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Report of Dr. H. Lorans on his Mission to India.

DR. LORANS TO THE DIRECTOR, MEDICAL AND HEALTH DEPARTMENT.

No. 184.

20th. July, 1897.

In accordance with the instructions conveyed to me in letter 2658/97 of the 1st. April last, I proceeded to Bombay, viâ Colombo, on the following day to study the Plague, its manifestations and the best means of preserving this Colony against it.

In the course of my visits to that town, Calcutta and Madras, I have inquired into the measures and precautions taken by the Authorities to stop the progress of the epidemic and prevent its invasion.

I landed in Port Louis on the 12th. instant, as you are aware, and resumed my duties in the Department the next day. I have however devoted the greater part of my time to the preparation of the report which I have been asked to write on the subject of my mission to India, and I beg to submit it herewith.

The questions under consideration are not only important but difficult ones, hence the length of the annexed document. I have discussed rather fully some questions when I thought it advisable to do so, and I have only referred cursorily to many points of great interest, but which I think of less practical importance. I shall however be glad to give all the details I can on any of these subjects, concerning which further information may be desired.

The knowledge I have obtained has been acquired to a great extent through conversations with scientific men, and during visits to hospitals and laboratories. Some of the questions referred to in the following pages are not definitely settled, and it is possible that, in a few instances, the opinions expressed by me may, in future, be found not to be absolutely accurate. I must say, however, that I have attempted to avoid mistakes by transcribing in my notes, as soon as I could, the information which I gathered.

On calling at the Government Offices indicated to me in the three principal towns of India, I found that, on receipt of the despatch from the Mauritius Government, each of the Presidency Government had issued a circular to some of the Medical and Sanitary Authorities of the Presidency concerned to help me in my mission. Thanks to this recommendation, my work has been greatly facilitated.

Owing to various circumstances, it has not been possible for me to see all the Officers to whom I had been recommended. I have however seen most of those who could assist me in my investigations, and I beg to record here my best thanks for the kindness and courtesy shown to me by them on many occasions.

The annexed report deals mainly with my study of the plague and my experiences at Bombay, but, if need be, I shall later on submit another report on my visits to Calcutta and Madras and on the questions concerning the Emigration Agencies.

I should however state at once that I found both the Calcutta and Madras depôts in very good condition. So far as emigration is concerned, if plague broke out in the country districts, I told our Agents that I saw no reason to stop emigration as long as the disease was sporadic, while, if it became epidemic, I supposed the Emigrants would be dealt with in accordance with the terms of the convention of Venice, which would meet all the requirements of the case.

I beg to forward along with this report, the following documents, some of which have kindly been given to me by the authors, and which deal with the matters which I have been studying in India, as they will prove valuable for record in the Office and reference in case of need :—

- 1o. File of the Indian Medical Gazette.
- 2o. Professor Hankin's reports to the Bombay Chamber of Commerce (3).
- 3o. Proceedings of the Bombay Medical and Physical Society, containing important papers by Professor Wysokowicz, Surg : Capt : Leuman, Hogel and others.
- 4o. File of the plague notifications by the Government of Bengal.
- 5o. File of the Gazette of India containing important documents on the plague question,—given to me by the Mauritius Emigration Agent at Calcutta.
- 6o. Professor Hankin's reports on Cholera in India cantonments.
Do. on Bacteriological test of the purity of water.
- 7o. Reports of the Health Officer of Calcutta, Dr. Simpson, for 1894 & 1895.
- 8o. A defence of the Madras sewage farms by Dr. Cook, Health officer.
- 9o. Administration Report of the Madras Municipality, 1894-95.
- 10o. Minutes of Proceedings of the Sanitary Commissioner of Madras, 1896.
- 11o. Madras Government Orders on the question of plague.
- 12o. Copies of the information on plague by the joint Plague Commissioners, and a reprint from the transactions of the Epidemiological Society (on plague) kindly given me by Dr. Lowson.

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Medical Inspector.

The Director of
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REPORT.

The first case of the Plague which has proved so disastrous to life and commerce in Bombay, during the early part of the year, was discovered, according to recent inquiries, on the 8th. of August 1896.

Some competent observers, however, are not averse to the opinion that this disease had already caused sickness and death in the city long before that date. Be that as it may, when Dr. Viegas officially called attention, in September last, to the dangerous epidemic which was then beginning to attract notice, his views met with a great deal of opposition.

