, ney make a line whose length is equal to the hickness of a hair. The plague microbe is about he same size, but is sometimes a little larger or maller according to the conditions of its growth.

How are we to know whether the plague microbe are the cause or the effect of the disease Researches carried out by Professor Kitasato, and afterwards by others, have shown that these bodies are necessarily connected with plague; for, in the first place, they are always present, if not in all at any rate, in certain stages of the malady secondly, they are completely absent from healthy persons; and thirdly, they are found in no other disease. When the patient is first attacked, they only exist in the first gland to be affected. As the disease progresses, they usually spread to other organs of the body, and towards the time of death exist also in numbers in the blood.

It is now known that microbes are of vegetable nature, and just as a farmer grows rice in one kind of soil, and wheat in another, so scientists can find the right kind of soil in which plague microbes can be grown. Such soils can be made from milk, agaragar (known in the bazar as "Chinische-ghas"), gelatine, and the flesh of goats or sheep. From such substances perfectly transparent liquids known as "bouillon" can be prepared. When kept under suitable conditions, such liquids will remain limpid and transparent for an indefinite time. If a minute trace of the contents of the gland of a plague patient is placed in a flask of such bouillon, the liquid for some time remains perfectly transparent. But after the lapse of two or three days, minute whitish flakes can be seen underneath the surfaoe of the liquid, growing down

almost to the bottom of the flask in the shape of threads of different length. For obtaining this phenomenon the flask must be kept in a perfectly quiet position. Professor Haffkine, who first discovered this property of the plague microbes, called it the *stalactite growth in bouillon*. On examination with a microscope these flakes and stalactites are found to consist of innumerable quantites of plague microbes. These masses of microbes are so fragile, that if the flask containing them be shaken, they become broken up and suspended in the liquid, so that the bouillon, which before was transparent, becomes slightly turbid. Afterwards it clears up again, the microbes falling down to the bottom of the flask.

If a minute trace of the now turbid bouillon is transferred to another flask, a precisely similar growth is obtained. The plague microbe may be passed through an indefinite number of flasks of bouillon, and thus may be obtained in pure culture completely free of any substance derived from the patient. Professor Haffkine has discovered that the amount of growth of the plague microbe can be greatly increased if a small quantity of ghee or butter is added to the soil in which it is cultivated. This is a most extraordinary fact ; for, so far as I am aware, no other microbe is influenced in its growth by such employment of ghee. Professor Haffkine has made his discovery of this action of ghee the basis of his method of preparation of the medicine that he uses to protect people against the plague.

But how are we to prove that the plague microbe thus obtained is capable of producing plague; in other words, that it, and it alone, is the cause of the disease ?

The most conclusive proof has been obtained that this is the case. Early in the year 1897, when the plague was raging in Bombay, the Austrian Government sent four scientists to study the plague and to devise measures to check its spread, should it be carried to Austria. On their leaving Bombay, these scientists took back with them some living plague microbes. Since then these microbes have been cultivated as described above. More than a year afterwards, these microbes have led to an outbreak of plague. In order to study the effect of these microbes, certain animals, such as rats and rabbits, had been infected. An attendant named Barisch was employed in cleaning out the cages and feeding the animals. It is stated, that he placed his tobacco-pipe on the ground near the cages, and that it thus became the means of the introduction of plague microbes into his mouth. However this may be, he became infected in the course of his duties. At first his illness was supposed to be influenza or pneumonia, but owing to the dangerous nature of his work, the doctors in attendance became suspicious, and at length the microbe of plague was discovered in his sputum. After three days' illness he died with all the symptoms of plague. Three days later, Dr. Muller, who had attended him, also fell ill of plague, and died next

night. A nurse was also attacked and died after ten days' illness. Another nurse was attacked and recovered. As soon as the disease was found to be plague, all the infected persons and those attending them were made to live in a separate building, and in consequence no further spread of the disease took place. There have been no other cases of plague in Vienna, and there is no other possible source of the infection than these plague microbes that had been brought from India.

