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Contributors

Mitra A.
Royal College of Physicians of Edinburgh

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BY

A. MITRA, L.R.C.P., L.R.C.S., F.C.S.,

Chief Medical Officer, Kashmir.



Calcutta:

THACKER, SPINK & CO.,

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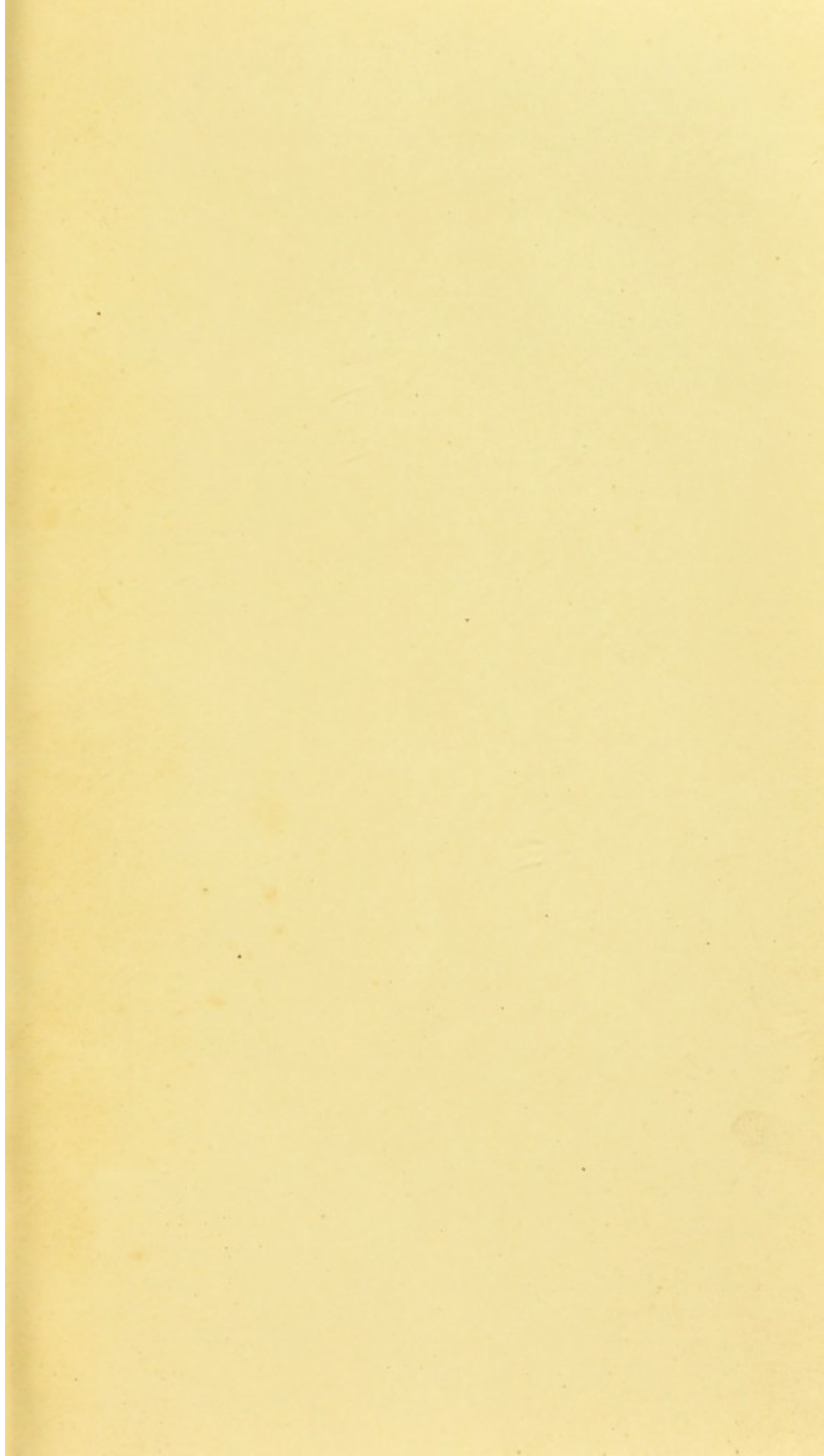
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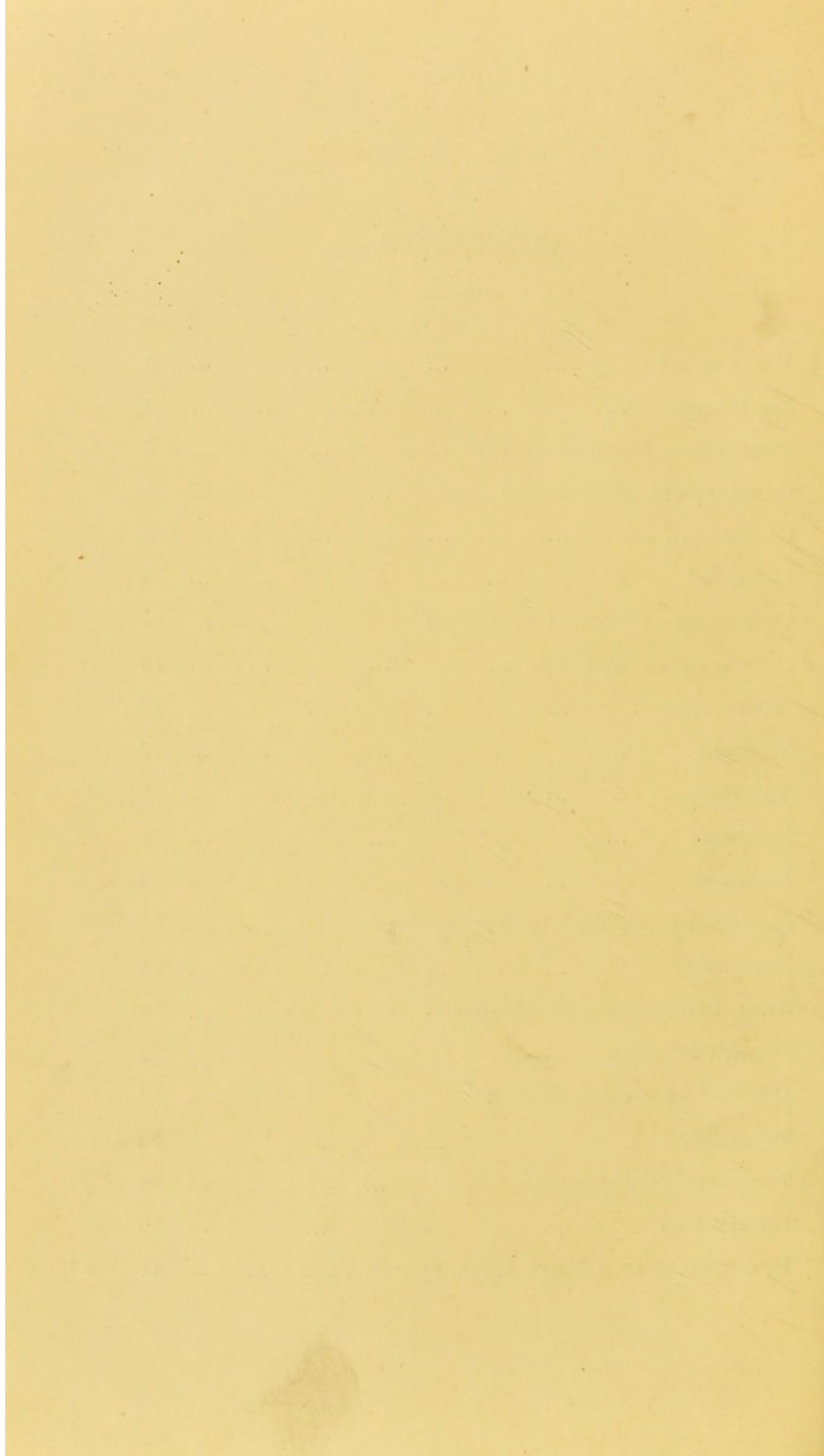
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THE BARRON'S PLAGUE

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THE BUBONIC PLAGUE.

