

PRINTED.

G.O., No. 1436m

DATED 18-6-97

DEPT. OF

[Despatch Abstract.]

Bubonic plague

Drawing the attention of the President of the Municipal Commission ^{of} ~~of~~ the collectors of Districts in which there are isolation or observation camps to the remarks of the Sanitary Commissioner on the subject of the vitality of plague bacillus in water.

[illegible]

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

Drawing the attention of the President of the Municipal Commission, Madras, and of Collectors of districts, in which there are isolation or observation camps, to the remarks of the Sanitary Commissioner on the subject of the vitality of plague bacillus in water.

GOVERNMENT OF MADRAS.
LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers:—

From Surgeon-Lieutenant-Colonel W. G. KING, M.B., C.M., D.P.H., Sanitary Commissioner for Madras, to the Secretary to Government, Local and Municipal Department, dated Camp, Ennore, 24th May 1897, No. 1139-S.

I have the honour to forward, for the information of Government, certain correspondence with Mr. Hankin on the subject of the vitality of the plague bacillus in water. This would dictate the desirability of water being protected in all isolation and observation camps by the covering of the wells and the use of pumps, as, indeed, already suggested by me in my inspection notes, dated 16th April last (embodied in G.O., No. 974 M., dated 26th April 1897).

ENCLOSURES.

From Surgeon-Lieutenant-Colonel W. G. KING, M.B., C.M., D.P.H., Sanitary Commissioner for Madras, to E. H. HANKIN, Esq., care of Plague Research Committee, Bombay, dated Fort St. George, 17th April 1897, No. 887-S.

As I understand from your recent work in connection with the behaviour of the plague bacillus in grain that you are undertaking the special branch of following the life history of the bacillus in connection with practical sanitation, I have the honour to state that, in the absence of any known source of information on this point, I should feel greatly obliged if you would inform me whether you have yet ascertained the conduct of the bacillus in water; can it live — can it propagate in water?

From E. H. HANKIN, Esq., Chemical Examiner, North-Western Provinces and Oudh, to the Sanitary Commissioner for Madras, dated Municipal Laboratory, Bombay, 25th April 1897.

I have the honour to acknowledge the receipt of your No. 887 of 17th April enquiring as to the vitality of the bubonic microbe in water.

2. In two out of three experiments, I found that the microbe died out in sterilised tap water within three days. In a third experiment it was still alive at that time. I once found the microbe in a pool of salt water in a piece of ground used as a salt factory at Sewri. The pool was surrounded by human dejecta, and for all I know to the contrary the infection may have been put there ten minutes before I arrived. I have found that the microbe is not harmed by immersion for three hours in a saturated salt solution, though after 24 hours in this solution it appeared to be either dead or attenuated. I have not yet commenced experiments on the fate of the microbe in not sterilised water. The question is obviously of great practical importance, but at present I shrink from the difficulty of the task. So far as my researches and the researches of other bacteriologists here go, it seems unlikely from the bacteriological standpoint that the microbe can maintain itself in the outside world for any time, in other words that it is only the secretions of men and animals infected by the disease that are the source of infection, and these secretions do not appear to retain their virulence for more than ten days under any conditions yet discovered. I do not, however, consider that we know enough about the microbe yet to make a dogmatic statement on this subject, and I hope to continue my researches.

From Surgeon-Lieutenant-Colonel W. G. KING, M.B., C.M., D.P.H., Sanitary Commissioner for Madras, to E. H. HANKIN, Esq., care of Plague Research Committee, Bombay, dated Fort St. George, 15th May 1897, No. 1058-S.

I have the honour to acknowledge, with many thanks, receipt of your letter, of the 25th April 1897, in which you had the courtesy to place at my disposal such information as you have yet been able to acquire as to the habits of the bacillus of plague in water.

2. I send you a pamphlet (circulated to district sanitary officers with this office letter No. 985-S., dated 3rd May 1897), containing extracts from certain old reports on former epidemics of plague. In these and other accounts, you will perceive the tenacity with which the disease clung to river-banks. Having regard to the favouring condition of damp soil, this may of course be pleaded as sufficient explanation—it being noteworthy that the majority of localities were marshy, or, on the other hand, the incidence of human traffic along the lines of rivers may also suffice; but it seems to me that the tendency is so marked (*vide* especially Netten Radcliffe's diagrams of the limit of spread in the Lower Volga epidemic) that I think the possibility of water, being one of the media of spread, is worthy of every consideration, and necessarily it is peculiarly one that the bacteriologist can afford much light on.

Memo. No. 621.

The Sanitary Commissioner is requested to be good enough to forward for reference a copy of his pamphlet referred to in paragraph 2 of his letter, No. 1058-S., dated 15th May 1897, to Dr. E. H. Hankin.

OOTACAMUND,
2nd June 1897.

(Signed) G. S. FORBES,
Secretary to Government.

From Surgeon-Lieutenant-Colonel W. G. KING, M.B., C.M., D.P.H., Sanitary Commissioner for Madras, to the Secretary to Government, Local and Municipal Department, dated Fort St. George, 12th June 1897, No. 1227-S.

With reference to official memorandum, No. 621, dated 2nd June 1897, I have the honour to forward herewith the pamphlet therein called for.

ENCLOSURE.

EXTRACTS from reports on plague by Mr. Netten Radcliffe, Surgeon-Major Colvill, Mr. C. Planck, Dr. E. D. Dickson, M.D., and of the Medical Officers of the Local Government Board.

(1) FAVOURABLE LOCALITIES AND CONDITIONS FOR SPREAD.

"During the years 1871, 1872 and 1873, I remarked that the epidemic began about the commencement of the rice-planting, that is to say, May or June. Onwards from this time its ravages were severe wherever it passed. During the summer, which in Yunnan is the rainy season, although the epidemic still held its course, yet it was of a milder character, but it is from the time the rain ceases to the end of the year that the disease is most active and deadly. A peculiar fact with regard to the track of the epidemic I have observed in several places both in the north and south of the province. Instead of visiting every village in its direct line of progress, it would pass some completely by, visiting places near them, and on both sides, to return to those forgotten spots, several months afterwards, when the epidemic would appear to have passed far away. Another fact not less curious is that, after having appeared in almost every one of the villages scattered about the plains, it ascends frequently the mountains, where among the aborigines, Ijèn, who inhabit the highlands, it claims many victims. One is inclined to believe that the disease is imported by the men and women who descend into the valley to barter, to work at certain seasons of the harvest, as it is chiefly the mountains adjoining the plains that are visited by the disease."

Good asserts, and Sir G. Blane supports him, that in Europe and Africa the plague is destroyed or suspended between 60 and 80 degrees. Copland gives lower figures, viz., from 35 to 75 degrees. But Mahamurree has appeared within a considerable range of temperature. I have seen it with the thermometer in my tent, varying from 83 to 95 degrees, rising in a grass hut to 105 degrees. But the atmosphere was more or less damp. It is very probable that, with a perfectly dry air and the thermometer at 75 degrees or above it, the poison would be inert.

Extremes of temperature, combined with moisture, are, as is well known, not unfavourable to the development of disease. But dry cold is bracing, and the healthiest season of the year in India is the hottest, when the dry hot winds are blowing their hardest. Kumaon and Gurhwal, as already stated, are in plague latitudes, as also are the plains of Upper India; but the native inhabitants of the latter escape Mahamurree, it is alleged, in consequence of the great heat. Their personal cleanliness and a better sanitary condition (though in many places there is room for improvement in this respect) doubtless conduce greatly to their immunity.

Pali Plague.—The Himalayahs are not the only place in India where plague has appeared. It has raged with great virulence, though more temporarily, in the west of India in the Bombay Presidency. Its first advent there was, it is believed, in May 1815 in Guzerat and Kuttaywar Cutch, after three years of severe famine. It re-appeared the following January, February and March, in the same locality, whence it migrated to Scinde. It seems to have remained in these parts till 1819, when it disappeared; and we hear no more of the disease till July 1836, when it broke out with violence at a town called Pali in Marwar, whence the name by which it has subsequently been known—*Pali Plague*.

This appearance of plague in the Province of Bengazi had been preceded by four years of drought and consequent failure of crops. Each successive year the miseries arising from dearth had increased. The greater part of the flocks and herds were destroyed from want of food, and the mortality among horned cattle was augmented by a fatal epizootic which attacked them. Plague appeared when the sufferings of the population from famine were greatest.

Among certain of the villages amidst the Hindieh marshes in 1867, after an excessive flood of the Euphrates and inundation of the marshes, plague, which was believed to have disappeared from Mesopotamia for 33 years, re-appeared.

Plague in this outbreak in Persian Kurdistan appears to have first shown itself at the end of autumn 1870 or the beginning of the winter of 1870-71, on an elevated table-land lying south-east of Lake Urumiah, between the head waters of the rivers Jagatu and Tatawa, both of which streams flow into the lake named. The district had last before suffered from plague in the epidemic of 1829-35. The villages attacked not only within the locality of first appearance, but also in neighbouring localities to which the disease extended, including the town of Bana (Berozh), are, according to Dr. Telafons, built at altitudes above the Black Sea of which the lowest (Uchtepé) is 4,540 feet, and the highest (Arbanos, where the disease seems first to have become active), 5,870. Bana has an altitude of 5,470 feet; and Akjivan, where the nature of the disease was first recognised, 5,240 feet.

The villages earliest attacked were situated in the district of Mikri. The disease is believed to have originated in a hamlet named Djoumouchan (Gamishan), which is situated at an altitude of 6,600 feet, and which at the time of the appearance of plague contained six families.

The existence of plague was first observed in April 1874, but Dr. Arnand is of opinion that cases had occurred several months before. The outbreak had been preceded by three years' privation arising from failure of crops in the successive years, consequent upon persisting drought. In the winter months of 1873-74 the famine had become so severe that persons might be seen hunting for undigested grain in the dung voided by camels. The cold season of 1873-74 and spring of 1874 had been unusually wet and had converted some of the favourite camping grounds of the nomadic tribes, as in the valley of Merdj, into swamps, adding to the misery of the starving population for the time being, but rendering secure the summer crops.

"Most of these villages are situated on an elevated table-land called 'Toumouna,' rising about 2,000 metres above the sea and 1,500 above the 'Tehama,' and extending as far as the 'Namaz' range, from which it is separated by the valley of 'Waba.'

"Here a marked contrast is seen between the barren, wretched plain of Tehama and the fertile, pleasing aspect of the Toumouna plateau. The villages just named are built of stone; the houses are several stories, are well-aired and properly distributed, and the soil is rich and produces the best quality of Yemen coffee, often giving two crops in the same year. Indian corn, dhurra, barley and indigo are cultivated; vegetation thrives and fruit trees abound. Running water is scarce, but in lieu of it the inhabitants are supplied with wells and cisterns."

To this interesting account Dr. Dickson adds a remark made by Dr. Parznichi, in a report to the central health department, dated from Djerzan in Arabia, on the 18th December 1874, that "the localities lately attacked by the outbreak of plague had been previously visited by famine."

I have already, besides mentioning the town, described four classes of villages or groups of huts. One class where irrigation takes place with skin buckets on account of the high bank, and the huts are on dry ground and therefore receive all the antiseptic influence of earth. In the second class the villagers only spend the season of cultivation on the ground and return to the towns for the rest of the year. In the third class the villagers are driven, on account of the rise of the water from their rice-fields, and forced to move their habitations twice a year, while the ground they occupy during the greater part of the year is thoroughly cleansed by the rising river. Those three classes of villages are all free from plague, and the disease is confined to the fourth class only. In this class the villages or groups of huts are permanent; they are on ground which is a foot or two lower than the surface of the water in spring, and the ground is so saturated with water that the refuse of the village is neither absorbed nor can it be evaporated, for it acquires fresh moisture from the ground, and this refuse acquires the form of a bluish-black oily fluid, which surrounds the huts and covers the paths, and stains the walls two feet from the ground; and, in fact, the village is in such a state of filth that it requires to be seen to be believed. It was this class of village which was exclusively attacked in the Hindieh in 1867. *

I can see no reason why it should have attacked this district last spring, and this in preference to any other year; for during the past two years every kind of grain has been in profusion, dates in abundance, and fish on the Euphrates are caught simply for the sake of the oil. It may be remarked that, during last spring, there was an excess of rain as in 1867, but that could not affect villages moist as these are. Still, it is a significant fact that the only two great inundations of the rivers since 1831 occurred in 1867 and last spring, and that during the great plague of 1831 there was an inundation of the Tigris, which washed half Bagdad away. In 1867, however, the disease died away in one spring, while this year the area has much increased since last year.

The malady would appear to have shown itself with more or less activity in various parts of the tract of country lying between the Shat-el-Atchin and the Shat-el-Hai, and along that part of the course of the Euphrates where it had been chiefly active the previous year (1875). Thus its presence was noted again at Shinafieh, on the Sea of Nedjef at Jerboyah, Diwanieh, Samara and other places on the Euphrates as low down as Suk-e-Sheyukh, and along the course of the Shat-el-Hai to its junction with the Tigris at Kut-el-Amarah. Moreover, in the district lying to the north of the tract of country above described, and which had been the scene of the outbreak of 1873-74, plague was noted at Meshedali, Kufa, Kifl, Tanabi (Tuarih) on the borders of the Hindieh marshes (the last-named place being the chief town of the Hindieh district), and at Kerbella. The disease also appeared at Hillah and at Bagdad, and in the villages of the district lying between the two towns.

The stress of the outbreak of 1875-76 would appear to have fallen upon the tract of country which extends immediately to the north of the district that had suffered in 1873-74.

(2) METHOD OF SPREAD.

Poison in the Soil.—I strongly incline to the belief that the poison of Mahamurree exists in great force in the soil, which becomes at every visitation more and more impregnated with it, owing to the filthy habits of the people. They contribute to its accumulation in every possible way. The death of rats and snakes favours the view of the poison emanating from the soil, but whether this be associated with electrical or volcanic changes in the rocks, or earthquakes, or the development of sulphuretted hydrogen, we do not as yet know. Dr. Planck, the Sanitary Commissioner of the North-West Provinces, who was deputed to investigate, in conjunction with Dr. Pearson, the outbreak of Mahamurree in 1876, believes that the rats die of suffocation. He comments upon the fact of these rats being unlike the large animal of Norway that frequents our sewers. They are grey and of a more delicate constitution. He discredits the diseased-grain theory, as the rats are not found dead in their holes. I am not aware, however, whether these have ever been thoroughly searched.

Whilst, from the past history and general characteristics of Mahamurree, we may reasonably infer that there is but little fear of its appearance in localities unsuitable for its reception from the fact of its having broken out in localities that are suitable (aye, even in those that apparently are not—witness some of the cleanliest villages in Kumaon), the inevitable conclusion is forced upon us, that the only safeguard is thorough sanitation in all its forms.

"Excepting inasmuch as any bad quality of the grain commonly consumed by the people may conduce to a low state of health, I do not think the prevalence of plague disease can be due to any peculiar condition of this or any other article of food. At the same time I should say that Dr. Watson, a careful observer, is of opinion that the prevalence of plague in Gairwal and Kumaon may be due to the generation of a fungus in decaying grain.

"It is undoubtedly true that rats are sometimes found dead in the houses of families about to suffer from an outbreak of plague. I have seen several of these dead rats in and about infected houses. They are not the strong, black Norway rat which lives in the sewers of Europe, but a more delicate-looking grey species. All I have seen appeared to have died suddenly, as by suffocation, their bodies being in good condition, a piece of rag sometimes clenched in the teeth; and I think it likely that they may have died from the same cause of vitiated atmosphere as produces the bad state of health conducive to attack of plague in man. The best record of this death of rats will be found in the Bintola History, and it may be noticed that the dead rats were described as being found in the morning on the floor near to the sleeping people. It seems probable that their ordinary places of exit may have been closed. If dying of poisonous grain, I should think they would be likely to die in their holes or hiding places. I have seen some live-snakes near to infected villages, and one particularly live-snake which came out of an infected house; but I have never seen any dead snake in connection with an infected house or village. If snakes die from eating the deceased rats, cats could hardly be expected to escape. Yet far from seeing any dead cats, I have on several occasions had some trouble in saving the life of a cat desperately attached to an infected house about to be burnt.