Thus this unfortunate incident gives the most complete proof that the plague microbe is the cause of the disease.

A more interesting proof of the nature of the plague microbe is the fact, already mentioned, that it can be changed into a medicine by means of which people can be protected against the disease. It is now known that the microbes which cause diseases are capable of producing poisonous substances, and that the symptoms of the disease are due to these poisons. In the same way a man can be killed by a snake-bite, because the snake has the power of secreting a poison. The poison of the snake can be obtained separate from the snake, and its poisonous properties can be shown by experiment. In exactly the same way the plague microbe secretes a poison, which substance can be obtained separately from the microbe itself. If a suitable liquid is infected with plague microbes and kept for a long time, the poisons made by

the microbe gradually accumulate in the liquid. If the liquid is then heated to a sufficient temperature, all the microbes present are killed, and the liquid contains the poisons made by the microbe, separated from the living microbe itself. M. Roux in Paris has succeeded in this way in making a liquid that is so poisonous that if a few drops are given to a small animal its death will shortly follow. Professor Haffkine cultivates the microbe in liquids to which ghee has been added. The liquids thus obtained are not poisonous in the way that are those made by M. Roux, but if injected under the skin they act as a preventative of plague. Since these liquids contain no living microbe they are incapable of producing the disease. They make people less likely to catch the disease as surely as vaccination makes people less likely to catch small-pox. Preventive medicines against many other diseases, such as cholera and enteric fever, have now been made by similar means. In such cases it has been found that the medicine for a disease can only be made from the microbe that produces the disease. Hence, in the fact that the plague microbe can be changed into a harmless medicine capable of being used to prevent the disease, we have a further proof that this microbe is the cause of plague.

Plague is a disease that attacks not only human beings, but also rats and other small animals. As a rule, at the commencement of plague epidemics, large numbers of rats may be seen

leaving their holes, staggering about on the floors, exhibiting none of their usual fear of man, and at length dying in numbers. After this happens human beings begin to be attacked, and it is well known that it is dangerous to live in a house in which rats are dying of plague. The fact that rats and similar animals are susceptible to plague, has made it possible to carry out researches that have led to the discovery of the plague preventive medicine now known as the "plague prophylactic." It will be of interest to examine the steps that have led to this discovery.

If the body of a rat found dead during the plague epidemic is examined, it will frequently be found that its spleen and glands are enlarged. If these organs are examined with a microscope they will be found to be crowded with microbes identical in appearance with those to be found in a human patient. By cultivation these microbes can be shown to be those of plague, and it is thus proved that rats are victims to plague as much as human beings. If a needle is dipped into a culture of plague microbes, so that its point is covered with an amount of the culture too small to be seen by the naked eye, and if this needle is used to prick a rat, then this animal will assuredly die of plague after the lapse of three or four days. Professor Haftkine carried out the following experiment in order to learn whether his plague prophylactic can protect animals from the disease. Twenty healthy rabbits were put in cages. Ten

of them were inoculated with his plague preventive. Then both the treated rabbits and the other ten rabbits that had not been treated, were infected with plague. The unprotected rabbits all died of the disease, and in their bodies innumerable quantities of the microbes were found. But the inoculated rabbits remained in good health. It was thus proved that the plague prophylactic can protect rabbits from the disease. It was necessary to learn whether it can also confer this benefit on human beings. Professor Haffkine first inoculated himself and then his friends. This produced some fever, from which after a day or two they recovered. In this way a proof was obtained that inoculation against plague, like inoculation against other diseases, is not dangerous to human beings. At this time an exceptionally good opportunity arose of obtaining a proof whether it could protect men in the same way that it can protect rats. Plague broke out in the Byculla Jail in Bombay in January 1897. Both men and rats were affected. The prisoners, though they were well fed, and though they were not overcrowded, and lived in fully ventilated rooms, suffered severely. About half of these prisoners volunteered to be inoculated. Of these, three developed plague on the day of inoculation, and it is probable that they were already infected before the treatment was carried out. On the same day six of the uninoculated also developed plague and three of these died. Of the remaining 148 who were inoculated, only two were afterwards attacked