WHAT IS IT?

Any contagious and fatal epidemic disease was originally called a plague (from *plaga*, a stroke), but this term is now applied to that particular kind of plague which is characterised by the appearance of high fever with inflammation of lymphatic glands or bubo, and is therefore called the Bubonic Plague. In Sanskrit Medical Books it has been described as *Vidradhi* and *Visharpa*, and in Yonani as *Taoon*. The following definition given by Cantlie is comprehensive. "Plague or Malignant Polyadenites is an acute febrile disease of an intensely fatal nature characterised by inflammation of the lymphatic glands, marked cerebral and vascular disturbances, and by the presence of a specific bacillus."

ITS HISTORY.

It is an ancient disease mentioned in Hindoo and Christian Scriptures. Long before the Christian era it prevailed in Greece, attacking the town of Piræus, where it raged for two years. Egypt, Syria, Constantinople and Rome were visited by the plague. In Constantinople the outbreak was once so furious that during three months from 5,000 to 10,000 deaths occurred daily. The first historical allusion to plague was made by Rufus, a physician who lived in the reign of Trajan (A. D. 98—117), and who mentions of glandular swellings. In 1347, plague appeared in almost all countries in Europe, where

Hecker believes, 25 millions of persons perished. Ireland was visited by plague three hundred years after its invasion by Patrolan, and it is said that 9,000 people died in a week and were buried at Tallagh near Dublin—a name which means the burial place of the plague-stricken. Plague visited England frequently, and no fewer than eighteen epidemics are said to have occurred before the great plague of 1665. In 1720, 40,000 out of a population of 90,000 died at Marseilles. In 1751, 150,000 died of plague in Constantinople. In 1799 the French Army in Syria was devastated by plague. 6,000 persons died in Malta in 1813. In 1834-35, 14,888 persons died in Alexandria out of a population of 42,000. In 1876 there was an outbreak of the disease at Kumaon in Northern India, where it prevailed several times during the present century, and where it is known as the *Maha-Mari*. It is also said that it prevailed in 1815 on the Island of Kutch, and lasted till 1821 in Kutch and Sindh. It also occurred between the years 1828 and 1838 in Jhansi, Bareilly, Pali and Jodhpore. In China the plague has been present for a long time in an epidemic form. In 1894 60,000 persons died at Canton. From Canton it spread to Hongkong and to Amoy. In 1895, it visited many places in Southern China. In 1896, it was present at Hongkong. Some people think that the disease has come to Bombay probably from Singapore. There was an epidemic at Merv when the Bombay outbreak appeared, others, however, think that the epidemic at Merv was not that of plague and that the disease has come from Hongkong.

THE LONDON EPIDEMIC OF 1665.

The following graphic and interesting account of the great London Epidemic of 1665 is taken from Sir William Guy's book on "Public Health."

"I now turn for a more exact account of the plague of 1665 to the work of Dr. Nathaniel Hodges, a Fellow of the College of Physicians, resident in the City, and, as his book shows, in active practice among the victims of the disease.

"Dr. Munk, in his roll of the Royal College of Physicians of London, says that he 'acquired a great name among the citizens of London; that he remained at his post and continued in unremitting attendance on the sick,' and that 'during the latter part of his life he received a regular stipend from the City of London for the performance of his charitable office.'

"Dr. Hodges tells us that about the close of 1664, two or three persons died suddenly with symptoms of the plague in one family at Westminster, that some timid neighbours of theirs took fright and removed into the City of London carrying the taint of pestilence with them whereby the disease, which existed only in a family or two, gained strength and spread abroad, and 'for want of confining the persons first seized with it, the whole city was in a little time irrecoverably infected.'

"In December a hard frost set in, which lasted three months, and during that time very few died of the plague. But the disease was not extinguished; for, in the middle of the Christmas holidays, the doctor was called to a young man in a fever, who after two days 'had two risings about the bigness of

a nutmeg,' 'one on each thigh,' with a 'black hue' and a 'circle round them.' By these and subsequent symptoms, he judged it to be a case of plague. It did not prove fatal.

"When the frost broke, the disease gained ground and extended into several parishes ; and the authorities issued an order 'to shut up all the infected houses,' so as to prevent ingress and egress. To give effect to this order, the houses of the infected were to be marked with a red cross, and to carry the inscription, '*Lord have mercy upon us,*' and a guard was set whose duty it was to hand food and medicine to the sick, and to prevent them from going abroad till forty days after their recovery. In spite of these harsh measures, 'the plague more and more increased.' Nor will this surprise us if we imagine the frantic and successful efforts that must have been made by the non-infected to escape, and the temptation to servants and nurses to appropriate and remove the property of the dying and dead. Indeed, Dr. Hodges accuses the nurses of strangling their patients, and secretly conveying the pestilential taint from sores of the infected to those who were well ; and he justifies his accusation of 'these abandoned miscreants,' the Gamps and Prigs of the seventeenth century, by two instances ; the one of a nurse who, 'as she was leaving the house of a family, all dead, loaded with her robberies, fell down dead under her burden in the streets,' the other of a 'worthy citizen' 'who, being suspected dying by his nurse, was beforehand stripped by her ; but recovering again, he came a second time into the world naked.'

“ In spite of the well intentioned measures of the authorities, the plague continued through May and June with more or less severity, sometimes in one place, sometimes in another, till the people becoming thoroughly frightened, flocked out of town in crowds. But the disease raged with redoubled fury among those that remained. Then the authorities bestirred themselves to the utmost. They instituted a monthly fast ; and the King commanded the College of Physicians ‘ to write somewhat in English,’ that might serve as ‘ a general directory.’ The college not only obeyed the royal commands, by inventing a ‘*Plague Water*,’ consisting of a cordial distilled off from a vinous infusion of a score of very harmless roots, leaves, and flowers, but also appointed two of their number to cooperate with two chosen from among the aldermen in attending the infected ; while Dr. Glisson, Regius Professor at Cambridge, and Drs. Paget, Wharton, Berwick and Brookes volunteered their help, with many others who survived, and eight or nine who fell victims to their self-devotion, among whom Dr. Conyers receives honourable mention.

“ Still, in the face of every precaution, the plague continued its work of destruction, especially among the common people, so as to be called the ‘*Poor’s Plague*,’ and, in August and September, completely got the mastery, ‘ so that three, four or five thousand died in a week, and once 8,000.’

“ And here I will follow Dr. Hodges’ example, and try to give you some idea of the state of things then prevailing. But in doing so I must shorten and tore down his description. ‘ In some houses,’

he says 'carcasses lay waiting for burial,' 'in others, persons in their last agonies.' 'In one room might be heard dying groans, in another the ravings of delirium,' and, near at hand, relations and friends bewailing their loss and their own dismal prospects. 'Death was the sure midwife to all children, and infants passed immediately from the womb to the grave.' Some of the infected ran about staggering like drunken men, and fell down dead in the streets, or they lay there comatose and half dead ; some lay vomiting as if they had drunk poison ; others fell dead in the market in the act of buying provisions. The plague spared 'no order, age or sex.' The divine was taken in the very exercise of his priestly office, and the physician while administering his own antidote ; and though the soldiers retreated, and encamped out of the city, the contagion followed, and vanquished them. Many in their old age, others in their prime, most women and still more children, perished ; 'and it was not uncommon to see an inheritance pass successively to three or four heirs in as many days.' There were not sextons enough to bury the dead, the bells ceased tolling, the burying places were full, so that the dead were thrown into large pits, dug in waste ground, in heaps 30 or 40 together ; and those who attended the funerals of their friends one evening were often carried the next to their own long home.