"The villages, in which the death of rats in the infected houses was testified to, were Bintola, Chanai, Kanasi, Khajuli, Tailihat, East Dugora, Parsali, Sungarh, and Naukori, and in all these places the history points to an outbreak of plague disease not resulting from infection. They seem to be places in which the disease renewed its active appearance; and as the result of careful inquiry and observation, I think it may be true that the death of rats, preceding an outbreak of the disease, points to certain local conditions or peculiarities as giving rise to the outbreak. In no village, where the history clearly points to infection as the cause of the outbreak, could I obtain evidence of the death of rats, and I think it may be true that where rats have not died infection has given rise to the outbreak, p. 94.]

"I have, on several occasions, recorded the fact that the people of an infected house when vacating it for a jungle residence, took with them a supply of the grain they had been eating for many previous days, lived on it in the jungle and suffered no harm. Indeed, that is the usual course of proceeding and frequent result."

In the early period of the outbreak when the malady manifested itself almost wholly as a non-fatal bubonic affection, communicability of the disease from the sick to the healthy was neither observed nor suspected. But in the second period of the outbreak, the probability of such communicability was early forced upon the attention, and presently was apparently confirmed by the spread of the disease being, in the main, strictly limited to persons who had been or were in close association with the sick. Subsequent examination of a relationship existing between those dead from the outbreak, and those who, having been attacked with the disease, recovered, has shown the accuracy of the grounds upon which this conclusion was founded, and from which the communicability of the disease was inferred.

Here lived a family consisting of a man, his wife and two children, the one aged six years, the other 18 years of age. The father had twice visited Vetlianka on the 7th (19th) and 14th (26th) December. The inhabitants knowing this avoided any communication with him or his wife and children. On the 15th (27th) he was taken ill, and died on the 17th (29th) of a malady, the symptoms of which are unknown. On the 17th (29th) December the wife and youngest child were taken ill, and they died the next day. The inhabitants of the village compelled the eldest child to bury the corpses of his parents and his brother, then to burn the house in which they had lived and all its contents, together with his own proper clothing. Clad in new habiliments, he was afterwards permitted to live in the granary of the court belonging to the house after it had been fumigated by burning sulphur within it, and repelled from personal communication with his neighbours, food was passed to him through a window. Fifteen days after the burial of his parents and brother [4th, 5th (16th, 17th) January] he fell ill and was seen by Dr. Pagorsky.

Importation.—The theory of importation was twofold. The Russian and German Medical Commissioners are inclined to believe that the infection of plague was introduced into Vetlianka by infected spoils brought by Cossacks returning from the seat of the Russo-Turkish war of 1877-78 in Asia Minor; the Roumanian and French Medical Commissioners believe that the disease was imported to the Lower Volga direct from Persia, or more precisely from Resht or its vicinity.

The first of these theories rests upon the facts that the first unquestioned case of plague at Vetlianka, that of the 17th (29th) October 1878 followed immediately upon the return home of the Cossacks from that village who had served in the war, and who had brought with them various articles of Turkish or Persian textile manufactures, spoils or purchases, or both, which might have been exposed to the infection of plague.

"There is a fact that inclines one to think that the epidemic is owing to exhalations from the soil, and it is this: those animals that live in the ground, in drains or in holes are the first to be attacked. This is particularly noticeable with the rats. As soon as these animals are ill, they leave their holes in troops, and after staggering about and falling over each other, drop down dead; more frequently they die under the floor, filling the apartments with foul odours, of which the source is not discovered at once. The same phenomenon occurs in the case of other animals, great and small, such as buffaloes, oxen, sheep and deer, and sometimes also courtyard fowl, but among these the disease is not very fatal. On our arrival in the province, we refused to believe these stories setting them down to the superstitious imaginations of the people; but when the malady broke out during our stay we had the opportunity of convincing ourselves of their veracity."

Death of Rats.—One very singular circumstance is the almost invariable death of the rats of the village, which occurs on the eve of an outbreak of Mahamurree.

A similar preliminary mortality amongst the rats occurs in Yunnan, in Western China, where the disease—evidently plague—has been endemic for some years past, especially since the occurrence of the massacres which accompanied the outbreak and suppression of the Mahometan rebellion in that province; the surrounding provinces remaining entirely free from it. Here the plague is invariably preceded by a great mortality among the rats and other animals living in drains and in holes in the ground. As soon as this premonitory warning is recognised, the people purify their houses, abstain from pork, and in some cases fly from the threatened district.

Mode of a Rat's Death.—The manner of a rat's death was remarkable; the animal would emerge from its hole on to the floor, stagger, perform an involuntary gyration or two, bring up blood and die. More commonly the rats were found in the morning lying dead near the sleepers. On more than one occasion a rag has been found between the clenched teeth of the rat. I am not aware that any of the professional observers ever saw a rat die and as thus stated; but, as the same statement was universally made by the natives, there is no reason to discredit it. And we saw rats dead.

Examination of the Grain.—An idea having prevailed in some quarters that diseased grain (that in common use is the *Eleusine coracana* known locally as *Mundooa*) might be a factor in the generation of Mahamurree, we carefully examined it as stowed away in the baskets, from top to bottom, but it was good throughout without any trace of fungus or any disease whatever. The pultaceous mass of food (consisting of grain) found in the rat's stomach seemed particularly wholesome. And on their return home from the jungles, the survivors, if they find any grain left by the bears—who generally, however, make a pretty good clearance—entertain no scruples about using it again. Indeed, they sometimes take it into the jungle with them. Doubtless it is diseased sometimes, and the people, who cannot afford to throw it away, do eat it in that state, but I very much doubt its ever lighting up Mahamurree, and if we admit it as a cause of the disease, it should be in universal operation.

I may mention here that Dr. Pearson, in his long experience, saw no connection between Mahamurree and the disorders of cattle. The cattle suffered occasionally from foot-and-mouth disease, but not especially in Mahamurree years. During the outbreaks of this disease and before, they, as a rule, remained healthy as did the sheep and the goats. Dr. Watson (who succeeded Dr. Pearson) attributes their immunity from the plague to the fact of their eating only grass and no grain. He gives, in support of the grain theory, the case of rats in the neighbourhood of a water-mill, beginning to die only when some grain had been taken from a village to be ground. With the exception of rats, and much more rarely, snakes, the death of animals in connection with Mahamurree was not a marked feature. If one animal, eating another plague-infected, should die, how much more the bears who, it is alleged, consume the bodies of the villagers that have died of Mahamurree? Certain it is that bears are often carnivorously disposed; and that they were observed in greater numbers than usual in outbreaks of this plague. I myself saw, one moonlight night, what appeared to be a small family of bears pass the bamboo scaffold on which I was seated—they were too far for a shot—and the plague-stricken corpses rapidly disappeared. No dead bears were ever seen.

From Pali the disease radiated within a circuit of 30 miles, extending in October as far as Jondhpoor. Under the energetic supervision of Major Dixon, then Superintendent of Ajmeer,

the capital of Rajpootana, quarantine was established, and the plague did not reach any other states in the province, the intervening hilly country of Mhairwarah helping to exclude them. One town, however, viz., Dewar, was affected owing to infringement of the quarantine regulations. Interested traders persuaded the inhabitants to conduct porters carrying the bales of merchandise into Dewar, where the disease immediately afterwards broke out; passing over in the setting in of the hot season in that same year the plague declined, and has not since been heard of as such in that part of India.

Commenced amongst the Chippahs.—We find that the Pali plague invariably appeared amongst one class of people, viz., the Chippahs, or cloth Printers of Pali; that it then attacked others, who fled and formed fresh foci of contagion. The Chippahs principally had dealings with the Bunnyahs, or intermediate small traders, who thus became the carriers of the poison. Why should the cotton-printers be the first to suffer? Because, it is urged, they imported the merchandise from Surat on the coast; because they unpacked it; and because it consisted of goods brought in part from plague countries, whence it would, therefore, contain the fomites of contagion. Surat has commercial intercourse with Egypt, the Red Sea and the Persian Gulf. In Kuttwar, as at Pali, these importers of cotton goods also worked in cotton—they made cotton cloths. From whatever source the poison came, the avocation of the Chippahs invited its advent amongst themselves, raw cotton affording a favourable nidus for its abode, just as the woollen dress of the Gurhwallee more readily gave a lodging to the poison of Mahamurree than did the cotton garment of the Kumaonee. Cotton raw and cotton made up are of course two very different things. The theory of packed goods transporting the poison, and disseminating it when those goods reached their destination and were unpacked, has been recently maintained by Professor Hirsch, the celebrated authority on infectious disorders who, in a discourse delivered last year before the Medical Association of Berlin, expressed his belief that the poison of the plague, which broke out at the end of 1878 in Vetlianka in Astrakhan, resided in the packed goods that were being conveyed from Mesopotamia to Armenia; and that, when these goods having become the spoil of the Cossacks, were taken by the latter to their homes and there opened out, this poison became diffused.

Communication between Kumaon and Gurhwal and the West of India.—On referring to the map of India, we find that a distance of between 700 and 800 miles separates the birth place of the plague in the West of India from Kumaon and Gurhwal, the plains of Northern India intervening, and I am not aware of any regular direct communication between the two. The Bhotiyahs—the carriers of the hills before referred to—annually descend into the plains during the cold season, and visit some of the principal towns there as Allahabad, Agra, Delhi, &c., going now that they have in a great measure overcome their dread of small-pox as far as Calcutta. But I believe that they have never yet penetrated into the presidencies of Madras and Bombay. Railway facilities may, in the future, enable them to do so, but without these facilities, it would be next to impossible, their time being so limited.

Dr. Arnaud was able to follow the movements of the disease in some detail, noting its dissemination through the inter-communication of the occupants of various encampments, and showing a period of latency after exposure to infection in three cases of five days, in one case of six days, and generally a limit of eight days.

Last spring a man arrived from Afiche at Um Nejeris, and died in a hut of plague; and two to three days after his arrival, the first case of plague occurred. Four people in that hut died, all who fell ill, leaving two only untouched. In all, 20 people in a population of 500 died, and some 20 recovered. The heats having set in, the disease became dormant till last autumn, when it again appeared at Um Nejeris, and four persons died, but the greater number recovered. Plague again became dormant till the beginning of January of this year, when it was reported to exist on the Shat-il-Hai. In the beginning of February it was carried to the district of Abdare by some Montefik Arabs from the Hai, and about 150 in the district died out of a population of 4,000 souls.

The village of Fowar had a population of about 250 souls, and up to the time of my visit 43 were known to have died though there were probably more deaths. On the 16th of April a man arrived from Fowar, and spent the night in a garden-house on the outskirts of the town of Diwanayah on the left bank of the Euphrates. He fell ill of plague and died there. After a few days, exact time unknown, four of the gardener's family died, besides a little daughter, who was carried by the father in a dying state to a garden-house on the opposite bank of a river, and left there. He returned next night and took his child, who meanwhile died, back with him. Forty-eight hours after taking the girl to the gardener's huts on the right bank of the river, the first of this man's family was seized; there were here 15 people in all, divided into four huts: in one hut, father, mother and son died, all it contained; in another hut a woman living by

herself died; in a third hut, two girls died, leaving father and mother and one girl behind. One or two Jews went to this garden on the 28th of April, and four days after a boy, 15 years of age, was attacked; but when I saw him on the 7th of May, he was recovering with a bubo on the left groin, which had burst. A soldier from the barracks close by was also attacked after entering this garden, but was recovering when I saw him. Another soldier from the barracks, after visiting a village three hours distant, towards Shinafeah, where he entered a hut, of which to use a local expression, the doors were shut, meaning that all had died inside, returned to Diwanayah and died. At Shatra the disease appeared only about the middle of April, and was increasing in the beginning of May. From Shatra, plague was carried into Nassreah by two messengers on the 20th of April. One of the messengers died and the other returned to Shatra. Between two and three days after the entrance of the messenger into a house in Nassreah, where he stayed, the head of that house was taken ill. Altogether up to the middle of May about thirty people died.

"The said disease first appeared in a village 10 miles to the north of Shuster called Jellikan towards the latter part of March. It broke out there just after the arrival of a caravan of pilgrims from Kerbela, who had come by way of Hillah, Bagdad, Amarah, and thence by land to said village. Two persons belonging to said caravan died of plague; the corpses were washed and buried at Jellikan. Shortly afterwards cases occurred in the village in such numbers as to constitute an epidemic. Out of a population of 300 souls there were 85 deaths. At Shuster the disease appeared in April. The first cases were noticed among persons who had come to the town from Jellikan. The disease lasted to the end of July. Out of a population of 8,000 there were about 1,800 deaths. As many as 40 deaths a day occurred during the height of the epidemic. In the neighbouring villages there were a few isolated cases."

It is noteworthy of the outbreak in the district of Abu Graib, recorded in the text, as of the outbreak at Azizie in November of the previous year (1875), one of several outbreaks marking the beginning of the diffusion of 1875-76, that it was attributed locally to the consumption of the flesh of diseased camels. Doctors Wortabet, Lubitz and Sebastio, of the Sanitary Administration of Bagdad, visited Abu Graib in the third week of November, immediately after the news of the outbreak reached Bagdad. They saw there two persons who were suffering from fever and glandular swellings, and who had been ill about a fortnight. The inhabitants of the district stated that a month before a party of Anezi Arabs had encamped in it for the sake of pasturage. The camels of the party became ill and were slaughtered, the flesh, notwithstanding the circumstances under which the animals were killed, being used for food. Of those who ate it, 40 sickened and died. The inhabitants then, alarmed by this fatal outbreak of disease, rose upon the nomads, and compelled them to withdraw into the desert.

"He states that not only human beings, but domestic animals, and even rats, are attacked by the pestilence.

"Its approach may often be known from the extraordinary movements of the rats, who leave their holes and crevices, and issue on to the floors without a trace of their accustomed timidity springing continually upwards from their hind legs as if they were trying to jump out of something.

"The rats fall dead, and then comes the turn of the poultry; after the poultry have succumbed, pigs, goats, ponies, and oxen successively die off.

"The good father has a theory of his own that the plague is really a pestilential emanation slowly rising in an equable stratum from the ground, and as it increases in depth, all animals are, as it were, drowned in its poisonous flood; the smaller creatures being first engulfed, and man, the tallest of Yunnan animals, suffering last."

"This absence of epidemic tendency would appear to exclude any supposition that the prevalence of the disease may be due to any cause affecting things enjoyed in common by the people, such as the air they breathe, or the food they eat, or from any peculiarity in their common habits. And the inquiry becomes narrowed to a consideration of the local condition or peculiarities of the centres of population in which the disease is seen to prevail.

"As touching this endemic peculiarity of the disease shown by the scattered geographical position of the villages affected, many villages unaffected intervening, a study of the histories, previously recorded, will add strength to that opinion. For it will be seen that, as a rule, the prevalence, even in the village itself, is confined to one house, or one terrace, or one portion of the village.

"This peculiarity is plainly shown in the rough ground plans which accompany the histories. Isolated cases may occur amongst families inhabiting other portions of the village, but commencing and excessive mortality appears, almost invariably, to be restricted in locality as described. And where, not so restricted, a means, other than that first operating, may be clearly traced to account for the peculiarity.

"This means is the communication of the disease from person to person, against which the strongest and best health is no guarantee, although probably debility of body conduces to an attack by this means. I use the term 'means' in preference to 'cause,' because the cause, whether in the first or last case of the local prevalence, is the same, namely, the specific germ or active principle of plague which can only produce plague disease; the disease being plague, it is hardly necessary to dwell upon the fact that it is communicable from the sick to the healthy; for, of all diseases, plague possesses that peculiarity in most marked degree. This opinion rests on the record of many facts, the principal of which are the death from plague of 80 medical officers of the French, and of half of the medical officers of the English Army during the campaign in Egypt; and the death, with hardly an exception, of some few persons who have inoculated themselves with plague matter.