It seems that the early cases did not present the typical character of plague. Cases of fever with enlarged glands had been recorded, patients with swellings in the neck, not unlike those present in diphtheria, had been treated, and cases of remittent fever with distinct buboes had already been observed when doubts as to the nature of the illness were still expressed.

It was only when microscopical examinations and bacteriological researches had distinctly proved the existence in the blood and in the inflamed glands of the bacillus similar to that discovered by Kitasato and Yersin in 1894, that the disease was designated as bubonic fever. Soon after, the distemper was recognized to be identical with the plague which had recently visited Hong Kong and several Chinese ports.

The onward progress of the sickness, and the enormous mortality in the first quarter of the year, subsequently left no doubt in the mind of epidemiologists as to the identity of this bubonic fever with the plague, which, at the different periods, even before the Christian era, had brought desolation and ruin to many parts of the old world.

The different epidemics of that dreaded disease have been carefully chronicled since its formidable visitation in the 6th. Century, called the Justinian plague.—It is not desirable in these pages to refer to them in detail, but it is satisfactory to note that our advanced degree of civilization and the conquests of sanitary science have divested this terrible sickness of many of its horrors and almost of all its repulsive features.

It is also beyond the province of this report, to discuss whether the habitat of the disease has been the valley of the Nile, Mesopotamia or certain parts of Asia.

It is sufficient to recall that the disease has repeatedly shown itself within the last twenty years, in Eastern Russia, Arabia, Persia, Mesopotamia, Turkestan, Upper India and South Western China principally.—A question of greater importance, and which unfortunately has not been solved so far, is the channel through which the disease introduced itself in Bombay.

It has been said that the plague was imported from Hong Kong; the ports of the Persian Gulf have been blamed by some, while others have alleged that it has been brought from the Kumaon hills situated in the Himalayan range.

The uncertainty which exists regarding the real date of the first cases, renders it unlikely that this matter will ever be satisfactorily or clearly elucidated.

The experience of most observers, and the evidence gathered during the last epidemic tend to establish that plague is almost invariably imported into new places by living beings. A sick person carries the germs of the disease into a locality, other individuals are then contaminated either directly by him or from the soil infected by his dejecta (fomites only taking a secondary part in the propagation of the malady), and thus new foci are established along the trade routes especially.

This mode of propagation of the plague in Bombay is not however accepted by many observers.—It is contended that no cases of plague were detected on board of the ships that arrived from Hong Kong at the time, and it is further pointed out that the length of the voyage between the two ports is much greater than the recognized period of incubation of the disease.

The possibility of the infection having been caused by rats has been put forward. These rodents, as is now well known, are very susceptible to contract plague; they easily escape attention. It is not impossible that some of these little animals, in the period of incubation of the disease, may have found their way from the docks, along which ships coming to Bombay even from infected ports are berthed, to the grain stores in the neighbourhood.

In support of this theory it is remarked that dead rats were noticed early in the epidemic in Bombay, and that the first cases among men were observed on people living above go-downs where grains and rice are stored in the District of Mandvie.

The occurrence of the disease near the rice stores gave rise, it may be remembered, to the idea that plague had been caused by the use of bad or musty grain. This theory, however, as well as some others ascribing the introduction of the disease (a) to dates from the Kumaon hills, (b) to the state of the drains, (c) to climatic conditions, &c., have at present few, if any, supporters.—The explanation of the mode of importation of plague in any place is further obscured by the possibility of a period of latent evolution in the soil, during which the infection of the latter gradually takes place.

Soil infection, though admitted by some, has been denied by other equally great scientific authorities in the matter, and further evidence on this point is much needed. However, I would point out that it has been noticed that in several localities where plague has broken out among fugitives from Bombay, it has frequently happened that some weeks elapsed before *local* cases were found. This interval of time has varied apparently according to the facility or otherwise with which the plague bacilli have been able to develop themselves in the soil. It has even been suggested that the length of this interval might be taken as an index of the sanitary condition of the place.—The plague bacillus, which is at present generally considered as having no spores, will not live for many days in a dry place, but it is capable of remaining active for a considerable time in damp soil and will thrive where it can besides find organic filth and absence of sunlight.

This mode of propagation of plague accounts for the prevalence of the disease on rats, and also for its incidence, first of all, on these animals which go about with their snouts in close proximity to the ground.

As an additional proof of the contamination of the soil and the liability of infection from it, the frequency of attacks among those who sleep on the ground, at night principally, may be mentioned. Further more, among the Parsees the greater incidence of plague among women has attracted attention. The reason for this occurrence has been ascribed to the custom observed by the women of that caste of living for several days, every month, during certain periods, on the ground floor of their premises.