with plague and both of them recovered. At the same time, of the 173 prisoners who had not been inoculated, twelve were attacked and of these six died. This case is most striking, because both those who had been inoculated and those who had not being protected, were living under the same conditions in every way. There is every reason for thinking that had these 148 men not been protected by the inoculation, several of them at least would have died of the disease. Thus a strong proof was obtained of the benefit of this preventive treatment. In every other of the many instances that have occurred since then, it has been found that those who have been treated with prophylactic show increased powers of resistance to the disease.

The inoculations carried out in the village of Undhera in February 1898, gave especially valuable results, because careful enquiries as to their effects were made by Surgeon-General Harvey, Director-General of the Indian Medical Service, and other independent witnesses by means of a house-to-house inspection. The village had contained more than 1,000 inhabitants, but 79 of these had died of plague before the inoculations were carried out. Over a half of the population were inoculated. Among the 513 inoculated, there were eight cases of which three died. Among those who had not been inoculated, whose number was 437, there were 28 persons attacked, of whom 26 died. In one house ten people lived. Of these five were inoculated and five were not inoculated. Two of the not inoculated got

plague and died. Those who had been inoculated, all remained in good health. In another house, three inoculated persons remained healthy, while two uninoculated died, out of a family of five. Many other similar cases occurred proving the value of Haffkine's inoculations.

At the commencement of this book I stated that knowledge enables one to protect oneself from evils. In proof of this I showed how far more terrible was the plague in Europe five hundred years ago, when the population was completely ignorant of its nature than it is to-day in India, where truer views exist. The discovery of the plague prophylactic is a still stronger example of the use of knowledge to protect people from danger. As often happens now-a-days in such matters, this advance in knowledge has not been obtained by one actively engaged in taking measures against the disease, but by one qualified for the task by many years' study and experience of the kind of research required. It is not every one who is fitted to make discoveries of this nature. The decision of character and self-reliance developed by administrative work, for example, would be a hindrance to the scientist, who at every step must doubt his results, and seek for new ways of putting them to a test. He must wait for repetition and verification of his experiments, and must hesitate before drawing conclusions in a way that would be impracticable in the common affairs of life. He must not mistake a habit of scepticism for a critical faculty, as do others, neither should he

exhibit reverence for so-called " axiomatic truths." In his work he should not be guided by a fixed line of policy, as is so often necessary in practical matters, but he should be ready to withdraw from any conclusion or conviction as soon as an advance of knowledge shows it to be erroneous ; and, on the other hand, accept as truth what he may not previously have believed to be such, as soon as the requisite proofs are forthcoming.

CHAPTER IV.

THE PREVENTION OF PLAGUE.

As already stated, infectious diseases are produced by microbes against which we can in great measure protect ourselves, and, not as ignorant people think, by mysterious or supernatural agencies against which no precautions could be taken. Each disease has its own separate microbe, and an outbreak of an infectious disease is, in general terms, a conflict between men and microbes.

Setting aside questions connected with the patient, what can be done if we have to deal with a conflict of this nature between men and microbes? There are three general principles by the application of which we may hope to bring the combat to an end. Firstly, we can remove the men, or evacuate the locality. Secondly, we can remove the microbes, or disinfect the locality. Thirdly, we can use some of the microbes to form a vaccine or a preventive medicine and thus bring peace into the locality by making the men and microbes mutually tolerant of one another.

It is not necessary to refer to the first measure, namely, evacuation, more than has already been done. Undoubtedly it is logical on the occurrence of such a disaster as plague to remove men from

its reach, as by so doing the epidemic may be brought to an end. More good has been done by evacuation than by any other measure. But in some cases it may be inconvenient and expensive, and it is irksome to people who do not know the terrible danger of plague.