"This is written of a time when the worst had not yet happened. It was about the beginning of September that the disease was at its height. Then fires were ordered to be burnt in the streets for three days together ; but before the time had ex-

pired, they were extinguished by heavy rains, which ushered in the most fatal night of all with its register of more than 4,000 deaths.

“ From this, its culminating point, the plague, ‘by leisurely degrees declined,’ ‘and before the number infected decreased, its malignity began to relax, insomuch that few died, and those chiefly such as were ill-managed.’ Dr. Hodges distinctly states that the pestilence did not stop for want of subjects, but from the nature of the distemper. ‘Its decrease was, like its beginning, moderate.’ Early in November, people grew more healthful, and though the funerals were still frequent, ‘yet many who had made most haste in retiring, made the most to return ;’ ‘insomuch that in December, they crowded back as thick as they fled.’ The houses were again inhabited ; the shops re-opened ; the people went cheerfully to their work ; the rooms, in which a short time before infected persons had breathed their last, were peopled afresh, and many went into their beds ‘before they were even cold or cleansed from the stench of the diseased.’ ‘They had the courage now to marry again,’ ‘and even women, before deemed barren, were said to prove prolific, so that, although the contagion had carried off, as some computed, about 100,000, after a few months, their loss was hardly discernable.’ But the next spring there appeared ‘some remains of the contagion,’ which was easily conquered by the physicians ; and the whole malignity ceasing, the city returned to perfect health, as after the great fire, ‘a new city suddenly arose out of the ashes of the old, much better able to stand the like flames another time.’ ”

GEOGRAPHICAL DISTRIBUTION.

Plague is known in Europe, Asia and Africa, but it has not been known in the Western Hemisphere. It is said that Mesopotamia is the home of plague. It has been known as far North as Astrakhan in Asia and Norway in Europe. During the last fifty years, however, it is chiefly confined to Asia from Red Sea on one side, and the shores of the Pacific on the other. Some are inclined to think that the plague was carried from Himalyan India across Thibet to Yanon in Chinese territory, thence to Pekoi whence it made its way to Cauton and Hongkong. If that be so, then the plague has accomplished a tour from Northern India *viâ* China by Sea route to Southern India within a period of twenty years between 1876 and 1896.

CAUSES—

A disease so fatal in its nature and against which human power is so futile was in ancient times naturally attributed to wrath of the gods. Supernatural, astrological, and, in some instances, rationalistic causes were assigned to it. In the fourteenth century the College of Physicians of Paris ascribed it to the influence of constellations in India. But more natural explanations, however, gradually followed. Putrefaction of dead animals was assigned as a cause in Egypt. Poisoning of water-supply was also believed to be the cause. Undue heat, rain, watery grain, and absence of the Etesian winds were thought to generate plague. Leaving ancient theories on the causation of the disease we find that modern Scientists divide themselves into two classes : *first*, those who believe in

the germ theory and attribute the plague to a specific germ, holding that germs can never arise *de novo*; *second*, those who believe that atmospheric changes and certain telluric conditions or insanitary surroundings engender the seeds of pestilence which are carried through air, water or other media. The arguments in favour of the first theory are, however, so strong and overwhelming, that it is now almost universally accepted that plague is due to a specific poison which grows and multiplies under favourable conditions, and that wherever it occurs it is caused by the implantation of those germs in a suitable soil. If the soil is not fit, the germs may be sown, but they will not germinate and, if the soil is fit but the germs are absent, the disease will not be seen. The soil best suited for the plague seed is one where insanitary conditions prevail. Dirt and filth, bad ventilation, and overcrowding are its manure. The history of plague from ancient times fully illustrates that plague thrives in dirt, filth, squalor and misery. Diseased grain and want of subsoil drainage are held to be potent factors in the diffusion of plague.

BACILLUS—

During the Hongkong epidemic the great Japanese bacteriologist Kitasato, who formerly worked with Koch in Germany, discovered a bacillus in plague-stricken patients, and showed by experiments that these bacilli if injected into lower animals produced in them symptoms of plague. Yersin simultaneously discovered the same germs in connection with plague. According to our modern notion of the causation of the disease, these germs must be

considered to be the specific poison which produces the symptoms of plague. The bacilli are found in the blood, in the buboes, and in all internal organs of the victim of the plague. They are short rods with rounded ends, with a clear space or band in the centre, readily stained by the aniline dyes and showing very little power of movement. The size of the plague bacillus varies, and bacilli of same character, but of less virulent nature, have been found in the soil of infected places. Some bacteriologists observed some development after death in the bacilli, this, if confirmed by observations at Bombay, will be highly interesting from a bacteriological point of view. If mice, rats, guinea-pigs and rabbits are inoculated with the plague bacillus, they soon become infected and die, and in their internal organs the same bacilli are found. They are also found in the soil and dust of houses where plague patients were kept, but not invariably so. Kitasato found the bacilli in the blood of patients convalescing from an attack of plague even three or four weeks after all symptoms have disappeared. It has been found that the bacillus dies after four days, during which it is kept at a dry heat, or at the temperature of 80°C . or 176°F . for half an hour, or at that of 100°C or 212°F . for a few minutes. Its resisting power to chemical disinfectants is feeble, dying in a 1 per cent. solution of carbolic acid or of lime water. It develops easily in many culture media at the ordinary temperature (from 18° to 22°C). An alkaline solution of Peptone 2 per cent., with from 1 to 2 per cent. of gelatine, is the best nutrient medium for its cultivation.

CONTAGIOUS AS WELL AS INFECTIOUS.

Experience has proved that plague can be transmitted from one person to another by direct contact ; when a case of plague occurs in a house, other inmates of the house are much liable to be attacked also. Visitors to the house, medical and other attendants are also liable to be seized or to carry with them fresh focus of infection. It was, however, found in the Hongkong epidemic of 1894 that none of the European medical men, some fifteen in number, nor any of the Chinese students who were on duty at the plague hospital died. During the Egyptian epidemic of 1835 a French doctor, Bulard, with the courage of his conviction that plague was not contagious wore the shirt of a patient who died from plague, and yet did not contract the disease. Such immunity, however, was probably due to some circumstances which might be easily explained. In the Hongkong epidemic of 1894 three Japanese medical men contracted the disease, and in 1896, some European nurses were attacked. In Bombay the sad deaths of Surgeon-Major Manser and Miss Joyce prove that contagion plays an important part in the spread of the disease.

It has been maintained that plague is a miasmatic or soil-bred disease, and that the germs find in earth, water or in some form of fermenting or decomposing material a suitable nidus for growth. In this sense it is like malaria, which is endemic in a particular suitable area appearing and disappearing according as climatic or other conditions are favourable or unfavourable. The Chinese have a peculiar idea of the infection of plague.

They consider that the plague rises from the soil and believe that it first attacks small animals with breathing organs near the soil, such as rats, then animals with breathing organs a little higher, such as poultry, pigs, dogs, goats, cows, so on till it reaches man, whose breathing organs are higher from the soil than those of other animals.