"The histories of this record provide ample evidence of the communicability of the Kumaun plague. These histories everywhere provide an account of a disease, not suddenly arising many cases together, but occurring, as a rule, in orderly succession of cases amongst those who lived habitually together, nursed the sick, and buried the dead. Indeed I think the histories support the opinion, that, ordinarily, the first case occurring in a village gives origin to all that succeed in that neighbourhood."

Dr. Cabiadis neither attempts to deny the contagious properties of plague, nor does he accept unconditionally the assertion of those who pretend that you must keep at a distance, say of six metres from the patient, in order to avoid contracting the disease. The experience acquired by him during the epidemic outbreaks of Illah and Bagdad has convinced him that no great risk is incurred in touching persons affected with the plague, provided you avoid exposing yourself for any lengthened period to the atmosphere of the apartment occupied by him. As a proof of this doctrine, he says that those persons who lived in the same house with a plague-smitten patient, but who avoided touching him or his clothes, through fear of catching the infection, generally did get the plague; while those who lived in houses exempt from the malady, but who visited plague patients and handled them freely, without remaining long in the same room with them, hardly ever caught the disease. When plague entered a house it seldom spared its inmates, and often carried them all off within a week's time. In noting these facts, Doctor Cabiadis was careful to take into account the various tenets of the different religious sects of the people of Bagdad; for while the Muhammadans discarding all sanitary precautions lived with and handled plague patients, the Jews and Christians, on the contrary, firmly believing in its contagious properties, very seldom touched them; yet all of them equally caught the disease if they lived in the same house with the plague patient, but were safe if they quitted the house the moment a case of plague occurred in it. Doctor Cabiadis quotes another remarkable fact in support of his theory. With one exception none of the physicians, surgeons, or assistants who daily attended on plague patients caught that malady, and he himself handled nearly 2,000 plague-smitten persons without suffering any inconvenience from it. To this it might be objected that the immunity enjoyed by them was owing to their contact with the sick being a momentary one. But, Doctor Cabiadis remarks, that if this be true with respect to the physician, it cannot be so with regard to the surgeon and assistant whose duties obliged them to prolong their stay near the patients for the purpose of opening abscesses, washing and dressing sores, &c. The exception alluded to above was that of an assistant who actually died of the plague. But in an epidemic outbreak affecting a whole population one death amongst an entire corporation would rather indicate the law that governed the general mortality at the time than the exceptional liability of that body for coming into contact with the diseased.

Dr. Cabiadis does not think that the infectious matter of the plague is contained in the pus secreted from the buboes and sores. Plague, he observes, is transmitted even in its incipient stage and before any of the swellings or boils have suppurated. The problem, therefore, remains to be solved, whether the specific materies morbi of plague is exhaled from the patients' respiratory organs, from his cutaneous surface, or from some other emanatory.

These considerations lead me to the important practical question of fomites. I was very anxious to obtain from Dr. Cabiadis the fullest information on this point, so as to clear up, if possible, this intricate subject. Dr. Cabiadis says that he considered the atmosphere which surrounds a person affected with plague as the true medium of transmission. Apart from this, he has also met numerous instances in which he believes the clothes and bedding of plague patients communicated the malady to sound persons living beyond the sphere of the epidemic outbreak. Such articles were made of wool, cotton, flax or hemp. He ignores whether these materials in a raw state would have given the disease as well, since he has not met with any fact to enlighten him upon the subject.

(3) MODIFIED FORME OF PLAGUE.

Two or three months previous to the manifestation of plague in Mesopotamia glandular swellings free from fever prevailed in that country. They showed themselves in the groin, arm pit, or neck, and were not accompanied by other symptoms. They began to appear amongst the inhabitants about the end of autumn and continued through the winter; but towards the end

of it plague broke out and reached its acme of intensity in the spring, and died out suddenly during the summer season when the great heat declared itself, and the thermometer rose to 45 or 50 degrees of centigrade scale (113° or 122° F.). During the prevalence of the plague the thermometer ranged between 5 and 30 degrees; and when it rose to 30 degrees (86° F.) the disease had reached its maximum of intensity. As the temperature increased from 30 to 45 degrees (86° to 113° F.) the epidemic began to diminish, and as soon as the thermometer got up to 45 degrees (113° F.) it ceased abruptly. On the cessation of the plague, apyretic glandular swellings re-appeared again, precisely similar to those which had preceded the outbreak, and they continued to manifest themselves for about two months longer. These glandular swellings were frequently met with, and were distinct from the chronic adenitic swellings met with in subjects of a scrofulous tendency, and evidently unconnected with any special diathesis.

Dr. Cabiadis gives the following translation of a telegram from Drs. Döppner and Zwillingmann, dated from Enotayevsk on the 15th (27th) December 1878: "In the beginning of November, cases of ague were observed (at Vetlianka), marked by two or three paroxysms of shivering, and succeeded by a hot stage, and by swellings of the inguinal and axillary glands, often ending in suppuration. On the 27th November (9th December), this outbreak assumed a new form; the glandular swellings did not appear but the patients became affected with shiverings, pain in the forehead and temples, vomiting, intense heat, aches in the limbs, giddiness, headache, altered features, injected eyes, nausea, anorexia, furred and dry tongue; in some cases pericardial distress, discharges of blood, insomnia, delirium and great weakness. These symptoms reached their acme on the third day."

"Relapses occurred occasionally in convalescence, and always ended in death. On the 9th December, the character of the outbreak assumed another type."

Note on larval, abortive, or ambulant plague.—The question here chiefly rests upon the significance to be attached to the non-fatal bubonic malady observed in the city of Astrakhan in 1877-79, and at the beginning of the outbreak at Vetlianka in 1878. This larval, abortive, or ambulant form of plague has received especial attention during the later outbreaks of the disease in Mesopotamia and Bonghazi, and its importance in an epidemiological point of view may be studied in Dr. Jholozan's recent work "*La Peste en Turquie dans les Temps Modernes, sa prophylaxie defectueuse, sa limitation spontanée*," a work which introduces a new era in epidemiological research and practice. But it may be useful here to note that the recognition of an abortive or ambulant form of plague is no new thing. Simply the circumstances under which recent outbreaks of the disease have occurred, give occasion for greater attention to be devoted to this non-fatal and seemingly slight form. Thus Sydenham, in his observations on 'The Pestilential fever and the Plague of the years 1665 and 1666,' writes: "It happens also that at times tumours may break out without either fever or shivers in some slight degree or other, although I suspect, for my own part, that chills or shivers precede. Those to whom this happens may walk about in more or less perceptible, invariably precede. Those to whom this happens may walk about in public as usual, and attend to the common duties of life like healthy men taking no thought of regimen."

In May 1877 there were observed on the outskirts of the city of Astrakhan and in the city itself a series of cases of sickness in which, after the patient had suffered for several days from a febrile state, sometimes acute, swellings of the lymphatic glands in the groin, the axilla, the submaxillary space, &c., occurred, usually ending in suppuration. The patient was rarely disabled altogether in the febrile state, and when the glands began to swell, except that the swelling impeded motion, he was commonly able to get about as usual, and the appetite and general functions of the body became normal.

Two hundred cases of this affection occurred in the city of Astrakhan, but it is to be assumed that in a non-fatal malady of this kind, rarely disabling the patient, many cases would escape notice, and this certainly appears to have been the case in the villages of the delta.

Nevertheless it received a certain sort of attention at the time, but more particularly afterwards with reference to the events which followed at Vetlianka and in the villages on the banks of the Lower Volga in that part of its course. The medical profession in the city of Astrakhan were much puzzled with the nature of the malady. One physician thought from the predominance of the affection of the glands of the neck that he had to deal with a form of mumps; others from the first regarded it as a slighter form of the plague then prevalent on the southern littoral of the Caspian; but the great majority appear to have looked upon it as a form of malarial poisoning, notwithstanding the absence of any disorder of the spleen. All, however, were of accord that the malady was new to the present generation of medical men in the city, and wholly distinct from the syphilitic and scrofulous glandular affections with which they were familiar.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers:—

From Surgeon-Lieutenant-Colonel W. G. KING, M.B., C.M., D.P.H., Sanitary Commissioner for Madras, to the Secretary to Government, Local and Municipal Department, dated Camp, Ennore, 24th May 1897, No. 1139-S.

I have the honour to forward, for the information of Government, certain correspondence with Mr. Hankin on the subject of the vitality of the plague bacillus in water. This would dictate the desirability of water being protected in all isolation and observation camps by the covering of the wells and the use of pumps, as, indeed, already suggested by me in my inspection notes, dated 16th April last (embodied in G.O., No. 974 M., dated 26th April 1897).

ENCLOSURES.

From Surgeon-Lieutenant-Colonel W. G. KING, M.B., C.M., D.P.H., Sanitary Commissioner for Madras, to E. H. HANKIN, Esq., care of Plague Research Committee, Bombay, dated Fort St. George, 17th April 1897, No. 887-S.

As I understand from your recent work in connection with the behaviour of the plague bacillus in grain that you are undertaking the special branch of following the life history of the bacillus in connection with practical sanitation, I have the honour to state that, in the absence of any known source of information on this point, I should feel greatly obliged if you would inform me whether you have yet ascertained the conduct of the bacillus in water; can it live—can it propagate in water?

From E. H. HANKIN, Esq., Chemical Examiner, North-Western Provinces and Oudh, to the Sanitary Commissioner for Madras, dated Municipal Laboratory, Bombay, 25th April 1897.

I have the honour to acknowledge the receipt of your No. 887 of 17th April enquiring as to the vitality of the bubonic microbe in water.

2. In two out of three experiments, I found that the microbe died out in sterilised tap water within three days. In a third experiment it was still alive at that time. I once found the microbe in a pool of salt water in a piece of ground used as a salt factory at Sewri. The pool was surrounded by human dejecta, and for all I know to the contrary the infection may have been put there ten minutes before I arrived. I have found that the microbe is not harmed by immersion for three hours in a saturated salt solution, though after 24 hours in this solution it appeared to be either dead or attenuated. I have not yet commenced experiments on the fate of the microbe in not sterilised water. The question is obviously of great practical importance, but at present I shrink from the difficulty of the task. So far as my researches and the researches of other bacteriologists here go, it seems unlikely from the bacteriological standpoint that the microbe can maintain itself in the outside world for any time, in other words that it is only the secretions of men and animals infected by the disease that are the source of infection, and these secretions do not appear to retain their virulence for more than ten days under any conditions yet discovered. I do not, however, consider that we know enough about the microbe yet to make a dogmatic statement on this subject, and I hope to continue my researches.

From Surgeon-Lieutenant-Colonel W. G. KING, M.B., C.M., D.P.H., Sanitary Commissioner for Madras, to E. H. HANKIN, Esq., care of Plague Research Committee, Bombay, dated Fort St. George, 15th May 1897, No. 1058-S.

I have the honour to acknowledge, with many thanks, receipt of your letter, of the 25th April 1897, in which you had the courtesy to place at my disposal such information as you have yet been able to acquire as to the habits of the bacillus of plague in water.

2. I send you a pamphlet (circulated to district sanitary officers with this office letter No. 985-S., dated 3rd May 1897), containing extracts from certain old reports on former epidemics of plague. In these and other accounts, you will perceive the tenacity with which the disease clung to river-banks. Having regard to the favouring condition of damp soil, this may of course be pleaded as sufficient explanation—it being noteworthy that the majority of localities were marshy, or, on the other hand, the incidence of human traffic along the lines of rivers may also suffice; but it seems to me that the tendency is so marked (*vide* especially Netten Radcliffe's diagrams of the limit of spread in the Lower Volga epidemic) that I think the possibility of water, being one of the media of spread, is worthy of every consideration, and necessarily it is peculiarly one that the bacteriologist can afford much light on.

Memo. No. 621.

The Sanitary Commissioner is requested to be good enough to forward for reference a copy of his pamphlet referred to in paragraph 2 of his letter, No. 1058-S., dated 15th May 1897, to Dr. E. H. Hankin.

(Signed) G. S. FORBES,
Secretary to Government.

OOTACAMUND,
2nd June 1897.

From Surgeon-Lieutenant-Colonel W. G. KING, M.B., C.M., D.P.H., Sanitary Commissioner for Madras, to the Secretary to Government, Local and Municipal Department, dated Fort St. George, 12th June 1897, No. 1227-S.

With reference to official memorandum, No. 621, dated 2nd June 1897, I have the honour to forward herewith the pamphlet therein called for.

ENCLOSURE.

EXTRACTS from reports on plague by Mr. Netten Radcliffe, Surgeon-Major Colvill, Mr. C. Planck, Dr. E. D. Dickson, M.D., and of the Medical Officers of the Local Government Board.

(1) FAVOURABLE LOCALITIES AND CONDITIONS FOR SPREAD.

"During the years 1871, 1872 and 1873, I remarked that the epidemic began about the commencement of the rice-planting, that is to say, May or June. Onwards from this time its ravages were severe wherever it passed. During the summer, which in Yunnan is the rainy season, although the epidemic still held its course, yet it was of a milder character, but it is from the time the rain ceases to the end of the year that the disease is most active and deadly. A peculiar fact with regard to the track of the epidemic I have observed in several places both in the north and south of the province. Instead of visiting every village in its direct line of progress, it would pass some completely by, visiting places near them, and on both sides, to return to those forgotten spots, several months afterwards, when the epidemic would appear to have passed far away. Another fact not less curious is that, after having appeared in almost every one of the villages scattered about the plains, it ascends frequently the mountains, where among the aborigines, Ijên, who inhabit the highlands, it claims many victims. One is inclined to believe that the disease is imported by the men and women who descend into the valley to barter, to work at certain seasons of the harvest, as it is chiefly the mountains adjoining the plains that are visited by the disease."

Good asserts, and Sir G. Blane supports him, that in Europe and Africa the plague is destroyed or suspended between 60 and 80 degrees. Copland gives lower figures, viz., from 35 to 75 degrees. But Mahamurree has appeared within a considerable range of temperature. I have seen it with the thermometer in my tent, varying from 83 to 95 degrees, rising in a grass hut to 105 degrees. But the atmosphere was more or less damp. It is very probable that, with a perfectly dry air and the thermometer at 75 degrees or above it, the poison would be inert.

Extremes of temperature, combined with moisture, are, as is well known, not unfavourable to the development of disease. But dry cold is bracing, and the healthiest season of the year in India is the hottest, when the dry hot winds are blowing their hardest. Kumaon and Gurhwal, as already stated, are in plague latitudes, as also are the plains of Upper India; but the native inhabitants of the latter escape Mahamurree, it is alleged, in consequence of the great heat. Their personal cleanliness and a better sanitary condition (though in many places there is room for improvement in this respect) doubtless conduce greatly to their immunity.

Pali Plague.—The Himalayahs are not the only place in India where plague has appeared. It has raged with great virulence, though more temporarily, in the west of India in the Bombay Presidency. Its first advent there was, it is believed, in May 1815 in Guzerat and Kuttwar Cutch, after three years of severe famine. It re-appeared the following January, February and March, in the same locality, whence it migrated to Scinde. It seems to have remained in these parts till 1819, when it disappeared; and we hear no more of the disease till July 1836, when it broke out with violence at a town called Pali in Marwar, whence the name by which it has subsequently been known—*Pali Plague*.

This appearance of plague in the Province of Bengazi had been preceded by four years of drought and consequent failure of crops. Each successive year the miseries arising from dearth had increased. The greater part of the flocks and herds were destroyed from want of food, and the mortality among horned cattle was augmented by a fatal epizootic which attacked them. Plague appeared when the sufferings of the population from famine were greatest.

Among certain of the villages amidst the Hindieh marshes in 1867, after an excessive flood of the Euphrates and inundation of the marshes, plague, which was believed to have disappeared from Mesopotamia for 33 years, re-appeared.