The second measure employed against infectious diseases is the use of disinfectants. These are substances that have the power of destroying microbes. A solution of one part of carbolic acid in a hundred parts of water, or a solution of one part of sublimate in a thousand parts of water, both have the power of rapidly destroying the microbe of plague. We know that it is dangerous to live in a house in which either men or rats are dying of plague. If a man lives in such a house it is likely that he himself, his sons, his daughters, and his whole family will be carried off by the pestilence. The reason of this is that the plague microbe is in the house. In some way as yet unknown, the plague microbe will pass either from the floor or some other part of the house, and will in turn infect every member of the family. During the plague in Bombay, I visited several houses in which every member or nearly every member of the family had died of plague. If the families had left the houses and gone and lived in a hut in the country as soon as the first case occurred, they would probably have remained in good health. If the house is thus infected, might it not be possible to free it from the infection by means of disinfectants? In the case

of other diseases, such use of disinfectants is known to do good ; but in the case of plague though disinfectants appear to do some good, it appears to be dangerous to live in the house however much these substances are employed. Probably one reason of this is, that plague-stricken rats will again infect a disinfected house. But this is by no means clearly understood. Some have even thought that the plague microbe in an infected house resides in the bodies of insects besides in the rats, where also it is protected from the action of disinfectants. But though disinfectants apparently cannot free a house completely from infection or make it safe to live in, it must be remembered that in Bombay and in Hong-Kong where disinfectants were used, the plague was far less severe than it was in Canton and in many other places where disinfectants were not employed. Further, there can be no doubt that disinfection of clothes, either by disinfectants or by the use of boiling water, is necessary and useful in times of plague. The following incident shows the danger of using clothes that have not been treated in this way.

In 1896, a man lost his wife in Bombay from plague. Ten days later taking with him her clothing and ornaments, he left Bombay and went to his house in a village near Hurnai. Up to this time no plague had existed in or near this village. About a week after his arrival, dead rats were found in this man's house, and in the vicinity. Then one relative after another, who lived in the house, sickened with plague and died. The man himself, was

the sixth person to be infected. None of these relatives had been out of the village or otherwise exposed to infection. That is to say, their deaths were due to their living in a house in which rats were dying of plague. After these deaths had occurred, many other plague cases occurred, first in the village and then in other neighbouring villages. Major Collie, *I.M.S.*, who recounts this story, regards it as a case of infection carried by means of the clothes of a plague patient. If this is the case, then this calamity would not have happened if the clothes had been disinfected or put in boiling water before they were brought into the village.

Let us now consider the third general measure that can be employed against an epidemic, namely, taking advantage of a system of inoculation as vaccination is commonly used in the case of small-pox. We have already seen that Haffkine's prophylactic can confer protection against the plague, but this prophylactic is difficult and expensive to prepare, and until experience had shown it to be possible, it was an open question whether it could be made on a large scale, and of such uniform composition that it could be used in protecting the population of a large town. A striking proof that this can be done is obtained from the history of the plague epidemic in the town of Hubli.

In October 1897, an outbreak of plague occurred among some Railway employés who lived in a block of buildings, situated near to the town of

Hubli, and belonging to the Southern Mahratta Railway. The inhabitants of these buildings (1,200 in number) were immediately turned out of the infected houses, and the precautions taken were attended with such success that only about one person in thirty-five was attacked.

The town of Hubli, containing then about 50,000 inhabitants, was situated close by, and obviously in great danger of infection. The greatest precautions were taken to prevent this occurring, and for some months the efforts to preserve the inhabitants of Hubli were attended with success.