The rats are undoubtedly attacked with plague before and during its prevalence among human beings, and they play an important part in the spread of its infection. In Kumaon this rat plague was observed by the people, and was recognized as a forerunner of the plague. The *Times of India*, September 30th, 1896, contains the following:—"It was known more than a month ago to all the people of Mandavi and to all the municipal sweepers in the district that the rats were dying in thousands all over the districts. They were found dead and dying almost everywhere, and in places where dead rats were never found before." In Bombay an instance has been reported of a man trampling with bare foot on a rat which was seen slowly passing in a room and getting attacked by the plague soon after. Pigs, dogs, snakes, and jackals are said to be also affected by the plague. It will be seen that flesh-eating animals are the sufferers, due evidently to their eating plague flesh. Snakes swallow rats, and rats become infected by consumption of poisoned material or from infected soil or by their cannibal habit. Like other diseases due to a specific germ, the infection of plague may be caught from various sources such as the following—(a) By means of breath. Plague dust and dirt

are very potent infective agents. A man getting a whiff of dust from the floor of a room in which there is a plague patient blown into his face may get the infection. Sweepers and others engaged in conservancy are, therefore, easily attacked. (b) By food or drink. Grain adulterated with sand or earth infected by rats may be a source of infection. Food may also be infected by flies or diseased rats. (c) By direct inoculation through any abrasion in the skin or mucous membrane. People with bare feet are, therefore, more liable to catch the infection. The infection may be spread by infected linen, bedding, furniture and fomites. The discharge from buboes contains the germs, and is, therefore, highly poisonous. The fæces, the urine, the sputum, the fur on the tongue are also infective. If the theory be true that the poison attaches itself to the soil, then persons living on ground-floor are more liable to the infection, and a floating population less so. Dust laden with germs is the principal agent in the diffusion of plague as that of any other germ disease. Professor Aoyama of Tokyo, whilst making a *post-mortem* examination, scratched the left third finger and was attacked with the plague, also Dr. Ishigami, assistant to Kitasato.

NATURE OF AN EPIDEMIC.

Plague is a very slow disease ; it takes some weeks to travel from one quarter of a city to another. It took nine months to travel from the city of London to Soho, and ten from Hongkong to Macao—a distance of 30 miles. Thousands of persons from Canton and Hongkong sought shelter at Macao, and there was free communication between

these places, still Macao became affected nine months after plague ceased at Hongkong. When plague is first imported in a place, for three or four weeks isolated cases occur in one neighbourhood. An epidemic may last only a few weeks or months, but may extend over several years in sporadic form and a recrudescence takes place abruptly. In Mesopotamia plague declines and becomes dormant with the setting in of the hot weather, its activity re-awakening in winter and gathering force with the advancing spring. The same was the case in Egypt. In Constantinople, on the contrary, as well as in England, the disease was dormant during the cold months but became active during the hotter. In England, September was the month of greatest prevalence. In the epidemic at Bengazi in 1858 as well as in Mukai in 1863 famine and plague were found together. That a water-logged soil favours famine was illustrated during the epidemic on the Lower Euphrates in 1867. In Persia and Arabia many epidemics were self-limited and spontaneously came to an end after spreading on a certain area, while, on the other hand, it has been known to obtain an endemic foot-hold, the virus remaining from year to year, and, occasionally under the influence of meteorological or unknown causes, becoming epidemic among the population.

Race.—No race seems to enjoy an immunity from the plague.

Geology and Climate.—Except the new hemisphere the plague has found congenial soil everywhere. It thrives as much in high and dry altitudes as in low-lying places, as much in over-

crowded towns as in sparsely populated semi-desert regions. In temperate regions it has been known to rage in summer, but in Astrakhan it prevailed when there were several feet of snow on the ground. On the Volga it prevailed during the severest cold (1878-79), as well as in the extreme heat of Smyrna (1735). In Bombay it commenced at the end of an exceptionally dry season, as it did in South China. During the Hongkong epidemic the rains increased it. The increase of the epidemic at Hongkong with the rains was probably due to the fact that the rains drove people into infected houses, instead of sleeping outside, as they did in summer when the weather was good. It has been said that plague flourishes in a warm moist atmosphere and dry hot air kills it, but there are records of plague thriving in conditions antagonistic to this theory. A temperature between 60° and 85° F. is said to be very favourable to it.

Sex and Age.—Both sexes are equally liable. It is said that people between the ages of 10 to 30 are frequently attacked. But experience shows that children and old people are alike liable to attack. In Bombay the disease has occurred most frequently between the ages of 20 and 30, and the male sex has suffered more than the female.

Occupation.—During one epidemic, water-carriers, or those who used much water, or who dealt in oil and fats were found comparatively free ; but this observation cannot be relied upon. Those whose business requires them to come much in contact with the sick, and also those who are engaged in cleaning are naturally more exposed to infection.

It has been said that one attack generally protects from a second, which, if it occurs, usually runs a mild course.

Sanitation and Personal Hygiene. — Plague, germs thrive in filth. Bad hygienic conditions, over-crowding, insufficient ventilation, and absence of sunlight in dwelling houses, accumulation of decomposing organic matter, effluvia from bad drains, sewer and cesspools are causes that favour the growth and dissemination of an epidemic of plague. When it attacks a town, it, therefore, naturally selects first the poorer classes who live in ill-ventilated and over-crowded houses. Over-crowding within dwelling houses is a fertile source of producing a constitution fitted for the reception of plague-germs. Such portions of towns where there is much congestion and over-crowding suffer most. Scarcity of food favours plague. It has been called *Miseriæ Morbus*, or the disease of misery, and the plague of London was called the "poor's plague." In Kumaon there is the usual custom of keeping cattle in the lower room of a hut, where a crowd of cattle stand udder deep in fætid straw. In one of the rooms of the upper storey grain is kept, and in another the whole family sleeps with doors and windows shut. Such conditions are undoubtedly very favourable to plague.

Predisposition.— Chill and exposure to cold, indigestion and any other disease producing a debilitated condition of body, fatigue, overwork, error of diet, mental emotion, and a terror of attack are predisposing causes. Catarrhs often predispose an attack.

INCUBATION.

Or how long does it take for the poison to develop symptoms after infection: generally three to six days, but the period may be up to ten days. The period varies with the virulence of the poison. The germs, however, remain active outside a host for a long time. An instance has been reported, in which a man, after handling some ropes which 20 years previously had been used in the burial of plague corpses, took the disease and died of it.

SYMPTOMS.

The usual premonitory symptoms are headache, loss of appetite, a feeling of general depression and aching of limbs. These symptoms may either be mild or may appear at once in very aggravated form; violent headache being usually of an acute dull character, accompanied by throbbing in the temples, giddiness, sleeplessness, palpitation, a feeling of oppression of the chest, even mental delusion may appear on the first day. The look of the patient is anxious, pale and cyanosed. The expression of the face resembles that of a man who has had no sleep for two or three nights but is being overpowered with the fatigue consequent to it. These symptoms are usually ushered in with a rise in the temperature. Well-marked rigor is usually not seen, but a slight shiver or chillness is complained of. Pulse is full, bounding and rapid—130 or more per minute. Respiration is difficult and accelerated even to 40 or 50 per minute. Skin is dry and hot, face puffed, conjunctivæ congested. Sense of hearing is dull. Speech is thick and faltering. Tongue is dry and coated with greyish white or dark

brown heavy fur. Violent thirst is present. Sometimes Patchiæ appear on the skin. In a few hours, or a few days after the appearance of the first symptoms, a swollen gland appears either in the neck or axilla or groin. The gland most commonly affected is one or some of the femoral chain. An inguinal, axillary or a cervical gland may also be affected. A number of glands may swell at one time or glands in all the above situations may be felt painful and swollen. The glands of the neck are most frequently attacked in children. Pains in the lower part of the abdomen and along the spine indicate affection of internal lymphatic glands. In some cases the first symptom noticed is a swollen and painful gland, but fever soon manifests itself. The glandular enlargement may antedate, coincide with, or follow the rise in temperature. Sometimes only pain in the gland is complained of, but no swelling is observed. The temperature rises gradually and goes up to 104° , 105° or 106° F. In some cases a temperature of 108° was observed. There may be a marked morning fall and an evening exacerbation, which is a favourable sign, or the temperature may remain high persistently. All the above symptoms become soon aggravated when the second stage or stage of acute development of the disease appears. Brain symptoms show themselves. Lowson noticed four distinct type of brain symptoms—(1) comatose, when the patient lies paralysed, mind and body; (2) wildly delirious, when the patient struggles and fights and still retains a fair command of rational speech; (3) apathetic, when he lies perfectly quiet

but is drowsy; (4) convulsive, which condition occurs when there is inflammation of the meninges or hæmorrhage in the brain.