Plague in this outbreak in Persian Kurdistan appears to have first shown itself at the end of autumn 1870 or the beginning of the winter of 1870-71, on an elevated table-land lying south-east of Lake Urumiah, between the head waters of the rivers Jagatu and Tatawa, both of which streams flow into the lake named. The district had last before suffered from plague in the epidemic of 1829-35. The villages attacked not only within the locality of first appearance, but also in neighbouring localities to which the disease extended, including the town of Bana (Berozeh), are, according to Dr. Telafons, built at altitudes above the Black Sea of which the lowest (Uchtepé) is 4,540 feet, and the highest (Arbanos, where the disease seems first to have become active), 5,870. Bana has an altitude of 5,470 feet; and Akjivan, where the nature of the disease was first recognised, 5,240 feet.

The villages earliest attacked were situated in the district of Mikri. The disease is believed to have originated in a hamlet named Djoumouchan (Gamishan), which is situated at an altitude of 6,600 feet, and which at the time of the appearance of plague contained six families.

The existence of plague was first observed in April 1874, but Dr. Armand is of opinion that cases had occurred several months before. The outbreak had been preceded by three years' privation arising from failure of crops in the successive years, consequent upon persisting drought. In the winter months of 1873-74 the famine had become so severe that persons might be seen hunting for undigested grain in the dung voided by camels. The cold season of 1873-74 and spring of 1874 had been unusually wet and had converted some of the favourite camping grounds of the nomadic tribes, as in the valley of Merdj, into swamps, adding to the misery of the starving population for the time being, but rendering secure the summer crops.

"Most of these villages are situated on an elevated table-land called 'Toumouna,' rising about 2,000 metres above the sea and 1,500 above the 'Tehama,' and extending as far as the 'Namaz' range, from which it is separated by the valley of 'Waba.'

"Here a marked contrast is seen between the barren, wretched plain of Tehama and the fertile, pleasing aspect of the Toumouna plateau. The villages just named are built of stone; the houses are several stories, are well-aired and properly distributed, and the soil is rich and produces the best quality of Yemen coffee, often giving two crops in the same year. Indian corn, dhurra, barley and indigo are cultivated; vegetation thrives and fruit trees abound. Running water is scarce, but in lieu of it the inhabitants are supplied with wells and cisterns."

To this interesting account Dr. Dickson adds a remark made by Dr. Parznichi, in a report to the central health department, dated from Djerzan in Arabia, on the 18th December 1874, that "the localities lately attacked by the outbreak of plague had been previously visited by famine."

I have already, besides mentioning the town, described four classes of villages or groups of huts. One class where irrigation takes place with skin buckets on account of the high bank, and the huts are on dry ground and therefore receive all the antiseptic influence of earth. In the second class the villagers only spend the season of cultivation on the ground and return to the towns for the rest of the year. In the third class the villagers are driven, on account of the rise of the water from their rice-fields, and forced to move their habitations twice a year, while the ground they occupy during the greater part of the year is thoroughly cleansed by the rising river. Those three classes of villages are all free from plague, and the disease is confined to the fourth class only. In this class the villages or groups of huts are permanent; they are on ground which is a foot or two lower than the surface of the water in spring, and the ground is so saturated with water that the refuse of the village is neither absorbed nor can it be evaporated, for it acquires fresh moisture from the ground, and this refuse acquires the form of a bluish-black oily fluid, which surrounds the huts and covers the paths, and stains the walls two feet from the ground; and, in fact, the village is in such a state of filth that it requires to be seen to be believed. It was this class of village which was exclusively attacked in the Hindieh in 1867.

I can see no reason why it should have attacked this district last spring, and this in preference to any other year; for during the past two years every kind of grain has been in profusion, dates in abundance, and fish on the Euphrates are caught simply for the sake of the oil. It may be remarked that, during last spring, there was an excess of rain as in 1867, but that could not affect villages moist as these are. Still, it is a significant fact that the only two great inundations of the rivers since 1831 occurred in 1867 and last spring, and that during the great plague of 1831 there was an inundation of the Tigris, which washed half Bagdad away. In 1867, however, the disease died away in one spring, while this year the area has much increased since last year.

The malady would appear to have shown itself with more or less activity in various parts of the tract of country lying between the Shat-el-Atchin and the Shat-el-Hai, and along that part of the course of the Euphrates where it had been chiefly active the previous year (1875). Thus its presence was noted again at Shinafieh, on the Sea of Nedjef at Jerboyah, Diwanieh, Samara and other places on the Euphrates as low down as Suk-e-Sheyukh, and along the course of the Shat-el-Hai to its junction with the Tigris at Kut-el-Amarah. Moreover, in the district lying to the north of the tract of country above described, and which had been the scene of the outbreak of 1873-74, plague was noted at Meshedali, Kufa, Kifl, Tanabi (Tuarich) on the borders of the Hindieh marshes (the last-named place being the chief town of the Hindieh district), and at Kerbella. The disease also appeared at Hillah and at Bagdad, and in the villages of the district lying between the two towns.

The stress of the outbreak of 1875-76 would appear to have fallen upon the tract of country which extends immediately to the north of the district that had suffered in 1873-74.

(2) METHOD OF SPREAD.

Poison in the Soil.—I strongly incline to the belief that the poison of Mahamurree exists in great force in the soil, which becomes at every visitation more and more impregnated with it, owing to the filthy habits of the people. They contribute to its accumulation in every possible way. The death of rats and snakes favours the view of the poison emanating from the soil, but whether this be associated with electrical or volcanic changes in the rocks, or earthquakes, or the development of sulphuretted hydrogen, we do not as yet know. Dr. Planck, the Sanitary Commissioner of the North-West Provinces, who was deputed to investigate, in conjunction with Dr. Pearson, the outbreak of Mahamurree in 1876, believes that the rats die of suffocation. He comments upon the fact of these rats being unlike the large animal of Norway apparently are not—witness some of the cleanest villages in Kumaon, the inevitable conclusion is forced upon us, that the only safeguard is thorough sanitation in all its forms.

Whilst, from the past history and general characteristics of Mahamurree, we may reasonably infer that there is but little fear of its appearance in localities unsuitable for its reception from the fact of its having broken out in localities that are suitable (aye, even in those that apparently are not—witness some of the cleanest villages in Kumaon), the inevitable conclusion is forced upon us, that the only safeguard is thorough sanitation in all its forms.

"Excepting inasmuch as any bad quality of the grain commonly consumed by the people may conduce to a low state of health, I do not think the prevalence of plague disease can be due to any peculiar condition of this or any other article of food. At the same time I should say that Dr. Watson, a careful observer, is of opinion that the prevalence of plague in Garhwál and Kumaon may be due to the generation of a fungus in decaying grain.

"It is undoubtedly true that rats are sometimes found dead in the houses of families about to suffer from an outbreak of plague. I have seen several of these dead rats in and about infected houses. They are not the strong, black Norway rat which lives in the sewers of Europe, but a more delicate-looking grey species. All I have seen appeared to have died suddenly, as by suffocation, their bodies being in good condition, a piece of rag sometimes clenched in the teeth; and I think it likely that they may have died from the same cause of vitiated atmosphere as produces the bad state of health conducive to attack of plague in man. The best record of this death of rats will be found in the Bintola History, and it may be noticed that the dead rats were described as being found in the morning on the floor near to the sleeping people. It seems probable that their ordinary places of exit may have been closed. If dying of poisonous grain, I should think they would be likely to die in their holes or hiding places. I have seen some live-snakes near to infected villages, and one particularly live-snake which came out of an infected house; but I have never seen any dead snake in connection with an infected house or village. If snakes die from eating the deceased rats, cats could hardly be expected to escape. Yet far from seeing any dead cats, I have on several occasions had some trouble in saving the life of a cat desperately attached to an infected house about to be burnt.

"The villages, in which the death of rats in the infected houses was testified to, were Bintola, Chanai, Kanasi, Khajuli, Tailihat, East Dugora, Parsali, Sungarh, and Naukori, and in all these places the history points to an outbreak of plague disease not resulting from infection. They seem to be places in which the disease renewed its active appearance; and as the result of careful inquiry and observation, I think it may be true that the death of rats, preceding an outbreak of the disease, points to certain local conditions or peculiarities as giving rise to the outbreak. In no village, where the history clearly points to infection as the cause of the outbreak, could I obtain evidence of the death of rats, and I think it may be true that where rats have not died infection has given rise to the outbreak, p. 94.]

"I have, on several occasions, recorded the fact that the people of an infected house when vacating it for a jungle residence, took with them a supply of the grain they had been eating for many previous days, lived on it in the jungle and suffered no harm. Indeed, that is the usual course of proceeding and frequent result."

In the early period of the outbreak when the malady manifested itself almost wholly as a non-fatal bubonic affection, communicability of the disease from the sick to the healthy was neither observed nor suspected. But in the second period of the outbreak, the probability of such communicability was early forced upon the attention, and presently was apparently confirmed by the spread of the disease being, in the main, strictly limited to persons who had been or were in close association with the sick. Subsequent examination of a relationship existing between those dead from the outbreak, and those who, having been attacked with the disease, recovered, has shown the accuracy of the grounds upon which this conclusion was founded, and from which the communicability of the disease was inferred.

Here lived a family consisting of a man, his wife and two children, the one aged six years, the other 18 years of age. The father had twice visited Vetlianka on the 7th (19th) and 14th (26th) December. The inhabitants knowing this avoided any communication with him or his wife and children. On the 15th (27th) he was taken ill, and died on the 17th (29th) of a malady, the symptoms of which are unknown. On the 17th (29th) December the wife and youngest child were taken ill, and they died the next day. The inhabitants of the village compelled the eldest child to bury the corpses of his parents and his brother, then to burn the house in which they had lived and all its contents, together with his own proper clothing. Clad in new habiliments, he was afterwards permitted to live in the granary of the court belonging to the house after it had been fumigated by burning sulphur within it, and repelled from personal communication with his neighbours, food was passed to him through a window. Fifteen days after the burial of his parents and brother [4th, 5th (16th, 17th) January] he fell ill and was seen by Dr. Pagorsky.

Importation.—The theory of importation was twofold. The Russian and German Medical Commissioners are inclined to believe that the infection of plague was introduced into Vetlianka by infected spoils brought by Cossacks returning from the seat of the Russo-Turkish war of 1877-78 in Asia Minor; the Roumanian and French Medical Commissioners believe that the disease was imported to the Lower Volga direct from Persia, or more precisely from Resht or its

The first of these theories rests upon the facts that the first unquestioned case of plague at Vetlianka, that of the 17th (29th) October 1878 followed immediately upon the return home of the Cossacks from that village who had served in the war, and who had brought with them various articles of Turkish or Persian textile manufactures, spoils or purchases, or both, which might have been exposed to the infection of plague.

"There is a fact that inclines one to think that the epidemic is owing to exhalations from the soil, and it is this: those animals that live in the ground, in drains or in holes are the first to be attacked. This is particularly noticeable with the rats. As soon as these animals are ill, they leave their holes in troops, and after staggering about and falling over each other, drop down dead; more frequently they die under the floor, filling the apartments with foul odours, of which the source is not discovered at once. The same phenomenon occurs in the case of other animals, great and small, such as buffaloes, oxen, sheep and deer, and sometimes also courtyard fowl, but among these the disease is not very fatal. On our arrival in the province, we refused to believe these stories setting them down to the superstitious imaginations of the people; but when the malady broke out during our stay we had the opportunity of convincing ourselves of their veracity."

Death of Rats.—One very singular circumstance is the almost invariable death of the rats of the village, which occurs on the eve of an outbreak of Mahamurree.

A similar preliminary mortality amongst the rats occurs in Yunnan, in Western China, where the disease—evidently plague—has been endemic for some years past, especially since the occurrence of the massacres which accompanied the outbreak and suppression of the Mahometan rebellion in that province; the surrounding provinces remaining entirely free from it. Here the plague is invariably preceded by a great mortality among the rats and other animals living in drains and in holes in the ground. As soon as this premonitory warning is recognised, the people * * * purify their houses, abstain from pork, and in some cases fly from the threatened district.

Mode of a Rat's Death.—The manner of a rat's death was remarkable; the animal would emerge from its hole on to the floor, stagger, perform an involuntary gyration or two, bring up blood and die. More commonly the rats were found in the morning lying dead near the sleepers. On more than one occasion a rag has been found between the clenched teeth of the rat. I am not aware that any of the professional observers ever saw a rat die and as thus stated; but, as the same statement was universally made by the natives, there is no reason to discredit it. And we saw rats dead.

Examination of the Grain.—An idea having prevailed in some quarters that diseased grain (that in common use is the *Eleusine coracana* known locally as *Mundooa*) might be a factor in the generation of Mahamurree, we carefully examined it as stowed away in the baskets, from top to bottom, but it was good throughout without any trace of fungus or any disease whatever. The pultaceous mass of food (consisting of grain) found in the rat's stomach seemed particularly wholesome. And on their return home from the jungles, the survivors, if they find any grain left by the bears—who generally, however, make a pretty good clearance—entertain no scruples about using it again. Indeed, they sometimes take it into the jungle with them. Doubtless it is diseased sometimes, and the people, who cannot afford to throw it away, do eat it in that state, but I very much doubt its ever lighting up Mahamurree, and if we admit it as a cause of the disease, it should be in universal operation.

I may mention here that Dr. Pearson, in his long experience, saw no connection between Mahamurree and the disorders of cattle. The cattle suffered occasionally from foot-and-mouth disease, but not especially in Mahamurree years. During the outbreaks of this disease and before, they, as a rule, remained healthy as did the sheep and the goats. Dr. Watson (who succeeded Dr. Pearson) attributes their immunity from the plague to the fact of their eating only grass and no grain. He gives, in support of the grain theory, the case of rats in the neighbourhood of a water-mill, beginning to die only when some grain had been taken from a village to be ground. With the exception of rats, and much more rarely, snakes, the death of animals in connection with Mahamurree was not a marked feature. If one animal, eating another plague-infected, should die, how much more the bears who, it is alleged, consume the bodies of the villagers that have died of Mahamurree? Certain it is that bears are often carnivorously disposed; and that they were observed in greater numbers than usual in outbreaks of this plague. I myself saw, one moonlight night, what appeared to be a small family of bears pass the bamboo scaffold—on which I was seated—they were too far for a shot—and the plague-stricken corpses rapidly disappeared. No dead bears were ever seen.

From Pali the disease radiated within a circuit of 30 miles, extending in October as far as Jondhpoor. Under the energetic supervision of Major Dixon, then Superintendent of Ajmeer,

the capital of Rajpootana, quarantine was established, and the plague did not reach any other states in the province, the intervening hilly country of Mhairwarah helping to exclude them. One town, however, viz., Dewar, was affected owing to infringement of the quarantine regulations. Interested traders persuaded the inhabitants to conduct porters carrying the bales of merchandise into Dewar, where the disease immediately afterwards broke out; passing over in March (1837) to Deogurh in Meywar, in which district 32 villages in all were attacked. With the setting in of the hot season in that same year the plague declined, and has not since been heard of as such in that part of India.

Commenced amongst the Chippahs.—We find that the Pali plague invariably appeared amongst one class of people, viz., the Chippahs, or cloth Printers of Pali; that it then attacked others, who fled and formed fresh foci of contagion. The Chippahs principally had dealings with the Bunnyahs, or intermediate small traders, who thus became the carriers of the poison. Why should the cotton-printers be the first to suffer? Because, it is urged, they imported the merchandise from Surat on the coast; because they unpacked it; and because it consisted of goods brought in part from plague countries, whence it would, therefore, contain the fomites of contagion. Surat has commercial intercourse with Egypt, the Red Sea and the Persian Gulf. In Kuttywar, as at Pali, these importers of cotton goods also worked in cotton—they made cotton cloths. From whatever source the poison came, the avocation of the Chippahs invited its advent amongst themselves, raw cotton affording a favourable nidus for its abode, just as the woollen dress of the Gurhwallee more readily gave a lodging to the poison of Mahamurree than did the cotton garment of the Kumaonee. Cotton raw and cotton made up are of course two very different things. The theory of packed goods transporting the poison, and disseminating it when those goods reached their destination and were unpacked, has been recently maintained by Professor Hirsch, the celebrated authority on infectious disorders who, in a discourse delivered last year before the Medical Association of Berlin, expressed his belief that the poison of the plague, which broke out at the end of 1878 in Vetlianka in Astrakhan, resided in the packed goods that were being conveyed from Mesopotamia to Armenia; and that, when these goods having become the spoil of the Cossacks, were taken by the latter to their homes and there opened out, this poison became diffused.