But in a somewhat isolated part of the town known as Mahratta Gully, there lived a man named Shidu. Owing to his foolish conduct, all the efforts to keep the disease out of the town were frustrated and he became the cause of the death of many of his relatives and friends. In defiance of the rules, and with the connivance of the police, he succeeded in gaining access to the Railway buildings where the disease existed in order to visit an acquaintance. There he stayed one night, and then returned to his house in Mahratta Gully. But by thus going to the infected place, although for so short a time, he had taken the infection, and he shortly afterwards found himself suffering from the disease. As soon as the symptoms of the disease appeared, he became terrified at the result of his conduct. Having engaged a bullock waggon he fled with his wife, and attempted to gain admission to the

neighbouring villages. Fortunately the villagers in each case refused his request, suspecting his illness to be due to plague. At length the cartman became terrified, and turned the sick man out of the waggon. Shortly after this, he died in the Jungle. This happened on the 7th December 1897.

But though Shidu did not die in his house, it appears to have retained the infection in some way or other. On the 20th January, a man who had been living for 21 days in the Health Camp, learnt that his hut, which was a lean-to against the house of Shidu, was about to be destroyed. Having bribed the police he managed to leave the camp and obtained access to his room on the 22nd January. He then went back to the camp, taking with him two articles of clothing. He died of plague on the 30th January. In addition, two children, who lived in a house opposite to that of Shidu in Mahratta Gully, died of plague on the 9th January. After one or two more cases of plague had occurred, the whole of Mahratta Gully which included 240 houses, was burnt down, but even this energetic measure was insufficient to preserve the town from infection. Cases of plague occurred at greater and greater distances from the original seat of the disease, and despite all that could be done, the town was subjected to the terrors of an outbreak of plague.

But, gradually, in addition to the other measures taken, Haffkine's prophylactic was introduced. In spite of opposition due to ignorance at the

commencement, larger and larger numbers of the inhabitants volunteered to be inoculated. The people themselves noticed that when in a house two or three persons had been inoculated, on the appearance of plague these persons remained in good health, while their relatives were carried off by the disease. Thus, every one, except the most ignorant, gradually saw the advantages of inoculation, whatever was his caste or occupation, and at length nearly the whole town was thereby protected against the disease. The results obtained during this time, and reported to Government by the Collector of the Dharwar district, gave the completest proof of the value of plague inoculation.

During the week ending the 26th August 1898, the disease was so virulent, that among those who had not been inoculated, one man in nine was attacked. But among those who had been inoculated once only, one man in 299 was attacked. Among those who had been inoculated twice, only one person in 755 was attacked. The number of those who had been twice inoculated by this date amounted to 26,428. This included persons of both sexes, of every age, occupation and social position, all of whom by this treatment were rendered less likely to take the plague.

During the succeeding weeks the disease appears to have increased in virulence as during the week ending on the 16th September 1898, about one in every seven persons of those who had not been

noculated was attacked. Of those who had been noculated twice, only one in 793 was attacked. At his time 30,911 persons had taken advantage of noculation. If these persons had not been inocu-ated, there is every reason for thinking that they ould have suffered as severely as those who refused o be protected. If this had happened, about one n seven of them would have been attacked; or, in ther words, more than 4,600 of them would have uffered from the disease during this week alone, nstead of only 39 as was actually the case.

During the week ending the 23rd September, here were only left 143 sceptics who had refused to ave the benefit of inoculation. In addition, a few her persons began to return to the town when they eard rumours of the cessation of the pestilence, nd who through ignorance did not take the trouble be inoculated. Among all these persons there ere 106 attacks. Among those who had been twice oculated, only one person in 1,320 was attacked. he number of such persons at this time was 31,680. n addition to this, there were present in the town 585 persons who had been inoculated only once. mong these, one man in 598 was attacked.

The result of this inoculation will be understood be the more beneficial when it is remembered that e few inoculated persons, who are attacked with ague, have a milder illness, and recover from the sease far more frequently than those who have t been treated.