In this stage all symptoms of a pronounced typhoid condition supervene. Tongue becomes parched and black. Sordes cover the teeth. Gradually a somnolent condition and low muttering delirium supervene. In some cases the delirium is violent and furious, while in others it culminates in complete stupor and coma. Picking of the bed-clothes, and subsultus tendinum are common, and the urine and fæces are passed involuntarily. The pupils are dilated. The skin is bathed with profuse perspiration. The pulse is dichrotic and compressible, and gradually becomes anachrotic and intermittent till it finally fails. The area of cardiac dullness is increased and pain in the cardiac region is complained of. Heart begins to fail rapidly. The usual complications of this stage are — (1) meningites; (2) hæmorrhages; (3) severe gastric disturbance, such as vomiting, diarrhœa, hiccough. As a rule, constipation is found during the course of an attack, but diarrhœa, even severe, may appear. There may be pain in the abdomen. Bladder may be distended and a catheter may be necessary to evacuate it. Cystitis often develop. Œdema of the lungs, pleurisy and pneumonia may also complicate a case. Hæmaturia, hæmoptysis and hæmatemesis may be seen. Bronchitis and hypostatic inflammation may occur. The urine always shows presence of albumen. Death may take place from cardiac failure or from any of the above complications. Death may take place within three

or four days, though in some virulent cases the patient dies within twenty-four hours. If the primary collapse is tided over, there is great chance of recovery, still deaths often occur of complications several days after the attack.

In mild cases the second stage is not so severe, and temperature may fall by lysis or crisis—the latter being rare.

The glands in the meantime become swollen and are surrounded by a sero-sanguinous exudation. The surrounding parts are œdematous. The glands usually do not suppurate, but they may do so and slough. The usual course after their enlargement is one of four: (1) resolution; (2) lengthened period of enlargement; (3) suppuration; (4) sloughing. In cases that recover the symptoms gradually take a favourable turn and recovery is as rapid as the attack. The fever slackens, the pulse becomes stronger, the tongue moist and the typhoid symptoms gradually pass away. The buboes either suppurate or subside; symptoms of secondary pyæmic conditions, however, may sometimes develop. Deviations from the typical course are, however, often observed. Some cases take an extremely rapid course, the patient succumbing within from 12 hours to two days. The duration of the disease varies between a few hours and a few weeks, but on an average up to the commencement of the convalescence it seems to last from 6 to 10 days. During convalescence the vitality of the issues are very low. Head symptoms sometimes persist for sometime. Temper is irritable. The sloughing glands often take a long time to heal. Convalescence is soon established.

VARIETIES.

Just as before an epidemic of cholera visits a place, it is usual to observe cases of mild diarrhoea and indigestion prevailing amongst its population ; so, before plague actually breaks out, it has been found that cases of buboes and parotites with fever are commonly observed. Such cases were called *Pestis Minor* at Astrakhan. "No one died from the disease *per se*, but few people were confined to bed." It is not known whether in *pestis minor* the plague germs could be found ; but presumably not.

Drs. Simpson and Cobb of Calcutta have described what is called *Pestis Ambulans*, or an ambulatory form of plague, in which plague germs have been found. The commonly accepted types of plague are (1) Fulminant ; (2) Typical ; (3) *Pestis Minor* (including *ambulans*). The cause of the first two is the bacillus discovered by Kitasato, and they are very fatal, of the third, the cause may be an allied bacterium less potent to produce toxic effects on man, and it may come and go but plague may not break out. In ambulatory form the patient has slight fever and glandular enlargement, but he can move about.

DIAGNOSIS—

It is difficult to differentiate a case of true plague in its early stages from a case of fever with benign glandular swellings or mumps. The premonitory symptoms of plague, and even the early symptoms of the first stage, may be due to many different diseases and therefore great caution is needed. It is needless to say how important it is that such diagnosis should be done with great care,

specially when plague cases have to be isolated, for if a case of simple fever with benign lymphadenitis be brought in close contact with patients suffering from true plague, it is a serious matter with the former. A venereal bubo, or scrofulous enlargement of glands, or enlargement of femoral or inguinal gland due to traumatic or other causes which may be attended with fever should not be mistaken for a plague symptom. A medical man who has, however, carefully observed the facies of a few cases of true plague, and who carefully takes into consideration all other probable conditions which may be mistaken for plague, may not commit a mistake, but its probabilities are to be borne in mind. The practical lesson is, that all doubtful cases should be isolated and kept separate from cases of pronounced type. The plague bears some resemblance to typhus. Murchison says: "Plague is perhaps the typhus of warm climates, the two diseases being generated from similar causes and differing only in intensity from the effects of climate and other collateral circumstances." In typhus there is a characteristic rash, and in plague there is bubo, but this order of things have been found in some instances to have changed, there being eruption in plague and bubo in typhus. The two diseases are, however, different and bacteriological and clinical evidence corroborate this view. Cantlie adds another disease, which he says he mistook for plague:—"On June 26th, 1894, when the plague was at its height, I saw a Parsee patient dwelling in a house in which plague existed, suffering from fever 104° (F.), dry tongue, headache,

backache and large swollen glands in the left groin, which had suddenly appeared. Plague seemed the only diagnosis, and the man, much against his will, was sent to the plague hospital. In two days he came back again quite well, and on examining him I found his urine thick and milky. That night I found filaria in the man's blood, and knew I had made a mistake in the first instance. Of course, the mistake is most likely to happen, but nevertheless it is not pleasant to think that we had subjected the man to the terrible danger of plague infection."

PROGNOSIS.

The mortality from plague may be about 90 per cent. or more when the epidemic is at its height. In the beginning, or towards the end of the epidemic, the mortality is less, as it is the case with all other epidemic diseases. The average mortality at Bombay has been 84 per cent. and in Karachi 89 per cent. It is, therefore, more fatal than all other epidemic diseases, the mortality from cholera during the height of an epidemic being about 60 per cent.

In children and in the aged the disease is more fatal than in healthy adults. Cases in which the bubo appears early and is single, or in which there is a distinct morning remission, or less general prostration or free perspiration, or in which there is no diarrhœa, have greater chance of recovery. Rapid suppuration of the buboes indicates a favourable termination. Buboes do not suppurate as a rule until the primary fever has fallen. On the other hand, carbuncles, multiple buboes (specially on the neck), meningitis, hæmorrhages, pleurisy, pneumonia, diarrhœa, gastric irritation, cyanosis,

jaundice and continued pyrexia are unfavourable signs.

MICROSCOPIC AND MACROSCOPIC APPEARANCES.

Bacilli are found in all the internal organs, notably in the spleen, in blood and in the enlarged glands.

Body does not show much emaciation ; decomposition commences early. Black hæmorrhagic patches are often found on the skin. The brain and membranes are congested. Sanguinous or serous effusions are found in serous cavities. Right side of the heart is dilated and is usually found full of coagulated or liquid blood. Cardiac muscles pale. The liver is enlarged and congested. The spleen is much enlarged, soft and congested. Hæmorrhagic patches have been found in the stomach. The mesenteric glands are enlarged. Kidneys congested. Bladder is sometimes found filled with bloody urine. The buboes are sometimes found to be soft and caseous. The tissues surrounding them are infiltrated with a reddish gelatinous exudation. The whole lymphatic chain from groin to the glands of the sacral or lumbar plexus, or from the axilla and neck to the glands of the mediastinum are affected. The internal glands are found more or less enlarged, injected and infiltrated with sanguineous fluid. The lymphatic follicles and Peyer's patches in the intestines are found swollen. Hæmorrhages are found in the mesentery.