Communication between Kumaon and Gurhwal and the West of India.—On referring to the map of India, we find that a distance of between 700 and 800 miles separates the birth place of the plague in the West of India from Kumaon and Gurhwal, the plains of Northern India. The intervening, and I am not aware of any regular direct communication between the two. The Bhotiyahs—the carriers of the hills before referred to—annually descend into the plains during the cold season, and visit some of the principal towns there as Allahabad, Agra, Delhi, &c., going now that they have in a great measure overcome their dread of small-pox as far as Calcutta. But I believe that they have never yet penetrated into the presidencies of Madras and Bombay. Railway facilities may, in the future, enable them to do so, but without these facilities, it would be next to impossible, their time being so limited.

Dr. Arnaud was able to follow the movements of the disease in some detail, noting its dissemination through the inter-communication of the occupants of various encampments, and showing a period of latency after exposure to infection in three cases of five days, in one case of six days, and generally a limit of eight days.

Last spring a man arrived from Afiche at Um Nejeris, and died in a hut of plague; and two to three days after his arrival, the first case of plague occurred. Four people in that hut died, all who fell ill, leaving two only untouched. In all, 20 people in a population of 500 died, and some 20 recovered. The heats having set in, the disease became dormant till last autumn, when it again appeared at Um Nejeris, and four persons died, but the greater number recovered. Plague again became dormant till the beginning of January of this year, when it was reported to exist on the Shat-il-Hai. In the beginning of February it was carried to the district of Abdare by some Montefik Arabs from the Hai, and about 150 in the district died out of a population of 4,000 souls.

The village of Fowar had a population of about 250 souls, and up to the time of my visit 43 were known to have died though there were probably more deaths. On the 16th of April a man arrived from Fowar, and spent the night in a garden-house on the outskirts of the town of Diwaniyah on the left bank of the Euphrates. He fell ill of plague and died there. After a few days, exact time unknown, four of the gardener's family died, besides a little daughter, who was carried by the father in a dying state to a garden-house on the opposite bank of a river, and left there. He returned next night and took his child, who meanwhile died, back with him. Forty-eight hours after taking the girl to the gardener's huts on the right bank of the river, the first of this man's family was seized; there were here 15 people in all, divided into four huts: in one hut, father, mother and son died, all it contained; in another hut a woman living by

herself died; in a third hut, two girls died, leaving father and mother and one girl behind. One or two Jews went to this garden on the 28th of April, and four days after a boy, 15 years of age, was attacked; but when I saw him on the 7th of May, he was recovering with a bubo on the left groin, which had burst. A soldier from the barracks close by was also attacked after entering this garden, but was recovering when I saw him. Another soldier from the barracks, after visiting a village three hours distant, towards Shinafeah, where he entered a hut, of which to use a local expression, the doors were shut, meaning that all had died inside, returned to Diwaniyah and died. At Shatra the disease appeared only about the middle of April, and was increasing in the beginning of May. One of the messengers died and the other into Nassreah by two messengers on the 20th of April. One of the messengers died and the other returned to Shatra. Between two and three days after the entrance of the messenger into a house in Nassreah, where he stayed, the head of that house was taken ill. Altogether up to the middle of May about thirty people died.

"The said disease first appeared in a village 10 miles to the north of Shuster called Jellikan towards the latter part of March. It broke out there just after the arrival of a caravan of pilgrims from Kerbela, who had come by way of Hillah, Bagdad, Amarah, and thence by land to said village. Two persons belonging to said caravan died of plague; the corpses were washed and buried at Jellikan. Shortly afterwards cases occurred in the village in such numbers as to constitute an epidemic. Out of a population of 300 souls there were 85 deaths. At Shuster the disease appeared in April. The first cases were noticed among persons who had come to the town from Jellikan. The disease lasted to the end of July. Out of a population of 8,000 there were about 1,800 deaths. As many as 40 deaths a day occurred during the height of the epidemic. In the neighbouring villages there were a few isolated cases."

It is noteworthy of the outbreak in the district of Abu Graib, recorded in the text, as of the outbreak at Azizie in November of the previous year (1875), one of several outbreaks marking the beginning of the diffusion of 1875-76, that it was attributed locally to the consumption of the flesh of diseased camels. Doctors Wortabet, Lubitz and Sebastio, of the Sanitary Administration of Bagdad, visited Abu Graib in the third week of November, immediately after the news of the outbreak reached Bagdad. They saw there two persons who were suffering from fever and glandular swellings, and who had been ill about a fortnight. The inhabitants of the district stated that a month before a party of Anezi Arabs had encamped in it for the sake of pasturage. The camels of the party became ill and were slaughtered, the flesh, notwithstanding the circumstances under which the animals were killed, being used for food. Of those who ate it, 40 sickened and died. The inhabitants then, alarmed by this fatal outbreak of disease, rose upon the nomads, and compelled them to withdraw into the desert.

"He states that not only human beings, but domestic animals, and even rats, are attacked by the pestilence.

"Its approach may often be known from the extraordinary movements of the rats, who leave their holes and crevices, and issue on to the floors without a trace of their accustomed timidity springing continually upwards from their hind legs as if they were trying to jump out of something.

"The rats fall dead, and then comes the turn of the poultry; after the poultry have succumbed, pigs, goats, ponies, and oxen successively die off.

"The good father has a theory of his own that the plague is really a pestilential emanation slowly rising in an equable stratum from the ground, and as it increases in depth, all animals are, as it were, drowned in its poisonous flood; the smaller creatures being first engulfed, and man, the tallest of Yunnan animals, suffering last."

"This absence of epidemic tendency would appear to exclude any supposition that the prevalence of the disease may be due to any cause affecting things enjoyed in common by the people, such as the air they breathe, or the food they eat, or from any peculiarity in their common habits. And the inquiry becomes narrowed to a consideration of the local condition or peculiarities of the centres of population in which the disease is seen to prevail.

"As touching this endemic peculiarity of the disease shown by the scattered geographical position of the villages affected, many villages unaffected intervening, a study of the histories, previously recorded, will add strength to that opinion. For it will be seen that, as a rule, the prevalence, even in the village itself, is confined to one house, or one terrace, or one portion of the village.

"This peculiarity is plainly shown in the rough ground plans which accompany the histories. Isolated cases may occur amongst families inhabiting other portions of the village, but commencing and excessive mortality appears, almost invariably, to be restricted in locality as described. And where, not so restricted, a means, other than that first operating, may be clearly traced to account for the peculiarity.

"This means is the communication of the disease from person to person, against which the strongest and best health is no guarantee, although probably debility of body conduces to an attack by this means. I use the term 'means' in preference to 'cause,' because the cause, whether in the first or last case of the local prevalence, is the same, namely, the specific germ or active principle of plague which can only produce plague disease; the disease being plague, it is hardly necessary to dwell upon the fact that it is communicable from the sick to the healthy; for, of all diseases, plague possesses that peculiarity in most marked degree. This opinion rests on the record of many facts, the principal of which are the death from plague of 80 medical officers of the French, and of half of the medical officers of the English Army during the campaign in Egypt; and the death, with hardly an exception, of some few persons who have inoculated themselves with plague matter.

"The histories of this record provide ample evidence of the communicability of the Kumaun plague. These histories everywhere provide an account of a disease, not suddenly arising many cases together, but occurring, as a rule, in orderly succession of cases amongst those who lived habitually together, nursed the sick, and buried the dead. Indeed I think the histories support the opinion, that, ordinarily, the first case occurring in a village gives origin to all that succeed in that neighbourhood."

Dr. Cabiadis neither attempts to deny the contagious properties of plague, nor does he accept unconditionally the assertion of those who pretend that you must keep at a distance, say of six metres from the patient, in order to avoid contracting the disease. The experience acquired by him during the epidemic outbreaks of Hilla and Bagdad has convinced him that no great risk is incurred in touching persons affected with the plague, provided you avoid exposing yourself for any lengthened period to the atmosphere of the apartment occupied by him. As a proof of this doctrine, he says that those persons who lived in the same house with a plague-smitten patient, but who avoided touching him or his clothes, through fear of catching the infection, generally did not get the plague; while those who lived in houses exempt from the malady, but who visited plague patients and handled them freely, without remaining long in the same room with them, hardly ever caught the disease. When plague entered a house it seldom spared its inmates, and often carried them all off within a week's time. In noting these facts, Doctor Cabiadis was careful to take into account the various tenets of the different religious sects of the people of Bagdad; for while the Muhammadans discarding all sanitary precautions lived with and handled plague patients, the Jews and Christians, on the contrary, firmly believing in its contagious properties, very seldom touched them; yet all of them equally caught the disease if they lived in the same house with the plague patient, but were safe if they quitted the house the moment a case of plague occurred in it. Doctor Cabiadis quotes another remarkable fact in support of his theory. With one exception none of the physicians, surgeons, or assistants who daily attended on plague patients caught that malady, and he himself handled nearly 2,000 plague-smitten persons without suffering any inconvenience from it. To this it might be objected that the immunity enjoyed by them was owing to their contact with the sick being a momentary one. But, Doctor Cabiadis remarks, that if this be true with respect to the physician, it cannot be so with regard to the surgeon and assistant whose duties obliged them to prolong their stay near the patients for the purpose of opening abscesses, washing and dressing sores, &c. The exception alluded to above was that of an assistant who actually died of the plague. But in an epidemic outbreak affecting a whole population one death amongst an entire corporation would rather indicate the law that governed the general mortality at the time than the exceptional liability of that body for coming into contact with the diseased.

Dr. Cabiadis does not think that the infectious matter of the plague is contained in the pus secreted from the buboes and sores. Plague, he observes, is transmitted even in its incipient stage and before any of the swellings or boils have suppured. The problem, therefore, remains to be solved, whether the specific *materies morbi* of plague is exhaled from the patients' respiratory organs, from his cutaneous surface, or from some other emunctory.

These considerations lead me to the important practical question of fomites. I was very anxious to obtain from Dr. Cabiadis the fullest information on this point so as to clear up, if possible, this intricate subject. Dr. Cabiadis says that he considered the atmosphere which surrounds a person affected with plague as the true medium of transmission. Apart from this, he has also met numerous instances in which he believes the clothes and bedding of plague patients communicated the malady to sound persons living beyond the sphere of the epidemic outbreak. Such articles were made of wool, cotton, flax or hemp. He ignores whether these materials in a raw state would have given the disease as well, since he has not met with any fact to enlighten him upon the subject.

(3) MODIFIED FORMS OF PLAGUE.

Two or three months previous to the manifestation of plague in Mesopotamia glandular swellings free from fever prevailed in that country. They showed themselves in the groin, arm pit, or neck, and were not accompanied by other symptoms. They began to appear amongst the inhabitants about the end of autumn and continued through the winter; but towards the end

of it plague broke out and reached its acme of intensity in the spring, and died out suddenly during the summer season when the great heat declared itself, and the thermometer rose to 45 or 50 degrees of centigrade scale (113° or 122° F.). During the prevalence of the plague the thermometer ranged between 5 and 30 degrees; and when it rose to 30 degrees (86° F.) the disease had reached its maximum of intensity. As the temperature increased from 30 to 45 degrees (86° to 113° F.) the epidemic began to diminish, and as soon as the thermometer got up to 45 degrees (113° F.) it ceased abruptly. On the cessation of the plague, apyretic glandular swellings re-appeared again, precisely similar to those which had preceded the outbreak, and they continued to manifest themselves for about two months longer. These glandular swellings were frequently met with, and were distinct from the chronic adenitic swellings met within subjects of a scrofulous tendency, and evidently unconnected with any special diathesis.

Dr. Cabiadis gives the following translation of a telegram from Drs. Döppner and Zwimgmann, dated from Enotayevsk on the 15th (27th) December 1878: "In the beginning of November, cases of ague were observed (at Vetlianka), marked by two or three paroxysms of shivering, and succeeded by a hot stage, and by swellings of the inguinal and axillary glands, often ending in suppuration. On the 27th November (9th December), this outbreak assumed a new form; the glandular swellings did not appear but the patients became affected with shiverings, pain in the forehead and temples, vomiting, intense heat, aches in the limbs, giddiness, headache, altered features, injected eyes, nausea, anorexia, furred and dry tongue; in some cases pericardial distress, discharges of blood, insomnia, delirium and great weakness. These symptoms reached their acme on the third day."

"Relapses occurred occasionally in convalescence, and always ended in death. On the 9th December, the character of the outbreak assumed another type."

Note on larval, abortive, or ambulant plague.—The question here chiefly rests upon the signification to be attached to the non-fatal bubonic malady observed in the city of Astrakhan in 1877-79, and at the beginning of the outbreak at Vetlianka in 1878. This larval, abortive, or ambulant form of plague has received especial attention during the later outbreaks of the disease in Mesopotamia and Benghazi, and its importance in an epidemiological point of view may be studied in Dr. Jholozan's recent work "*La Peste en Turquie dans les Temps Modernes, sa prophylaxie defectueuse, sa limitation spontanée*," a work which introduces a new era in epidemiological research and practice. But it may be useful here to note that the recognition of an abortive or ambulant form of plague is no new thing. Simply the circumstances under which recent outbreaks of the disease have occurred, give occasion for greater attention to be devoted to this non-fatal and seemingly slight form. Thus Sydenham, in his observations on 'The Pestilential fever and the Plague of the years 1665 and 1666,' writes: "It happens also that at times tumours may break out without either fever of any important symptom as their precursors, although I suspect, for my own part, that chills or shivers in some slight degree or other, and more or less perceptible, invariably precede. Those to whom this happens may walk about in public as usual, and attend to the common duties of life like healthy men taking no thought of regimen."

In May 1877 there were observed on the outskirts of the city of Astrakhan and in the city itself a series of cases of sickness in which, after the patient had suffered for several days from a febrile state, sometimes acute, swellings of the lymphatic glands in the groin, the axilla, the submaxillary space, &c., occurred, usually ending in suppuration. The patient was rarely disabled altogether in the febrile state, and when the glands began to swell, except that the swelling impeded motion, he was commonly able to get about as usual, and the appetite and general functions of the body became normal.

Two hundred cases of this affection occurred in the city of Astrakhan, but it is to be assumed that in a non-fatal malady of this kind, rarely disabling the patient, many cases would escape notice, and this certainly appears to have been the case in the villages of the delta.

Nevertheless it received a certain sort of attention at the time, but more particularly afterwards with reference to the events which followed at Vetlianka and in the villages on the banks of the Lower Volga in that part of its course. The medical profession in the city of Astrakhan were much puzzled with the nature of the malady. One physician thought from the predominance of the affection of the glands of the neck that he had to deal with a form of mumps; others from the first regarded it as a slighter form of the plague then prevalent on the southern littoral of the Caspian; but the great majority appear to have looked upon it as a form of malarial poisoning, notwithstanding the absence of any disorder of the spleen. All, however, were of accord that the malady was new to the present generation of medical men in the city, and wholly distinct from the syphilitic and scrofulous glandular affections with which they were familiar.

Similar differences of opinion existed among the medical profession in St. Petersburg when the facts were reported there. Nevertheless certain medical men in Astrakhan did not hesitate to speak of the affection under the term of *Pestis nostras*, and Dr. Arkhangel'sky of St. Petersburg used the phrase *Pestis ambulans*.

The glandular sickness observed in the city and environs of Astrakhan in 1877 appears to have been observed there also in 1878 and 1879, but no definite particulars are given as to its prevalence in the two last-named years.

(4) PREVENTION OF SPREAD.