In the town of Hubli, the treated and not-treated belonged to every caste and followed every occupation. Both classes of the people were living in the town as the monsoon did not permit of extensive Health Camps being built. Thus the above wonderful result gives a strong and conclusive proof of the value of plague inoculation.

Inoculation is being introduced into other towns and villages. Wherever it is being used in the presence of plague, the people themselves soon see its benefits; and this prophylactic is used as fast as it is possible to manufacture it.

At present, in the whole district of Dharwar, of which Hubli is a part, the following regulations have been introduced and are now in force. The inoculation is voluntary, and no one can be treated excepting very poor persons), unless he is willing to pay the small sum of 2 annas for this benefit. This charge helps to defray the expense of the local plague administration. The following are the regulations:—

(1) The fee for inoculation is 2 annas. This fee covers the first and second inoculations, and must be paid before the first inoculation.

(2) The fee for an inoculation visit by a Medical Officer to a private house is Rs.5, which covers the two visits for the first and second inoculations. Each person

inoculated at a private house must pay the fee of 2 annas.

(3) Each person receiving an inoculation visit from a Medical Officer must produce not less than 20 candidates for inoculation, or in default, must make up the total fees paid at the house to Rs.7-8-0.

(4) Persons certified in writing by the Superintendents to be too poor to pay 2 annas, will be inoculated free of charge.

(5) Payment may be made to the clerk of the Medical Officer or at the Municipal Office.

(6) The receipts will be credited to the Mnuicipal Plague Fund.

People from distant villages are collecting in the inoculation centres, and bringing in their 2 annas in payment for the inoculation. In a small place called Gadag, close to Hubli and Dharwar, at present, in January 1899, some 1,500 people are being inoculated daily by two inoculators, Doctor (Miss) Corthorn and Dr. Foy, on plague duty there, and the nu bers of those coming for inoculation increase daily. These are chiefly people from a distance who have heard of the advantages of the process.

CHAPTER V.

WHAT TO DO WHEN PLAGUE THREATENS.

IN this, the last Chapter, I propose to give some advice as to conduct in times of plague.

Some outbreaks of plague are known in which only a few persons in a village have been attacked, but such outbreaks are exceptional. More commonly this pestilence destroys such numbers of the population, that the survivors are only those who are saved by a timely flight. If plague is in the neighbourhood, it is wise to prepare for the worst, remembering that it is a disease, which, if it once enter a house, will often destroy the whole family.

(1) It is dangerous to allow persons to enter the village who come from a place in which the disease exists. The danger is less if all the inhabitants of the village have been inoculated.

While plague was present in Kurrachee, in February 1897, a woman returned from that place to her village which was situated in Cutch. On her arrival she was found to be ill of plague. She was at once placed in a hut outside the village, where she was nursed by her

sister-in-law. The woman shortly afterwards died, and the sister-in-law returned to her house in the village. A few days later this sister-in-law also was attacked with plague and died. After her death ten other members of the family living in the same house, were attacked. After an interval of some weeks, the plague spread, and 199 deaths from plague occurred in the village.

(2) It is dangerous to go to a place where plague exists, unless one has been inoculated beforehand.

While plague was raging in Bombay in the cold weather of 1897-98, the fishermen living in the village of Dharavi-Koliwada, at a meeting of their caste, made rules that were rigidly enforced in order to prevent plague being carried to the village. By these rules no one was allowed to sleep in Bombay, or even outside the village. No one was allowed to admit persons from Bombay into their houses. No one was allowed to visit places where the disease existed. For a long time these rules were effectual. But at length, when the disease in Bombay appeared to have come to an end, the rules were greatly relaxed. Consequently two brothers were allowed to leave the village to attend a funeral of a person who had died of plague at the village of Danda. Some time after their return a dead rat was found in the house. Shortly after this, a daughter of one of the brothers was attacked with plague and died. Her

mother was next attacked, but recovered. The father of the man was next attacked, and died. A son, a granddaughter and a second son were then attacked, and died. A nephew was also attacked, but recovered. Thus, out of 14 persons who lived in the house, seven were attacked with plague. Until the two men had gone to the plague funeral, and then carried the germ of the disease back with them, the village had remained entirely free from plague.