PREVENTION.—

It is evident from what has been said that to prevent plague our efforts should be directed in

two ways :—(1) To prevent the importation of germs; (2) to make the environment of a place such that the germs, even if imported, may not find suitable condition for their growth. To accomplish the first we need (*a*) inspection of people coming from infected places ; (*b*) stopping importation of such articles as may carry infection with them ; (*c*) quarantine, a word which owes its origin to the fact that, during the epidemic of plague at Milan in 1527, patients when cured were despatched to lazarettos and detained there 40 days.

For the second, we require (*a*) sanitary precautions by guardians of public health; (*b*) observance of rules of personal hygiene by which good health can be maintained.

(1). Wherever possible a medical inspection should be made to prevent importation of the disease. This is, however, a very difficult matter, and one unforeseen difficulty was experienced at Sukkur, where it was found that people booked to stations short of Sukkur, and rebooked at stations on the other side. Still this measure is highly important, and should be carried out most rigorously as long as there is any chance of importation of plague into an unaffected country. It is needless to feel the pulse of the patient ; his gait, temperature, and look would afford a great deal of information. Information should be obtained from where the patient is travelling. An examination should also be made of clothes. Dirty clothes, soiled linen and rags should not be allowed to pass through an inspection post.

(2). There should be a disinfecting or sterilizing room fitted with a steam sterilizer in all

large railway stations, where all goods should be disinfected. Mail bags should also be subjected to this disinfection. Transmission of such goods as corpses, used clothes, rags, waste paper, fur, hide, feather, and fish should be entirely suspended.

(3). If quarantine is imposed, it should be for a period not less than ten days. Every arrangement, however, should be made for suitable accommodation and sanitation in quarantine camps. In a quarantine camp new arrivals should not be mixed up with those who are already in quarantine.

(4). Ships from infected ports should be carefully watched. If any infection is discovered, then isolation of the sick, disinfection of the ship and quarantine are required, but ships with clean bills of health, and if ten days have passed since its departure from the infected port, may be admitted after medical inspection. It must, however, be borne in mind that rats could easily carry infection from one port to another without any fear of detection. These facts show that medical inspection and quarantine may be useful, but they can never be perfect, and therefore the principal safeguard of a place lies in the improvement of its sanitation, and therefore greater attention and energy should be directed towards it.

*Sanitary Measures that should be taken by
Municipal and Railway authorities.*

(1). All filth should be removed from the vicinity of towns and villages and *burnt*, and no filth of any kind should be allowed to remain within an inhabited area for any length of time.

(2). All private and public latrines and public urinals should be cleaned and disinfected daily. All receptacles used for night-soil either in the latrine or for transport should be daily disinfected.

(3). Latrine accommodation, according to the requirements of the population, should be provided.

(4). Drains should be well washed and flushed with a disinfectant solution. In towns where there is an underground sewer, it should be well flushed and ventilated, and a disinfectant solution used for cleaning it. A house-to-house examination should be made to ascertain that all house-connections are properly and efficiently trapped. Deposits in the sewer should be taken out and suitably disposed off after disinfection.

(5). Special attention for cleansing should be given to the following :—

Cesspools, privies, cow-houses, stables, slaughter-houses, markets, workshops, common lodging houses, serais, bustees, and crowded quarters of a town.

(6). All public roads should in the dry season be watered with a weak disinfectant solution.

(7). Pure drinking water should be supplied. All articles of food should be inspected. Musty and decomposing grains should not be allowed to be sold. The meat market, dairies and bakeries should be under strict sanitary supervision.

(8). Over-crowding in houses should be prevented. Steps should be taken for spreading out the population of much over-crowded and congested parts of towns.

(9). Lime in a dry state and in solution should be abundantly used in drains, &c.

(10). All railway carriages travelling through infected areas should be daily washed with a reliable disinfectant solution, such as 5 per cent. carbolic acid.

(11). Railway platforms, waiting rooms and halls, and latrines should be frequently cleaned and disinfected.

(12). There should be a system of house-to-house inspection to ascertain the sanitary condition of dwelling-houses, and also to find out, as far as possible, the condition of health of the inmates.

Common lodging houses, serais and houses of a similar nature should be most carefully examined.

(13). If plague breaks out, then isolation of cases is a great necessity. When practicable, such isolation may be done in the house of the patient. The patient should be kept in a separate room apart from those where other inmates of the house live. A temporary room could be put up on the roof of a house or in the compound, if there is any, or a tent may be pitched. Where possible, all healthy inmates of the house should at once remove themselves in camp leaving only such near relatives who must attend and nurse the patient. For patients living in lodging houses, or, where there is no means of such isolation as stated above, segregation in special isolation hospitals should at once be done. The isolation hospitals should be separate for each of the following classes—(a) for lower class people; (b) for middle class people; (c) for such people of the middle or upper class who may chose to pay for their expenses. It is needless to say that there should be special hospitals for women, where only

female attendants and nurses should be employed. Hospitals should be provided with means for free ventilation, both for the sake of patients as well as attendants. No other disease requires more careful nursing than the plague, therefore ample nursing staff should be provided. The hospitals should have a separate observation ward and a separate convalescent ward, and by no means doubtful cases should be mixed up with confirmed cases. Disinfecting apparatus, sterilizers, good water supply and special laundry are other adjuncts essentially necessary for a plague hospital. Greatest care is required in the management of such a hospital, and only trained men should be employed.

Suitable means for ambulance should be provided, and should be had ready within convenient distances. They should be thoroughly disinfected after the conveyance of any case. Ambulance carts or doolies should be comfortable, for physical exertion and exhaustion, attending a long journey in the early stage, greatly compromise chance of recovery.

(14). Burial within inhabited areas of a town or village should be stopped. Dead bodies should be removed under strict precautions for disinfection and disposed off quickly. Bodies should be buried deeply—4 to 6 feet.

PRIVATE HYGIENE.

I. Houses and compounds, stables, kitchen and outhouses should be thoroughly cleaned, and they should be whitewashed with lime. Air-tight dustbins should be kept in the house.

II. Rooms, specially bed-rooms, should be well ventilated, attention should be paid to the condition

of the floor, which should not be damp, and care should be taken that rats may not infest the house and spaces under the floor. If dead rats are found in the house, they should be removed and burnt, and the place thoroughly disinfected.

III. House drains should be cleaned and well flushed with a disinfectant solution.

IV. Nowhere in the house or compound should any kind of organic refuse be allowed to accumulate. Better not use any organic manure in the kitchen garden or house garden during an epidemic.

V. Articles of food should not be allowed to remain uncovered on the table or elsewhere, for there is chance of their infection by flies, mice, or rats.

VI. Clothes received from the dhoby's house should be again boiled in water, dried, and then used.

VII. Bed-clothes and wearing apparel should be aired and exposed to the sun daily. As frequently as possible floors and passages should be well washed with a disinfectant solution and then well dried.

VIII. There should not be any over-crowding in bed-rooms.

IX. Drinking water should be boiled before use. Raw vegetables, such as salad, cucumber, &c., should only be used after thoroughly washing them, and then with vinegar.

X. Personal cleanliness should be strictly observed. Daily bath, cleaning the teeth with carbolic tooth powder, and carefully washing hands and mouth before and after meals are essential.

XI. Those who have to attend on plague cases should be very careful. Hands should be thoroughly washed with a disinfectant solution, and a nail brush used soon after the patient or anything in contact with him is touched. A bath to which some antiseptic is added should be taken immediately after coming in contact with plague patients. Workers in plague hospitals should be warned about scratches or wounds on their bodies. Use of respirators with an antiseptic sprinkled over the entrance valves is recommended. Only very healthy people should approach plague cases. On the appearance of slightest headache, langour, or fever an attendant should be relieved from duty.