Prophylactic Measures.—The most effectual means for the protection of a community against the propagation of plague—the isolation of the sick, the destruction by fire of their clothes, and the whitewashing with lime and free ventilating of the domiciles in which cases of plague occur. The plague re-appeared in only one out of 350 houses which had been whitewashed after an outbreak of plague in them, whilst its re-appearance in houses that had merely been abandoned for a time, after an attack of that disease, but which had not been whitewashed, was of frequent occurrence.

The other disinfectants tried, such as sulphur fumigations, lighting fires, and throwing a solution of sulphate of iron into the drains, gave no decided results, except when associated with the whitewashing and airing of the infected house.

But it is pretty certain that the clearer view of what was desirable, indicated by some of the earlier measures, was quickly obscured by the panic which followed, and that sick and healthy were shut up indiscriminately in the infected houses, with the sad results which had been partially recognised even in this country over two hundred years ago.

"But if hereafter again a Plague should break out (which God forbid) with Submission to Superiors, I should think it not improper to appoint proper Accommodation out of the City, for such as are yet untouched in infected Families; and who should continue there for a certain time; the sick in the meantime to be removed to convenient Apartments provided on purpose for them: For by this means, that Practice, so abhorrent to Religion and Humanity, even in the Opinion of a Mahometan, of shutting up the sick and well together, would be avoided."—*Loimologia* or an Historical Account of the Plague in London in 1665. By Nath Hodges, M.D., and Fellow of the College of Physicians, who resided in the City all that Time. Edited by John Quincy, M.D. (2nd ed., 1720, p. 11). So also Mr. William Boghurst, a medical practitioner, who resided in St. Giles-in-the-Fields during the whole period of the plague in 1665, and who left a manuscript account of the outbreak, now in the British Museum, and from which extracts are given in Brayley's edition of Defoe's "A Journal of the Plague Year":—"As soon as any House is Infected, all the sound people should be had out of it, and not shut up therein to be murdered!"

ORDER—No. 1436 M., dated 18th June 1897.

The attention of the President of the Municipal Commission, Madras, and of Collectors of districts, in which there are isolation or observation camps, will be drawn to the remarks of the Sanitary Commissioner.

(True Extract.)

Secretary to Government.

To all Collectors.
 „ all Presidents of District Boards.
 „ the President, Municipal Commission, Madras.
 „ all Chairmen of Municipal Councils.
 „ the Surgeon-General.
 „ the Sanitary Commissioner.

Ed. W. D'Moss.

No. 1139
 S

Office of Sanitary Commissioner
 Camp Ennore 25 May 1897.
 Recd 27

From

Surgeon. Lieut. Col. W. G. King, M.B. Ch.D.
 Sanitary Commissioner for Madras
 2053 M.

To

The Secretary to Government
 Local & Municipal Department

Sir,

I have the honor to forward for the information of Government certain correspondence with Mr. Hankin on the subject of the vitality of the plague bacillus in water. This would dictate the desirability of water being protected in all isolation and observation camps by the covering of the wells and the use of pumps, as, indeed, already suggested by me in my Inspection Notes dated 16th April last (embodied in G.O. dated 26th April 1897 N^o 944 h. Local and Municipal)

I have the honor to be
 Sir

Yours most obedt Servant
 W. G. King
 Surgeon & Lieut. Col.
 Sanitary Commissioner for Madras

J.M. 1436 M. 18/6/97

No. 887
S

OFFICE OF SANITARY COMMISSIONER,
Fort St. George, 17th April 1897.

From

SURGEON LIEUT.-COL. W. G. KING, M.B., C.M., D.P.H.,
SANITARY COMMISSIONER FOR MADRAS,

To

THE
E. H. Hankin Esquire,
C/o Plague Research Committee
Bombay.

Enclosure.

SIR,

As I understand from your recent work in connection with the behaviour of the plague bacillus in grain that you are undertaking the special branch of following the life history of the bacillus in connection with practical sanitation, I have the honour to state that, in the absence of any known source of information on this point, I should feel greatly obliged if you would inform me whether you have yet ascertained the conduct of the bacillus in water; can it live — can it propagate in water?

Sincerely

(True copy)

W. G. King

Surgeon Lieut. Col.
Sanitary Commr. Madras.

I have etc.
(sd) W. G. King.
Surgeon Lieut. Col.
Sanitary Commr. Madras.

20532m 2897

From, E. H. Hankin
Chemical Examiner N. W. P. & Cuth,
To, Lt. Colonel King,
Sanitary Commissions Madras.
Dated, Municipal Laboratory Bombay.
25th April 1897.

Sir,
I have the honour to acknowledge
the receipt of your No. 887 of 17th April
enquiring as to the vitality of the bubonic
microbe in water.
2. In two out of three experiments,
I found that the microbe died out in steril-
ised tap water within three days. In a third
experiment it was still alive at that time.
I once found the microbe in a pool of salt
water in a piece of ground used as a salt
factory at Sewri. The pool was surrounded by
human dejecta and for all I know to the
contrary the infection may have been put there
ten minutes before I arrived. I have found
that the microbe is not harmed by immersion
for three hours in a saturated salt solution,
though after 24 hours in this solution it ap-
peared to be either dead or attenuated.
I have

2
2053299

Fort St. George, 15th May 1897.No. 1058.
S.

From

SURGEON-LIEUT.-COL. W. G. KING, M.B., C.M., D.P.H.,

SANITARY COMMISSIONER FOR MADRAS,

To

E. H. Hankin, Esquire,
Care of Plague Research Committee,
Bombay.

Enclosure.

Sir,

I have the honour to acknowledge, with many thanks, receipt of your letter of the 25th April 1897, in which you had the courtesy to place at my disposal such information as you have yet been able to acquire as to the habits of the bacillus of plague in water.

2. I send you a pamphlet [circulated to district sanitary officers with this official letter No. 985/s dated 3rd May 1897], containing extracts from certain old Reports on former epidemics of plague. In these and other accounts, you will perceive the tenacity with which the disease clung to river-banks. Having regard to the favouring condition of damp soil, this may of course be pleaded as sufficient explanation - it being noteworthy that the majority of localities were marshy, or, on the other hand,

3
2053 2nd 97

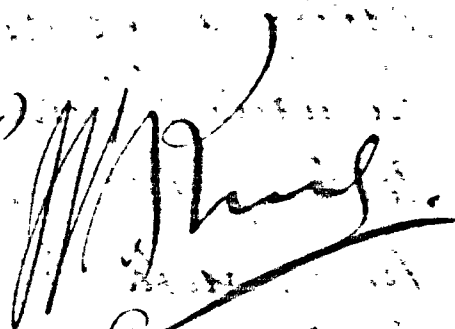
have not yet commenced experiments on the fate of the microbe in not-sterilised water. The question is obviously of great practical importance but at present I shrink from the difficulty of the task. So far as my researches and the researches of other bacteriologists here go, it seems unlikely from the bacteriological standpoint that the microbe can maintain itself in the outside world for any time, in other words that it is only the secretions of men and animals infected by the disease that are the source of infection, and these secretions do not appear to retain their virulence for more than four days under any conditions yet discovered. I do not however consider that we know enough about the microbe yet to make a dogmatic statement on this subject, and I hope to continue my researches.

I have etc.

(sd) E. H. Hankin

Chemical Examiner A. H. P. & Co.

(True copy)


Surgeon-Lieut. Colonel
Sanitary Commissioner for Madras

Memorandum.

House T. R.

Dated the 2. 6. 1897.

No. 621.

The San. Com. is requested
 to forward for reference a
 copy of his pamphlet
 referred to in para 2 of his
 letter No. 1058/s of 15th
 May 1897 to Dr. E. H. Hankin

J. R.
 1/6/97

hand, the incidence of human traffic
 along the lines of rivers may also
 suffice; but it seems to me that the
 tendency is so marked (Vide especially
 Nutton Radcliffe's diagrams of the limit
 of spread in the lower Volga epidemic)-
 that I think the possibility of water being
 one of the media of spread is worthy of
 every consideration, and necessarily it is
 peculiarly one that the bacteriologist can
 afford much light on.

I have, etc,
 (Signed) W. G. King,
 Surgeon Lieut-Colonel,
 Sanitary Commissioner for Madras.

(True copy)

M. A. S. S. S.
 Manager and Assistant
 for Sanitary Commissioner for Madras.

No. 1227
8

From

SURGEON-LIEUT.-COL. W. G. KING, M.B., C.M., D.P.H.,

SANITARY COMMISSIONER FOR MADRAS,

To

THE

*Secretary to Government,
Local & Municipal Department,
Fort Saint George*

Enclosure.

Sir,

*With reference to Official Memorandum No 621 dated 2nd June 1897, I have the honor to forward herewith the pamphlet therein called for.**I have the honor to be,
Sir,
Your most obedient servant,**W. G. King*
Surgeon-Lieut. Col.
Sanitary Commissioner for Madras

18

EXTRACTS FROM REPORTS ON PLAGUE BY MR. NETTEN RADCLIFFE,
SURGEON-MAJOR COLVILL, MR. C. PLANCK, DR. E. D. DICKSON,
M.D., AND OF THE MEDICAL OFFICERS OF THE LOCAL GOVERN-
MENT BOARD.

(1) FAVOURABLE LOCALITIES AND CONDITIONS FOR SPREAD.

"During the years 1871, 1872 and 1873, I remarked that the epidemic began about the commencement of the rice-planting, that is to say, May or June. Onwards from this time its ravages were severe wherever it passed. During the summer, which in Yünnan is the rainy season, although the epidemic still held its course, yet it was of a milder character, but it is from the time the rain ceases to the end of the year that the disease is most active and deadly. A peculiar fact with regard to the track of the epidemic I have observed in several places both in the north and south of the province. Instead of visiting every village in its direct line of progress, it would pass some completely by, visiting places near them, and on both sides, to return to those forgotten spots, several months afterwards, when the epidemic would appear to have passed far away. Another fact not less curious is that, after having appeared in almost every one of the villages scattered about the plains, it ascends frequently the mountains, where among the aborigines, Ijên, who inhabit the high lands, it claims many victims. One is inclined to believe that the disease is imported by the men and women who descend into the valley to barter, to work at certain seasons of the harvest, as it is chiefly the mountains adjoining the plains that are visited by the disease."

* * * * *

Good asserts, and Sir G. Blane supports him, that in Europe and Africa the plague is destroyed or suspended between 60 and 80 degrees. Copland gives lower figures, viz., from 35 to 75 degrees. But Mahamurree has appeared within a considerable range of temperature. I have seen it with the thermometer in my tent, varying from 83 to 95 degrees, rising in a grass hut to 105 degrees. But the atmosphere was more or less damp. It is very probable that, with a perfectly dry air and the thermometer at 75 degrees or above it, the poison would be inert. Extremes of temperature, combined with moisture, are, as is well known, not unfavourable to the development of disease. But dry cold is bracing, and the healthiest season of the year in India is the hottest, when the dry hot winds are blowing their hardest. Kumaon and Gurhwal, as already stated, are in plague latitudes, as also are the plains of Upper India; but the native inhabitants of the latter escape Mahamurree, it is alleged, in consequence of the great heat. Their personal cleanliness and a better sanitary condition (though in many places there is room for improvement in this respect) doubtless conduce greatly to their immunity.

* * * * *

Pali Plague.—The Himalayahs are not the only place in India where plague has appeared. It has raged with great virulence, though more temporarily, in the west of India in the Bombay Presidency. Its first advent there was, it is believed, in May 1815 in Guzerat and Kuttywar Cutch, after three years of severe famine. It reappeared the following January, February and March, in the same locality, whence it migrated to Scinde. It seems to have remained in these parts till 1819, when it disappeared; and we hear no more of the disease till July 1836, when it broke out with violence at a town called Pali in Marwar, whence the name by which it has subsequently been known—*Pali Plague*.

* * * * *

This appearance of plague in the province of Bengazi had been preceded by four years of drought and consequent failure of crops. Each successive year the miseries arising from dearth had increased. The greater part of the flocks and

1/222-17

herds were destroyed from want of food, and the mortality among horned cattle was augmented by a fatal epizootic which attacked them. Plague appeared when the sufferings of the population from famine were greatest.

Among certain of the villages amidst the Hindieh marshes in 1867, after an excessive flood of the Euphrates and inundation of the marshes, plague, which was believed to have disappeared from Mesopotamia for 33 years, reappeared.

Plague in this outbreak in Persian Kurdistan appears to have first shown itself at the end of autumn 1870 or the beginning of the winter of 1870-71, on an elevated table-land lying south-east of Lake Urumiah, between the head waters of the rivers Jagatu and Tatawa, both of which streams flow into the lake named. The district had last before suffered from plague in the epidemic of 1829-35. The villages attacked not only within the locality of first appearance, but also in neighbouring localities to which the disease extended, including the town of Bana (Berozeh), are, according to Dr. Telafons, built at altitudes above the Black Sea of which the lowest (Uchtepé) is 4,540 feet, and the highest (Arbanos, where the disease seems first to have become active), 5,870. Bana has an altitude of 5,470 feet; and Akjivan, where the nature of the disease was first recognised, 5,240 feet.

The villages earliest attacked were situated in the district of Mikri. The disease is believed to have originated in a hamlet named Djoumouchan (Gamishan), which is situated at an altitude of 6,600 feet, and which at the time of the appearance of plague contained six families.

The existence of plague was first observed in April 1874, but Dr. Arnand is of opinion that cases had occurred several months before. The outbreak had been preceded by three years' privation arising from failure of crops in the successive years, consequent upon persisting drought. In the winter months of 1873-74 the famine had become so severe that persons might be seen hunting for undigested grain in the dung-voided camels. The cold season of 1873-74 and spring of 1874 had been unusually wet and had converted some of the favourite camping grounds of the nomadic tribes, as in the valley of Merdj, into swamps, adding to the misery of the starving population for the time being, but rendering secure the summer crops.

"Most of these villages are situated on an elevated table-land called 'Toumouna,' rising about 2,000 metres above the sea and 1,500 above the 'Tehama,' and extending as far as the 'Namaz' range, from which it is separated by the valley of 'Waba.'

"Here a marked contrast is seen between the barren, wretched plain of Tehama and the fertile, pleasing aspect of the Toumouna plateau. The villages just named are built of stone; the houses have several stories, are well-aired and properly distributed, and the soil is rich and produces the best quality of Yemen coffee, often giving two crops in the same year. Indian corn, dhurra, barley and indigo are cultivated; vegetation thrives and fruit trees abound. Running water is scarce, but in lieu of it the inhabitants are supplied with wells and cisterns."

To this interesting account Dr. Dickson adds a remark made by Dr. Parznichi, in a report to the Central Health Department, dated from Djerzan in Arabia, on the 18th December 1874, that "the localities lately attacked by the outbreak of plague had been previously visited by famine."

I have already, beside mentioning the town, described four classes of villages or groups of huts. One class where irrigation takes place with skin buckets on account of the high bank, and the huts are on dry ground and therefore receive all the antiseptic influence of earth. In the second class the villagers only spend the season of cultivation on the ground and return to the towns for the rest of the year. In the third class the villagers are driven, on account of the rise of the water from their rice-fields, and forced to move their habitations twice a year, while the ground they occupy during the greater part of the year is thoroughly cleansed by the rising river. Those three classes of villages are all free from plague, and the disease is confined to the fourth class only. In this class the villages or groups of huts are permanent; they are on ground which is a foot or two lower than the surface of the water in spring, and the ground is so saturated with water that the refuse of the village is neither absorbed nor can it be evaporated, for it acquires fresh moisture from the ground, and this refuse acquires the form of a bluish-black oily fluid, which surrounds the huts and covers the paths, and stains the walls two feet from the ground; and, in fact, the village is in such a state of filth that it requires to be seen to be believed. It was this class of village which was exclusively attacked in the Hindeah in 1867.