Lastly, the immunity that has been enjoyed by the population living in boats, in the Hong Kong river, and in the Bombay harbour, lends great weight to the soil-borne theory of plague.

A further light has been thrown on the mode of introduction of plague and of its possible propagation by the recognition of mild forms of the disease termed *pestis minor* and *pestis ambulans*.

The existence of mild cases of plague which did not compel the sufferers to give up their occupations, was known to the ancients to occur at the beginning and at the end of epidemics—This form of the disease has been described in the epidemic of Astrakhan in 1878, and recently Dr. Cantlie seems to have connected with this type of plague the so-called idiopathic buboes, *bubons d'emblée*, which have been prevalent among the inhabitants of the Southern coast of China during the past few years.

In the numbers of the Indian Medical Gazette, which I forward with these papers, there will be found besides many other interesting documents, instructive communications concerning *pestis ambulans*.

There is nothing characteristic in the appearance of such cases. The patient has a little fever, perhaps also some shivers, which in some cases may not even attract his notice, he then develops one or more slight glandular swellings in the groin, neck or armpit, but these may not prevent him from attending to his usual work, and the nature of the sickness, which is often a chronic one, remains undetected. In the more severe cases the glandular inflammation may be ascribed to adenitis due to ordinary causes, and the complaint has been confounded with mumps, scrofula and syphilitic affections.

The importance of being on the look out for such cases in tropical climates, where lymphatic and glandular inflammations are frequent, is evident and must be brought particularly to the notice of the Port sanitary authorities.

The cases of *pestis ambulans* reported at Howrah and Calcutta, since the Bombay outbreak, by several distinguished Medical Officers, have given rise to a considerable amount of discussion. Through the kindness of Dr. Simpson, the Health Officer of Calcutta, I was able to examine several of the microscopic specimens obtained from the blood of the patients referred to. The bacilli in some of these preparations, though they

cannot be said to be identical with those seen in the Bombay plague cases, presented, if I may so say, a great family likeness with them. Transformations in bacilli according to the media on which they grow are well known, and even the newly discovered plague bacillus is known to have involution forms. The bacillus in *pestis minor* may consequently differ from the typical one, and it is highly desirable that further researches should throw light on the question.

It is strange, however, that all these cases (except one if I am well informed) in whose blood the bacilli were detected, rapidly recovered. This, I believe, is contrary to the experience of most observers in Bombay. Whenever the bacilli were easily detected in the blood of the general circulation, the patient as a rule died.

Moreover, it appears that the cultures from the blood of these cases of *pestis minor* did not prove virulent and it is not astonishing, consequently, to find that the Calcutta Medical Board came to the conclusion that "there was no evidence in any of these cases of true bubonic plague".

It is still disputed whether cases of *pestis minor* or *ambulans* are infectious or not. Several authorities hold that it is under this form that the disease is maintained in those countries where plague is endemic and from which it seems to disappear during certain periods.

Anyhow, there is no doubt that Sanitary Authorities should be on the look out for such cases, and that, whenever met with, they should be isolated and treated as possible sources of danger.

It is better in such instances, and in the present state of knowledge, to err on the side of over-carefulness.

Once established in a certain locality, plague gives rise to symptoms which are well marked, and the diagnosis in the majority of attacks is easy.—A full and correct account of the clinical aspect of the disease may be found in very ancient literature, and the description given by Procopius of the plague which began in 542, and which he witnessed in Constantinople, is a remarkably faithful picture of the ordinary bubonic malady. It is however only within the last three or four years that the disease has been studied in a really scientific spirit, and that recent means of research have permitted of the correct diagnosis of certain forms which do not present the ordinary symptoms and signs of plague.

Since the Hong Kong epidemic the complete monographs of Lowson, Yersin and Wilm, who have had ample opportunities of observing the disease in that town, as well as interesting contributions from other observers, have not only again given a full description of the symptoms of the illness, but they have carefully indicated the pathological appearances to be seen in the post-mortem room and in the laboratory. They have thus supplied invaluable material for the study of the disease.

During the recent epidemic at Bombay several countries have sent delegates to study the manifestations of plague, its diagnosis and treatment; Austria, Germany and Russia have moreover sent to the capital of Western India

scientific missions, consisting of renowned bacteriologists with fully equipped laboratories to investigate the disease, while Professor Hankin and Mr. Haffkine have been employed by the Indian Government for a similar purpose. The amount of work done by these scientists has been considerable, important discoveries have been made, and the publication of their full reports must be awaited with impatience.