XII. As a prophylactic 5 grains of quinine sulphate may be taken twice daily, or a small bottle containing eucalyptus or some other volatile disinfectant, may be carried in the pocket, and a few drops may be occasionally poured on the handkerchief. Smoking good tobacco may have a prophylactic value.

XIII. If plague occurs in the house, the following steps should be taken :—

(a) The patient should at once be put in bed and kept in a temporary room, which may be put up on the roof of a house. No healthy inmate of the house should go in that room or have any connection with the sick, except those who have to nurse the patient.

(b) All discharges, fæces, urine, sputum, vomited matter, &c., should be taken in vessels with disinfectant solution in it, and some quicklime should immediately be sprinkled over them. On no

account should anything leave the room but to be disinfected.

(c) Floor and bedsteads should be washed with a disinfectant solution, clothes and other articles that touch the patient should be carefully disinfected. Crockery and glass should be scalded. If great care and cleanliness are not observed with regard to the bed and body linen of the patient, the infection may be diffused through the air immediately around the patient.

(d) A medical man should be at once sent for. Delay is fatal.

INOCULATION AGAINST PLAGUE.

M. Haffkine, of cholera inoculation fame, has commenced to inoculate against the plague under the same principles on which his inoculation against cholera is based. By injecting into the body an attenuated virus of plague, a very mild attack is produced, which in people inoculated has proved harmless. This mild attack, it is thought, would protect the system from more potent forms of the poisonous germs. The inoculation for plague is still in its experimental stage, and cannot, for obvious reasons, be applied to a large population. Medical attendants, nurses and others who, by call of duty, have to constantly come in contact with plague patients may, however, take advantage of this means of protection, which, in the hands of M. Haffkine, may yield good results. Yersin also claims for his serump rophylactic value. In this and all other matters connected with bacteriology, such as germs, sero-therapeutics, &c., the medical profession now-a-days receives a good deal of satirical re-

marks from sceptical lay public. It is natural that it should be so, for the science of bacteriology is still in its infancy, and many of its practical applications are still in their experimental stage. But undoubtedly the science is advancing, and by its aid we are now better able to understand diseases and their nature. Many facts have been demonstrated and proved with precision. What is disbelieved to-day, may, however, be believed tomorrow, for, with all human attempt to reveal secrets of nature, such is the case. Readers of Smollet's Roderick Random may remember how in the Surgeon's Hall one of the examiners said :—" I affirm that all wounds of the intestine whether great or small are mortal." Now, however, if a man dies of a wound of the intestine, the unfortunate doctor in whose hand such a casualty takes place runs great risk of being charged with malpraxès.

TREATMENT.

I. *Hygienic.*—The patient should take to bed immediately on the appearance of the first symptoms. The room should have means for free ventilation, and the temperature in it should be between 60° to 70° F. The air of the room may be cooled by a block of ice. The room should be kept clean, and there must not be in it any curtain, carpet or hangings. The floor and bedsteads should be daily washed with a disinfectant solution. A position of absolute rest in bed is to be maintained throughout the illness.

Bedpan and urinal should be always used. Bedclothes should be light and warm. Wearing apparel if saturated with perspiration should be changed. It is best to have two beds side by side so as to be

able to move the patient easily from one to another for cleansing purposes. Mattresses should be suitably protected from penetration by the discharges. The air of the sickroom can be made antiseptic by placing pieces of blotting paper saturated with eucalyptus oil or phenol on plates about the apartment or by pouring carbolic acid on hot water in a plate. The doorways should be curtained by a sheet wet with disinfectant solution. Great cleanliness of the body of the patient should be enforced by cold sponging with an antiseptic solution. Skilful nursing is essentially necessary. The motions should be disinfected by strong antiseptics such as quicklime, carbolic acid, &c., as soon as they are passed.

II. *Dietetic.*—From the commencement of the disease the diet should be liquid and nourishing. Milk is best. The quantity for adults should not be less than three or four pints in the twenty-four hours. It must be given in small quantities at short intervals. Soda, potash or plain carbonated water may be mixed with it. Barley water and thin sago water may also be given. If the patient's vital powers are low, the milk may be peptonised by using Fairchild's powders or by adding a little of Benger's Liquor Pancreatices. In cases when milk cannot be taken in sufficient amount, animal food may be given in the form of plain meat broth. Egg-flip with or without brandy may also be given. It is useless to give strong meat essences when the digestive powers are seriously impaired, and excess of zeal in this direction does a great deal of harm. These accumulate in the intestinal canal and form a fermenting mixture in which poisonous

ptomaines form. Throughout the attack the patient's strength should be husbanded as carefully as possible. When there is thirst, water, or iced water, or iced beer or stout, or ice-cream, or fruit *sherbat* should be given. During convalescence great care should be taken of diet, for then the vital powers are at a very low ebb.

III. *External*.—In order to lower the temperature rubbing of the skin with oil from the commencement of the disease has been recommended, but this procedure is, I think, of no use. I suggest, however, that when temperature is high 15 drops of Creosote may be rubbed near the axilla. During height of fever, the body may be lightly sponged all over, twice or thrice a day, with the following solution :—

Thymol	...	...	...	40 grains.
Spirit Lavendula	...	...	...	2 oz.
Spirit Vin. rectific.	...	...	...	3 "
Acid Acetic dil.	...	...	...	3 "
Aquæ Rose	...	...	...	add 16 "

Mustard plasters to limbs and over the heart should be given when there are signs of failing heart and circulation, and over the epigastrium when there is vomiting or hiccough. Smelling salts and strong ammonia should be applied to the nostrils for their restorative action. Blister over the nape of the neck is useful when cerebral symptoms are present. Ice caps over the head is very useful and should be applied continuously. The enlarged glands may be fomented with hot water or spongio-piline wrung out of hot antiseptic solution. When they are much painful, poppy or belladonna may be added to the water. Belladonna with glycerine should be applied in the beginning and iodine afterwards. Hot

corrosive sublimate fomentations are also useful. If the glands suppurate, they should be opened aseptically and dressed with antiseptics. Proper drainage should be provided.

IV. *Internal*.—Knowing as we do that the plague is due to the toxic products metabolized by a pathogenic bacillus, the question comes—would an antiseptic treatment be of any use? Can we by any means induce an antiseptic action on the blood, or have we any drug which can act as antitoxin? It must be at once stated that no drug that has been tried yet fulfils the above conditions. The claims of quinine, however, should be taken into account. This drug in small repeated doses acts as a general antiseptic. I would, therefore, advocate its use especially in the early stages. Plague is a disease in which collapse sets in early and cardiac asthenia is a very early complication. There is, therefore, great urgency for early stimulation. Alcohol may be given freely, but at the same time it must be remembered that if the organs of elimination are not acting properly, alcohol may do harm. For their stimulant effects whiskey or iced champagne may be given. Carbonate of ammonia or spirit ammonia aromatic are held to be very useful stimulants in plague cases. They may be given in combination with cinchona, digitalis and ether. A prescription like the following may be useful :—

Ammonia Carb.	...	...	...	5 grains.
Chloric Ether	...	...	...	20 minims.
Sulphuric Ether	...	...	...	15 „
Tint. Digitalis	...	...	...	5 „
Tint. Cinchona	...	...	...	1 dram.
Aquæ Camphor	...	...	...	1 ounce.

Every three hours.