I can see no reason why it should have attacked this district last spring, and this in preference to any other year; for during the past two years every kind of grain has been in profusion, dates in abundance, and fish on the Euphrates are caught simply for the sake of the oil. It may be remarked that, during last spring, there was an excess of rain as in 1867, but that could not affect villages moist as these are. Still, it is a significant fact that the only two great inundations of the rivers since 1831 occurred in 1867 and last spring, and that during the great plague of 1831 there was an inundation of the Tigris, which washed half Bagdad away. In 1867, however, the disease died away in one spring, while this year the area has much increased since last year.

The malady would appear to have shown itself with more or less activity in various parts of the tract of country lying between the Shat-el-Atchin and the Shat-el-Hai, and along that part of the course of the Euphrates where it had been chiefly active the previous year (1875). Thus its presence was noted again at Shinafieh, on the Sea of Nedjef at Jerboyah, Diwanieh, Samara and other places on the Euphrates as low down as Suk-e-Sheyukh, and along the course of the Shat-el-Hai to its junction with the Tigris at Kut-el-Amarah. Moreover, in the district lying to the north of the tract of country above described, and which had been the scene of the outbreak of 1873-74, plague was noted at Meshedali, Kufa, Kifl, Tanabi (Tuarich) on the borders of the Hindieh marshes (the last-named place being the chief town of the Hindieh district), and at Kerbella. The disease also appeared at Hillah and at Bagdad, and in the villages of the district lying between the two towns.

The stress of the outbreak of 1875-76 would appear to have fallen upon the tract of country which extends immediately to the north of the district that had suffered in 1873-74.

(2) METHOD OF SPREAD.

Poison in the Soil.—I strongly incline to the belief that the poison of Mahamurree exists in great force in the soil, which becomes at every visitation more and more impregnated with it, owing to the filthy habits of the people. They contribute to its accumulation in every possible way. The death of rats and snakes favours the view of the poison emanating from the soil, but whether this be associated with electrical or volcanic changes in the rocks, or earthquakes, or the development of sulphuretted hydrogen, we do not as yet know. Dr. Planck, the Sanitary Commissioner of the North-West Provinces, who was deputed to investigate, in conjunction with Dr. Pearson, the outbreak of Mahamurree in 1876, believes that the rats die of suffocation. He comments upon

the fact of these rats being unlike the large animal of Norway origin that frequents our sewers. They are grey and of a more delicate constitution. He discredits the diseased-grain theory, as the rats are not found dead in their holes. I am not aware, however, whether these have ever been thoroughly searched.

Whilst, from the past history and general characteristics of Mahamurree, we may reasonably infer that there is but little fear of its appearance in localities unsuitable for its reception from the fact of its having broken out in localities that are suitable (aye, even in those that apparently are not—witness some of the cleanest villages in Kumaon), the inevitable conclusion is forced upon us, that the only safeguard is thorough sanitation in all its forms.

"Excepting inasmuch as any bad quality of the grain commonly consumed by the people may conduce to a low state of health, I do not think the prevalence of plague disease can be due to any peculiar condition of this or any other article of food. At the same time I should say that Dr. Watson, a careful observer, is of opinion that the prevalence of plague in Garhwál and Kumaun may be due to the generation of a fungus in decaying grain.

"It is undoubtedly true that rats are sometimes found dead in the houses of families about to suffer from an outbreak of plague. I have seen several of these dead rats in and about infected houses. They are not the strong, black Norway rat which lives in the sewers of Europe, but a more delicate-looking grey species. All I have seen appeared to have died suddenly, as by suffocation, their bodies being in good condition, a piece of rag sometimes clenched in the teeth; and I think it likely that they may have died from the same cause of vitiated atmosphere as produces the bad state of health conducive to attack of plague in man. The best record of this death of rats will be found in the Bintola History, and it may be noticed that the dead rats were described as being found in the morning on the floor near to the sleeping people. It seems probable that their ordinary places of exit may have been closed. If dying of poisonous grain, I should think they would be likely to die in their holes or hiding places. I have seen some live-snakes near to infected villages, and one particularly live-snake which came out of an infected house; but I have never seen any dead snake in connection with an infected house or village. If snakes die from eating the deceased rats, cats could hardly be expected to escape. Yet far from seeing any dead cats, I have on several occasions had some trouble in saving the life of a cat desperately attached to an infected house about to be burnt.

"The villages, in which the death of rats in the infected houses was testified to, were Bintola, Chani, Kanasi, Khajuli, Tailihat, East Dugora, Parsali, Sungarh, and Naukori, and in all these places the history points to an outbreak of plague disease not resulting from infection. They seem to be places in which the disease renewed its active appearance; and as the result of careful inquiry and observation, I think it may be true that the death of rats, preceding an outbreak of the disease, points to certain local conditions or peculiarities as giving rise to the outbreak. In no village, where the history clearly points to infection as the cause of the outbreak could I obtain evidence of the death of rats, and I think it may be true that where rats have not died infection has given rise to the outbreak, p. 94.]

"I have, on several occasions, recorded the fact that the people of an infected house, when vacating it for a jungle residence, took with them a supply of the grain they had been eating for many previous days, lived on it in the jungle, and suffered no harm. Indeed that is the usual course of proceeding and frequent result."

In the early period of the outbreak when the malady manifested itself almost wholly as a non-fatal bubonic affection, communicability of the disease from the sick to the healthy was neither observed nor suspected. But in the second period of the outbreak the probability of such communicability was early forced upon the attention, and presently was apparently confirmed by the spread of the disease being,

in the main, strictly limited to persons who had been or were in close association with the sick. Subsequent examination of a relationship existing between those dead from the outbreak, and those who, having been attacked with the disease, recovered, has shown the accuracy of the grounds upon which this conclusion was founded, and from which the communicability of the disease was inferred.

Here lived a family consisting of a man, his wife and two children, the one aged six years, the other 18 years of age. The father had twice visited Vetlianka on the 7th (19th) and 14th (26th) December. The inhabitants knowing this avoided any communication with him or his wife and children. On the 15th (27th) he was taken ill, and died on the 17th (29th) of a malady, the symptoms of which are unknown. On the 17th (29th) December the wife and youngest child were taken ill, and they died the next day. The inhabitants of the village compelled the eldest child to bury the corpses of his parents and his brother, then to burn the house in which they had lived and all its contents, together with his own proper clothing. Clad in new habiliments, he was afterwards permitted to live in the granary of the court belonging to the house after it had been fumigated by burning sulphur within it, and repelled from personal communication with his neighbours, food was passed to him through a window. Fifteen days after the burial of his parents and brother [4th, 5th (16th, 17th) January] he fell ill and was seen by Dr. Pagorsky.

Importation.—The theory of importation was twofold. The Russian and German Medical Commissioners are inclined to believe that the infection of plague was introduced into Vetlianka by infected spoils brought by Cossacks returning from the seat of the Russo-Turkish war of 1877-78 in Asia Minor; the Roumanian and French Medical Commissioners believe that the disease was imported to the Lower Volga direct from Persia, or more precisely from Resht or its vicinity.

The first of these theories rests upon the facts that the first unquestioned case of plague at Vetlianka, that of the 17th (29th) October 1878 followed immediately upon the return home of the Cossacks from that village who had served in the war, and who had brought with them various articles of Turkish or Persian textile manufactures, spoils or purchases or both, which might have been exposed to the infection of plague.

"There is a fact that inclines one to think that the epidemic is owing to exhalations from the soil, and it is this: those animals that live in the ground, in drains or in holes are the first to be attacked. This is particularly noticeable with the rats. As soon as these animals are ill, they leave their holes in troops, and after staggering about and falling over each other, drop down dead; more frequently they die under the floor, filling the apartments with foul odours, of which the source is not discovered at once. The same phenomenon occurs in the case of other animals, great and small, such as buffaloes, oxen, sheep and deer, and sometimes also courtyard fowl, but among these the disease is not very fatal. On our arrival in the province, we refused to believe these stories setting them down to the superstitious imaginations of the people; but when the malady broke out during our stay we had the opportunity of convincing ourselves of their veracity."

Death of Rats.—One very singular circumstance is the almost invariable death of the rats of the village, which occurs on the eve of an outbreak of Mahamurree.

A similar preliminary mortality amongst the rats occurs in Yunnan, in Western China, where the disease—evidently plague—has been endemic for some years past, especially since the occurrence of the massacres which accompanied the outbreak and suppression of the Mahometan rebellion in that province; the surrounding provinces remaining entirely free from it. Here the plague is invariably preceded by a great mortality among the rats and other animals living in drains and in holes

6

in the ground. As soon as this premonitory warning is recognised, the people
 * * * purify their houses, abstain from pork, and in some cases fly from the
 threatened district.

Mode of a Rat's Death.—The manner of a rat's death was remarkable; the animal would emerge from its hole on to the floor, stagger, perform an involuntary gyration or two, bring up blood and die. More commonly the rats were found in the morning lying dead near the sleepers. On more than one occasion a rag has been found between the clenched teeth of the rat. I am not aware that any of the professional observers ever saw a rat die and as thus stated; but, as the same statement was universally made by the natives, there is no reason to discredit it. And we saw rats dead.

Examination of the Grain.—An idea having prevailed in some quarters that diseased grain (that in common use is the *Eleusine coracana* known locally as *Mundooa*) might be a factor in the generation of Mahamurree, we carefully examined it as stowed away in the baskets, from top to bottom, but it was good throughout without any trace of fungus or any disease whatever. The pulaceous mass of food (consisting of grain) found in the rat's stomach seemed particularly wholesome. And on their return home from the jungles, the survivors, if they find any grain left by the bears—who generally, however, make a pretty good clearance—enter-tain no scruples about using it again. Indeed, they sometimes take it into the jungle with them. Doubtless it is diseased sometimes, and the people, who cannot afford to throw it away, do eat it in that state, but I very much doubt its ever lighting up Mahamurree, and if we admit it as a cause of the disease, it should be in universal operation.

I may mention here that Dr. Pearson, in his long experience, saw no connection between Mahamurree and the disorders of cattle. The cattle suffered occasionally from foot-and-mouth disease, but not especially in Mahamurree years. During the outbreaks of this disease, and before they, as a rule, remained healthy as did the sheep and the goats. Dr. Watson (who succeeded Dr. Pearson) attributes their immunity from the plague to the fact of their eating only grass and no grain. He gives, in support of the grain theory, the case of rats in the neighbourhood of a water-mill, beginning to die only when some grain had been taken from a village to be ground. With the exception of rats, and much more rarely, snakes, the death of animals in connection with Mahamurree was not a marked feature. If one animal, eating another plague-infected, should die, how much more the bears who, it is alleged, consume the bodies of the villagers that have died of Mahamurree? Certain it is that bears are often carnivorously disposed; and that they were observed in greater numbers than usual in outbreaks of this plague. I myself saw, one moonlight night, what appeared to be a small family of bears pass the bamboo scaffolding on which I was seated—they were too far for a shot—and the plague-stricken corpses rapidly disappeared. No dead bears were ever seen.

From Pali the disease radiated within a circuit of 30 miles, extending in October as far as Jondhpoor. Under the energetic supervision of Major Dixon, then Superintendent of Ajmere, the capital of Rajpootana, quarantine was established, and the plague did not reach any other states in the province, the intervening hilly country of Mhairwarah helping to exclude them. One town, however, viz., Dewar, was affected owing to infringement of the quarantine regulations. Interested traders persuaded the inhabitants to conduct porters carrying the bales of merchandise into Dewar, where the disease immediately afterwards broke out; passing over in March (1837) to Deogurh in Meywar, in which district 32 villages in all were attacked. With the setting in of the hot season in that same year the plague declined, and has not since been heard of as such in that part of India.

7

Commenced amongst the Chippahs.—We find that the Pali plague invariably appeared amongst one class of people, viz., the Chippahs, or Cloth Printers of Pali; that it then attacked others, who fled and formed fresh foci of contagion. The Chippahs principally had dealings with the Bunnyahs, or intermediate small traders, who thus became the carriers of the poison. Why should the cotton-printers be the first to suffer? Because, it is urged, they imported the merchandise from Surat on the coast; because they unpacked it; and because it consisted of goods brought in part from plague countries, whence it would, therefore, contain the fomites of contagion. Surat has commercial intercourse with Egypt, the Red Sea and the Persian Gulf. In Kuttwar, as at Pali, these importers of cotton goods also worked in cotton—they made cotton cloths. From whatever source the poison came, the avocation of the Chippahs invited its advent amongst themselves, raw cotton affording a favourable nidus for its abode, just as the woollen dress of the Gurhallee more readily gave a lodging to the poison of Mahamurree than did the cotton garment of the Kumaonee. Cotton raw and cotton made up are of course two very different things. The theory of packed goods transporting the poison, and disseminating it when those goods reached their destination and were unpacked, has been recently maintained by Professor Hirsch, the celebrated authority on infectious disorders, who, in a discourse delivered last year before the Medical Association of Berlin, expressed his belief that the poison of the plague, which broke out at the end of 1878 in Vetlianka in Astrakhan, resided in the packed goods that were being conveyed from Mesopotamia to Armenia; and that, when these goods, having become the spoil of the Cossacks, were taken by the latter to their homes and there opened out, this poison became diffused.

Communication between Kumaon and Gurhwal and the West of India.—On referring to the map of India, we find that a distance of between 700 and 800 miles separates the birth place of the plague in the West of India from Kumaon and Gurhwal, the plains of Northern India intervening, and I am not aware of any regular direct communication between the two. The Bhotiyahs—the carriers of the hills before referred to—annually descend into the plains during the cold season, and visit some of the principal towns there as Allahabad, Agra, Delhi, &c., going, now that they have in a great measure overcome their dread of small-pox as far as Calcutta. But I believe that they have never yet penetrated into the presidencies of Madras and Bombay. Railway facilities may, in the future, enable them to do so, but without these facilities, it would be next to impossible, their time being so limited.

Dr. Arnaud was able to follow the movements of the disease in some detail, noting its dissemination through the inter-communication of the occupants of various encampments, and showing a period of latency after exposure to infection in three cases of five days, in one case of six days, and generally a limit of eight days.

Last spring a man arrived from Afiche at Um Nejeris, and died in a hut of plague; and two to three days after his arrival, the first case of plague occurred. Four people in that hut died, all who fell ill, leaving two only untouched. In all, 20 people in a population of 500 died, and some 20 recovered. The heats having set in, the disease became dormant till last autumn, when it again appeared at Um Nejeris, and four persons died, but the greater number recovered. Plague again became dormant till the beginning of January of this year, when it was reported to exist on the Shat-il-Hai. In the beginning of February it was carried to the district of Abdare by some Montefik Arabs from the Hai, and about 150 in the district died out of a population of 4,000 souls.

The village of Fowar had a population of about 250 souls, and up to the time of my visit 43 were known to have died though there were probably more deaths. On the 16th of April a man arrived from Fowar, and spent the night in a garden-house on the outskirts of the town of Diwaniyah on the left bank of the Euphrates.

He fell ill of plague and died there. After a few days, exact time unknown, four of the gardener's family died, besides a little daughter, who was carried by the father in a dying state to a garden-house on the opposite bank of a river, and left there. He returned next night and took his child, who meanwhile died, back with him. Forty-eight hours after taking the girl to the gardener's huts on the right bank of the river, the first of this man's family was seized; there were here 15 people in all, divided into four huts: in one hut, father, mother and son died, all it contained; in another hut a woman living by herself died; in a third hut, two girls died, leaving father and mother and one girl behind. One or two Jews went to this garden on the 28th of April, and four days after a boy, 15 years of age, was attacked; but when I saw him on the 7th of May, he was recovering with a bubo on the left groin, which had burst. A soldier from the barracks close by was also attacked after entering this garden, but was recovering when I saw him. Another soldier from the barracks, after visiting a village three hours distant, towards Shinafeah, where he entered a hut, of which, to use a local expression, the doors were shut, meaning that all had died inside, returned to Diwaniyah and died.

* * * * * At Shatra the disease appeared only about the middle of April, and was increasing in the beginning of May. From Shatra, plague was carried into Nassreah by two messengers on the 20th of April. One of the messengers died, and the other returned to Shatra. Between two and three days after the entrance of the messenger into a house in Nassreah, where he stayed, the head of that house was taken ill. Altogether up to the middle of May about thirty people died.