(3) If plague exists in a village, it is dangerous to live in a house in which rats are dying. It is dangerous to touch a rat dead of plague. It is especially dangerous to live in or near houses where there are many rats. Therefore every one who cannot avoid living in such places should get inoculated, by doing which the danger from all the above causes is greatly diminished.

In Bombay the plague began in Mandvie, a district where there are many grain stores, and consequently many rats. It is often noticed that the first to be attacked are grain-dealers, who owing to their occupation generally live in houses where there are many rats. Rats once began to die in the house of an English Doctor in Colaba, Bombay. He at once removed himself and his family, and therefore remained in good health. But the servant who was employed to remove the dead rats was attacked with plague and died. On the following day I visited the house to collect specimens of mud and water, that had been soiled by the rats,

for examination. Five days later, I was attacked with plague, and in consequence was made to live in a grass-hut in a camp for sixteen days, by which time I had recovered. If I had been inoculated I should probably have escaped.

(4) If plague is in the neighbourhood, the wise man will get inoculated against plague; and have his family inoculated against plague as early as possible; even whether or not he is likely to have to come into contact with infected persons.

The advantage of getting vaccinated against small-pox is widely known and appreciated in India. It is now a still greater advantage to be protected against the plague by use of the prophylactic of the learned Jew.

(5) It is dangerous to use clothes or bedding that have been worn or used by a plague patient, unless they have been placed in hot water and boiled. By this treatment the infection carried in clothes can be destroyed.

The first eight cases of plague in Hurdwar occurred in a quarter of the town which was partly detached from other houses, and which, as a precaution, was completely evacuated. This apparently brought the disease to an end. But fifteen days later, a priest who had been living at a distance was allowed to come into this evacuated area to witness the disinfection of some vestments that belonged to a temple and that had been stored in a house. It is suspected that that night he

slept either in the verandah on the clothes, or in the house. Seven days later he was attacked with plague, and a few other cases afterwards occurred in the town. An example of infection carried by clothes to a distance has been related in an earlier chapter of this book.

(6) It is not right or necessary to run away from a village because plague exists there and to go to another village. If the inhabitants of other villages know the danger they will not admit such fugitives.

All that is necessary is to leave the neighbourhood of infected houses, and to encamp in an open space outside the village.

(7) Having left the house, because of the danger of plague, it is not safe to return until at least a month has elapsed, but this danger is much less for persons who have been inoculated against plague.

For instance, plague broke out in Bintola, a village in Gurhwal, in November 1878. A woman named Bani, who lived in the village of Balt, went to Bintola to help to nurse the children of the headman of Bintola, three of whom had been attacked with plague. On her return to her village she was attacked with plague, and died. Her daughter was next attacked, and also died. Then four persons who lived in the next house were attacked. Her husband died next, and the disease then spread through every house in that part of the

village. On this the inhabitants left their houses and went to live in grass-huts on the side of the mountain. Before a month had elapsed a great storm and fall of snow occurred. Owing to the cold, the people returned to their villages, and during the succeeding five days, four cases of plague occurred. The people thereupon fled again to their grass-huts, and consequently the disease came to an end.

(8) By the efforts of the Government many million people were preserved from death by starvation during the last famine. Government is now trying to preserve the people from death by plague. If Government had not prevented infected people from travelling by rail, the plague would have been carried to many parts of India that hitherto have remained free of the disease, and many million people would have been exposed to infection who hitherto have been preserved from this danger.

In every case in which the first infected persons have been found and effectively isolated, no further extension of the disease has occurred. Intelligent people understanding this, and knowing the danger of plague, will aid Government in preventing infected persons from bringing this terrible scourge into their villages, and in carrying out the other measures described in this book.

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