For cardiac asthenia, the following may be tried:—(1) Caffeine, hypodermically, 5-grains dissolved by the aid of 5 grains of Sodium Benzoate in 20 minims of warm distilled water and injected three or four times a day if needful; (2) Ether or ethereal solution of camphor hypodermically; (3) Strychnine, hypodermically, beginning with gr. $\frac{1}{60}$ every four or six hours till gr. $\frac{1}{16}$ is injected, or Liquor Strychnia in 5—10-minim doses every four hours; (3). Musk may be given in 5-grain doses, or as in the following mixture:—

Pulv. Moschi	...	...	... 10 grains.
Mucilage Acacia	...	...	... 2 drams.
Syr. Aurantii	...	...	... 2 „
Aqua Camphor	...	...	... $\frac{1}{2}$ ounce.

To be given every 6 hours.

Digitalis does not always give good results, a fact which Lawson attributes to some inflammatory or fatty degenerative changes in the small vessels giving rise to a tendency to hæmorrhage. Stropanthus may be substituted. Transfusion of blood a hot saline solution and inhalation of oxygen have been recommended for collapse. Dr. Viegas of Bombay recommends Liquor Hydrasgyie Perchloride 10 to 15 minims every four hours if there is no albumen in the urine. Dr. Dimmock has advised subcutaneous injection of Guaicol 10 or 15 minims every two hours. Permanganate of Potash 5 to 12 grains in 24 hours has also been recommended. Dr. Blaney has recommended Medritina in two-dram doses every two hours when the kidneys are involved. Camphor has been recommended by some as a cardiac stimulant.

TREATMENT OF SYMPTOMS.

(1). High temperature may be reduced by antipyretics, such as antipyrin, phenacetin, anti-febrine, &c. These drugs produce profuse perspiration and a certain amount of depression ; it is, therefore, advisable to restrict their use during the first few hours only, and if not found responding, they should be dropped altogether. Pyrexia is but a sign of the intensity of the activities of the infective agent, and by artificially reducing the body heat we really do not lessen the virulence of the poison, as shown by the rise of the temperature again as soon as the action of the antipyretic subsides. Hyperpyrexia itself is, however, an injurious symptom, and when there is long continued high temperature it is necessary to reduce it, either by an antipyretic, quinine or cold bath, or cold sponging. Cold bath is not suitable in plague patients on account of the movement of the body which it entails, and also on account of the serious cardiac depression which accompanies the disease. Two grains of phenacetin with 1 grain of hydrobromate of quinine is a safe antipyretic. Brandy and tepid sponging are also very useful.

(2). *Brain symptoms.*—For headache a mustard plaster behind the upper part of the neck and over the occiput. Ice cap or Lieter's tube or plain water should be applied over the temples and scalp. Nervine sedatives, such as Potassium Bromide, may be given for insomnia when there is not much depression. Otherwise full doses of alcohol may be tried. Opium should not be used, but in mild cases, without great depression, 10 to 20 minims of Liquor

Opii sedativus with 30 minims of Sal Volatile in an ounce of camphor water may be given to soothe nervous unrest. For insomnia Lawson speaks highly of Morphinæ gr. $\frac{1}{8}$ to gr. $\frac{1}{2}$. Hyoscine gr. $\frac{1}{200}$ to gr. $\frac{1}{75}$ may be tried. Meningites should be treated by cold to the scalp and counter-irritation to the nape of the neck and occiput.

(3). *Hæmorrhages* may be treated by Ergot or Ergotin internally or hypodermically. When there is much hæmorrhage, use of alcohol should be partly suspended.

(4). If there is constipation, a dose of calomel may be given. In the beginning there is almost always constipation, which should be removed by a dose of calomel followed by a saline. Diarrhœa may be checked by an enema of opium. Two grains of Dover's powder and 10 grains of tannin mixed with an ounce of gum mucilage and with two or three ounces of warm water, arrowroot or starch may be used for injection. Salol in 10-grain doses every 4 hours may be given for diarrhœa. For vomiting and hiccough sinapism over the epigastrium, sucking of ice, and for thirst acidulated water with syrup of lemon are recommended. Coma must be promptly met by cold effusion if there is pyrexia or by rectal injection of strong coffee. The bladder of the patient should be carefully watched. Pneumonia and other complications should be treated under general principles.

When temperature falls and convalescence begins, the stimulants should be lessened, and afterwards a tonic with quinine, acid nitromuriatic dil.,

tincture calumba or quassia may be given with infusion aurantii.

Serum treatment.—The whole system of serum therapeutics is due to the genius of Pasteur. Diphtheria and tetanus are diseases that are caused by specific germs and are now successfully treated by immunised serum. Tetanus can be prevented and even cured by the injection of serum of other animals vaccinated against this disease : this process has been applied by Yersin for producing a plague serum, for which a prophylactic and curative power is claimed, and this serum may be called plague anti-toxin. Yersin treated his first case in Canton. At Amoy, the people were less averse to treatment, and in 10 days he was able to treat 23 with two deaths only. As yet Yersin's serum has been tried in the declared diseases, but Yersin also proposes to use it as a preventive. Haffkine also proposes to make use of his serum for curative purpose. Yersin's serum is older than Haffkine's, otherwise bacteriologically they are identical. The subject is in far too unsettled a condition at present, but it has no doubt a hopeful future before it.

DISINFECTION.

Substances which can prevent infectious diseases from spreading by destroying their specific germs are called disinfectants. These disinfectants can kill pathogenic germs. Heat is a most powerful agent in killing germs, therefore anything which is subjected to prolonged boiling becomes sterile or germ-free. For purification of clothes and bedding, heat is the best agent, either by boiling them in water or by placing them in a hot-air chamber. The

usual arrangement is a furnace with the smoke shaft passing under or on one side of a brick chamber and with a hot-air blast from a shaft running through or under the fire into the chamber itself, or into a passage below it, whence it passes into the chamber through a valve ; an exit for the hot-air is provided at the top of the chamber, the clothes are suspended in the chamber, at a little distance from the walls. Various kinds of ingenious apparatus have been recently contrived and are used. Steam disinfecting chambers are necessary for the disinfection of clothes, &c., of a large population, and all large towns and railway stations should have them. High pressure steam in an apparatus contrived for the intermission of its pressure is found to give the best heat penetration to large non-conducting articles such as bedding. Fumigation by burning sulphur or chlorine is a very useful method for disinfection of rooms. Large bonfires of sulphur may also have a beneficial effect on the air.

PURIFICATION OF A ROOM AFTER PLAGUE CASES—

All woodwork should be thoroughly cleansed with soft soap and water, to which a little carbolic acid has been added. The walls should be scraped and then washed with hot lime to which carbolic acid should be added in the proportion of one pint to four gallons of water. Then the room should be fumigated for 3 hours, with all doors and windows and the chimney being closed, sulphur about 1 seer for every 100 cubic feet of space should be put in a metallic dish, a little alcohol is poured on it, and it is lighted. After 3 hours the doors and

windows should be opened and kept open for 24 or 36 hours. Rooms may be disinfected by chlorine. Carbolic acid in 5 per cent. solution is useful for all ordinary purposes, such as washing hands, utensils, &c.

Quicklime is the cheapest and the most easily procurable disinfectant for drains and for disinfection of discharges. Carbolic powder made by adding carbolic acid to lime is very useful for the disinfection of public latrines, drains and sewers. Corrosive sublimate, in the proportion of 1 part in 4,000, is the most efficient germicide known and should be used diluted with water for sprinkling on public roads and for flushing drains and washing latrines, &c. It is, however, poisonous and corrodes metal drain pipes. In quarantine or isolation camp the latrines should be of the dry earth system. Carbolic acid powder should be largely used in them. The question of suitable disposal of sewage depends on the circumstances of each town or village, but incineration is the most sanitary method during an epidemic. Other disinfectants too, such as Jey's Fluid, Creoline, Phenyle, Izal, Sanitas, may also be used.