* * * * * "The said disease first appeared in a village 10 miles to the north of Shuster called Jellikan towards the latter part of March. It broke out there just after the arrival of a caravan of pilgrims from Kerbela, who had come by way of Hillah, Bagdad, Amarah, and thence by land to said village. Two persons belonging to said caravan died of plague; the corpses were washed and buried at Jellikan. Shortly afterwards cases occurred in the village in such numbers as to constitute an epidemic. Out of a population of 300 souls there were 85 deaths. At Shuster the disease appeared in April. The first cases were noticed among persons who had come to the town from Jellikan. The disease lasted to the end of July. Out of a population of 8,000 there were about 1,800 deaths. As many as 40 deaths a day occurred during the height of the epidemic. In the neighbouring villages there were a few isolated cases."

* * * * * It is noteworthy of the outbreak in the district of Abu Graib, recorded in the text, as of the outbreak at Azizie in November of the previous year (1875), one of several outbreaks marking the beginning of the diffusion of 1875-76, that it was attributed locally to the consumption of the flesh of diseased camels. Doctors Wortabet, Lubitz and Sebastio, of the Sanitary Administration of Bagdad, visited Abu Graib in the third week of November, immediately after the news of the outbreak reached Bagdad. They saw there two persons who were suffering from fever and glandular swellings, and who had been ill about a fortnight. The inhabitants of the district stated that a month before a party of Anezi Arabs had encamped in it for the sake of pasturage. The camels of the party became ill and were slaughtered, the flesh, notwithstanding the circumstances under which the animals were killed, being used for food. Of those who ate it, 40 sickened and died. The inhabitants then, alarmed by this fatal outbreak of disease, rose upon the nomads, and compelled them to withdraw into the desert.

* * * * * "He states that not only human beings, but domestic animals, and even rats, are attacked by the pestilence.

"Its approach may often be known from the extraordinary movements of the rats, who leave their holes and crevices, and issue on to the floors without a trace of their accustomed timidity springing continually upwards from their hind legs as if they were trying to jump out of something.

"The rats fall dead, and then comes the turn of the poultry; after the poultry have succumbed, pigs, goats, ponies, and oxen successively die off.

"The good father has a theory of his own that the plague is really a pestilential emanation slowly rising in an equable stratum from the ground, and as it increases in depth, all animals are, as it were, drowned in its poisonous flood; the smaller creatures being first engulfed, and man, the tallest of Yunnan animals, suffering last."

* * * * * "This absence of epidemic tendency would appear to exclude any supposition that the prevalence of the disease may be due to any cause affecting things enjoyed in common by the people, such as the air they breathe, or the food they eat, or from any peculiarity in their common habits. And the inquiry becomes narrowed to a consideration of the local condition or peculiarities of the centres of population in which the disease is seen to prevail.

"As touching this endemic peculiarity of the disease shown by the scattered geographical position of the villages affected, many villages unaffected intervening, a study of the histories, previously recorded, will add strength to that opinion. For it will be seen that, as a rule, the prevalence, even in the village itself, is confined to one house, or one terrace, or one portion of the village.

"This peculiarity is plainly shown in the rough ground plans which accompany the histories. Isolated cases may occur amongst families inhabiting other portions of the village, but commencing and excessive mortality appears, almost invariably, to be restricted in locality as described. And where, not so restricted, a means, other than that first operating, may be clearly traced to account for the peculiarity.

"This means is the communication of the disease from person to person, against which the strongest and best health is no guarantee, although probably debility of body conduces to an attack by this means. I use the term 'means' in preference to 'cause,' because the cause, whether in the first or last case of the local prevalence, is the same, namely, the specific germ or active principle of plague which can only produce plague disease; the disease being plague, it is hardly necessary to dwell upon the fact that it is communicable from the sick to the healthy; for, of all diseases, plague possesses that peculiarity in most marked degree. This opinion rests on the record of many facts, the principal of which are the death from plague of 80 medical officers of the French, and of half of the medical officers of the English Army during the campaign in Egypt; and the death, with hardly an exception, of some few persons who have inoculated themselves with plague matter.

* * * * * "The histories of this record provide ample evidence of the communicability of the Kumaun plague. * * * These histories everywhere provide an account of a disease, not suddenly arising many cases together, but occurring, as a rule, in orderly succession of cases amongst those who lived habitually together, nursed the sick, and buried the dead. Indeed I think the histories support the opinion, that, ordinarily, the first case occurring in a village gives origin to all that succeed in that neighbourhood."

* * * * * Dr. Cabiadis neither attempts to deny the contagious properties of plague, nor does he accept unconditionally the assertion of those who pretend that you must keep at a distance, say of six metres from the patient, in order to avoid contracting the disease. The experience acquired by him during the epidemic outbreaks of Hillah and Bagdad has convinced him that no great risk is incurred in touching persons affected with the plague, provided you avoid exposing yourself for any lengthened period to the atmosphere of the apartment occupied by him. As a proof of this doctrine, he says that those persons who lived in the same house with a plague-smitten patient, but who avoided touching him or his clothes, through fear of catching the infection, generally did get the plague; while those who lived in houses exempt from the malady, but who visited plague patients and handled

them freely, without remaining long in the same room with them, hardly ever caught the disease. When plague entered a house it seldom spared its inmates, and often carried them all off within a week's time. In noting these facts, Doctor Cabiadis was careful to take into account the various tenets of the different religious sects of the people of Bagdad; for while the Mohammedans discarding all sanitary precautions lived with and handled plague patients, the Jews and Christians, on the contrary, firmly believing in its contagious properties, very seldom touched them; yet all of them equally caught the disease if they lived in the same house with the plague patient, but were safe if they quitted the house the moment a case of plague occurred in it. Doctor Cabiadis quotes another remarkable fact in support of his theory. With one exception none of the physicians, surgeons, or assistants who daily attended on plague patients caught that malady, and he himself handled nearly 2,000 plague-smitten persons without suffering any inconvenience from it. To this it might be objected that the immunity enjoyed by them was owing to their contact with the sick being a momentary one. But, Doctor Cabiadis remarks, that if this be true with respect to the physician, it cannot be so with regard to the surgeon and assistant whose duties obliged them to prolong their stay near the patients for the purpose of opening abscesses, washing and dressing sores, &c. The exception alluded to above was that of an assistant who actually died of the plague. But in an epidemic outbreak affecting a whole population one death amongst an entire corporation would rather indicate the law that governed the general mortality at the time than the exceptional liability of that body for coming into contact with the diseased.

Dr. Cabiadis does not think that the infectious matter of the plague is contained in the pus secreted from the buboes and sores. Plague, he observes, is transmitted even in its incipient stage and before any of the swellings or boils have supplicated. The problem, therefore, remains to be solved, whether the specific materies morbi of plague is exhaled from the patients' respiratory organs, from his cutaneous surface, or from some other emunctory.

These considerations lead me to the important practical question of fomites. I was very anxious to obtain from Dr. Cabiadis the fullest information on this point, so as to clear up, if possible, this intricate subject. Dr. Cabiadis says that he considered the atmosphere which surrounds a person affected with plague as the true medium of transmission. Apart from this, he has also met numerous instances in which he believes the clothes and bedding of plague patients communicated the malady to sound persons living beyond the sphere of the epidemic outbreak. Such articles were made of wool, cotton, flax or hemp. He ignores whether these materials in a raw state would have given the disease as well, since he has not met with any fact to enlighten him upon the subject.

(3) MODIFIED FORMS OF PLAGUE.

Two or three months previous to the manifestation of plague in Mesopotamia glandular swellings free from fever prevailed in that country. They showed themselves in the groin, arm pit, or neck, and were not accompanied by other symptoms. They began to appear amongst the inhabitants about the end of autumn, and continued through the winter; but towards the end of it plague broke out and reached its acme of intensity in the spring, and died out suddenly during the summer season when the great heat declared itself, and the thermometer rose to 45 or 50 degrees of centigrade scale (113° or 122° F.). During the prevalence of the plague the thermometer ranged between 5 and 30 degrees; and when it rose to 30 degrees (86° F.) the disease had reached its maximum of intensity. As the temperature increased from 30 to 45 degrees (86° to 113° F.) the epidemic began to diminish, and as soon as the thermometer got up to 45 degrees (113° F.) it ceased abruptly. On the cessation of the plague, apyretic glandular swellings reappeared again, precisely similar to those which had preceded the outbreak, and they continued to manifest themselves for about two months longer. These glandular swellings were frequently met with, and were distinct from the chronic adenitic swellings met with in subjects of a scrofulous tendency, and evidently unconnected with any special diathesis.

Dr. Cabiadis gives the following translation of a telegram from Drs. Döppner and Zwingmann, dated from Enotayevsk on the 15th (27th) December 1878: "In the beginning of November, cases of ague were observed (at Vetlianka), marked by two or three paroxysms of shivering, and succeeded by a hot stage, and by swellings of the inguinal and axillary glands, often ending in suppuration. On the 27th November (9th December), this outbreak assumed a new form; the glandular swellings did not appear, but the patients became affected with shiverings, pain in the forehead and temples, vomiting, intense heat, aches in the limbs, giddiness, headache, altered features, injected eyes, nausea, anorexia, furred and dry tongue; in some cases pericardial distress, discharges of blood, insomnia, delirium and great weakness. These symptoms reached their acme on the third day." * *

"Relapses occurred occasionally in convalescence, and always ended in death. On the 9th December, the character of the outbreak assumed another type."

Note on larval, abortive, or ambulant plague.—The question here chiefly rests upon the signification to be attached to the non-fatal bubonic malady observed in the city of Astrakhan in 1877-79, and at the beginning of the outbreak at Vetlianka in 1878. This larval, abortive, or ambulant form of plague has received especial attention during the later outbreaks of the disease in Mesopotamia and Benghazi, and its importance in an epidemiological point of view may be studied in Dr. Jholozan's recent work "*La Peste en Turquie dans les Temps Modernes, sa prophylaxie defectueuse, sa limitation spontanée*," a work which introduces a new era in epidemiological research and practice. But it may be useful here to note that the recognition of an abortive or ambulant form of plague is no new thing. Simply the circumstances under which recent outbreaks of the disease have occurred, give occasion for greater attention to be devoted to this non-fatal and seemingly slight form. Thus Sydenham, in his observations on 'The Pestilential fever and the Plague of the years 1665 and 1666,' writes: "It happens also that at times tumours may break out without either fever of any important symptom as their precursors, although I suspect, for my own part, that chills or shivers, in some slight degree or other, and more or less perceptible, invariably precede. Those to whom this happens may walk about in public as usual, and attend to the common duties of life like healthy men taking no thought of regimen."

In May 1877 there were observed on the outskirts of the city of Astrakhan and in the city itself a series of cases of sickness in which, after the patient had suffered for several days from a febrile state, sometimes acute, swellings of the lymphatic glands in the groin, the axillæ, the submaxillary space, &c., occurred, usually ending in suppuration. The patient was rarely disabled altogether in the febrile state, and when the glands began to swell, except that the swelling impeded motion, he was commonly able to get about as usual, and the appetite and general functions of the body became normal.

Two hundred cases of this affection occurred in the city of Astrakhan, but it is to be assumed that in a non-fatal malady of this kind, rarely disabling the patient, many cases would escape notice, and this certainly appears to have been the case in the villages of the delta * *

Nevertheless it received a certain sort of attention at the time, but more particularly afterwards with reference to the events which followed at Vetlianka and in the villages on the banks of the Lower Volga in that part of its course. The medical profession in the city of Astrakhan were much puzzled with the nature of the malady. One physician thought from the predominance of the affection of the glands of the neck that he had to deal with a form of mumps; others from the first regarded it as a slighter form of the plague then prevalent on the southern littoral of the Caspian; but the great majority appear to have looked upon it as a form of malarial poisoning, notwithstanding the absence of any disorder of the spleen. All, however, were of accord that the malady was new to the present generation of

The glandular sickness observed in the city and environs of Astrakhan in 1877 appears to have been observed there also in 1878 and 1879, but no definite particulars are given as to its prevalence in the two last-named years.

(4) PREVENTION OF SPREAD.

Prophylactic Measures.—The most effectual means for the protection of a community against the propagation of plague—the isolation of the sick, the destruction by fire of their clothes, and the whitewashing with lime and free ventilating of the domiciles in which cases of plague occur. The plague reappeared in only one out of 350 houses which had been *whitewashed* after an outbreak of plague in them, whilst its re-appearance in houses that had merely been abandoned for a time, after an attack of that disease, but which had not been whitewashed, was of frequent occurrence.

The other disinfectants tried, such as sulphur fumigations, lighting fires, and throwing a solution of sulphate of iron into the drains, gave no decided results, except when associated with the whitewashing and airing of the infected house.

But it is pretty certain that the clearer view of what was desirable, intimated by some of the earlier measures, was quickly obscured by the panic which followed, and that sick and healthy were shut up indiscriminately in the infected houses, with the sad results which had been partially recognised even in this country over two hundred years ago.

“But if hereafter again a Plague should break out (which God forbid) with Submission to Superiors, I should think it not improper to appoint proper Accommodation out of the City, for such as are yet untouched in infected Families; and who should continue there for a certain time; the sick in the meantime to be removed to convenient Apartments provided on purpose for them: For by this means, that Practice, so abhorrent to Religion and Humanity, even in the Opinion of a Mahometan, of shutting up the sick and well together, would be avoided.”—*Loimologia* or an Historical Account of the Plague in *London* in 1665. By Nath Hodges, M.D., and Fellow of the College of Physicians, who resided in the City all that Time. Edited by John Quincy, M.D. (2nd ed., 1720, p. 11). So also Mr. William Boghurst, a medical practitioner, who resided in St. Giles-in-the-Fields during the whole period of the plague in 1665, and who left a manuscript account of the outbreak, now in the British Museum, and from which extracts are given in Brayley's edition of Defoe's “A Journal of the Plague-Year”:—“As soon as any House is Infected, all the sound people should be had out of it, and not shut up therein to be murdered!”

CURRENT No. 2053 m.

C. No. 2053 & 2222 m

From
The Sanitary Commission
for Canada

No. 1139
S

Order:

~~Recorded~~

The attention of the Mass.

of districts in which there
are isolation or observation
camps will be drawn to
the remarks of the San. Com.

Dated 24th May 1897

Received 27 MAY 1997

Registered

Enclosures Three.

Spare copies

SUBJECT

SUBJECT.
 For forwarding for the information
 of Government certain corres-
 pondence with Mr. E. H. Hankins
 on the subject of the vitality
 of the plague bacillus in water.

To All collectors.
Bets of Dr. Bor. To apri 17/97
The Surg. Genl. Chairman of Comm. Sept 27/97
The Sanit Comm.
~~The Sanit Dept of the Government.~~

BACK PAPERS.

G.O.	No.	Department.	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.

Local & Munl. (1897) Department.

CURRENT No. 2222 *in*

From
*The Sanitary Commissions
for Madrid.*

No. 1227
8

Dated 12th June 1897.

Received 12 JUL 1897

Registered

Enclosures

Spare copies

Order.

SUBJECT.

*Forwarding the pamphlet called
for in A. M. No 621 dated 2nd
June 1897.*

BACK PAPER:

G.O.	No.	Department.	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.

First copy sent to them. 23-6-97
 Returned for signature. 30-6-97
 Despatched in print. 1-7-97
 2-7-97

ORIGINAL NO. 660

2053-A
 Ref to 621-A
 2222-A

ENCLOSURE TO C No.

MINISTER OF GOVERNMENT

MINISTER OF GOVERNMENT

STATEMENT WITH DILIG.

PAPER NO. FILED UP BEING MEANT FOR
 IN ORIGINAL.

S. C. H. Suba...
...not
...the recognized

Print in full = A
 Not to be printed = B
 Print abstract only = P
 Print heading only = P

Print in full
Not to be printed
abstract only
heading only