Dr. Yersin came to Bombay to apply his anti-toxin serum for plague, and the devoted phalanx of Medical Practitioners in charge of hospitals have tried all the therapeutical means that seemed likely to alleviate suffering and effect a cure. The results, when published, will show that some modes of treatment have done good in a number of cases, while other methods adopted at the beginning, such as surgical interference with the buboes before suppuration, have had to be abandoned because actually harmful.

In spite of the knowledge thus acquired, the student of plague cannot avoid feeling how helpless he is as yet in dealing with that very lethal disease. It is evident that definite information on points of primary importance is still wanting and that further evidence is required in support of some views, the correctness of which appears at present probable.

The manner in which the poison gains entrance in the human body may be cited as an instance of an important matter to be settled.

Three modes of infection are generally mentioned. No one denies that plague may be contracted, 1o. by respiration through the lungs, and 2o. by any abrasion or wound of the skin or mucous membrane. The case of Dr. Sticker of the German mission well exemplified this latter view. But the possibility of infection in a third manner, viz: by the alimentary canal in a normal-state, is still disputed.

Laboratory experiments have proved that susceptible animals, such as rats and monkeys, may be infected in that way. But when cultures have been introduced into the stomach of monkeys by a tube, it is apparent that the possibility of wounding the alimentary tract has occurred and that such positive results may in reality be the consequence of an inoculation.

Once however that the plague germs have gained admission into the body, the phenomena usually seen in all infective processes follow.

There is a period of incubation. In plague this incubation lasts, as a rule, from 3 to 4 days. In a case cited by Lawson the incubation apparently extended to the ninth day. Other cases with a longer period of incubation have been mentioned, but their investigation shows that no sufficient account has been taken of the possible infection by fomites at a date later than the one fixed upon to calculate the length of the incubation. Short periods of incubation have been known in cases where infection took place through a wound of the tegumentary surface. In the case already referred to, of Dr. Sticker, who accidentally wounded himself while performing an autopsy, symptoms of the disease were marked the next day. The arm became painful, there was lymphangitis of the region and in the contents of a

vesicle which formed at the seat of injury, plague bacilli were detected with the microscope.

The period of invasion of plague is hardly marked. The onset of the disease is generally sudden. It is rare that prodromal symptoms such as malaise, lassitude, want of appetite, or pains in the backs and limbs are felt even for twenty-four hours before the attack.

As a rule, the patient is seized suddenly, often in the midst of his occupations, by a feeling of weakness and depression soon followed by chills and fever. There is severe headache; nausea and vomiting frequently occurs. The fever quickly rises to 103° F. or more. The tongue gets furred and some medical practitioners lay great stress on the appearance of this organ. The fur is not thick, but extends uniformly on the dorsum of the tongue which is moist as a rule, the edges and tip are red, while angry looking papillæ may be seen through the white coating. Should the patient live long enough and become comatose the tongue may take a typhoid brown appearance.

The skin is dry and hot, very rarely moist. Sometimes within 24 hours occasionally on the 2nd. or 3rd. day, and rarely later, the characteristic bubo makes its appearance, and the nature of the disease becomes manifest. The situation of these buboes varies; the inguinal region is more commonly affected, but these glands may be seen in other situations and the following table taken from the report of Dr. Wilm, on the Hong Kong epidemic of 1896, will give an idea of the relative frequency of the regions involved in 300 cases.

Unilateral inguinal or femoral buboes	...	42.6	o/o.
Bilateral " " "	...	3.3	"
Unilateral axillary buboes	... ..	11.1	"
Bilateral " " ... ..	...	nil.	
Unilateral buboes in the neck...	... ..	10.7	"
Bilateral " " ... ..	...	1.0	"
Unilateral submaxillary buboes	... ..	1.0	"
Bilateral " " ... ..	...	nil.	
Unilateral buboes in region of elbow...	... ..	0.7	"
Buboes in various parts of body	... ..	2.7	"
No appreciable buboes, but painful or painless slight glandular swellings in various parts of the body ... ..	... ..	27.0	"

The progress of a case of plague varies according to the intensity of the infection and the powers of resistance of the organism which lead to the recovery or death of the patient.

As long as the glands offer a barrier to the passage of the bacilli through the blood, a cure may be hoped for, but when the micro-organisms reach the general systemic circulation, in appreciable numbers, the septicæmic form of plague follows, and recovery, if it ever takes place, is the exception.

In an ordinary favourable case the patient continues with high fever for two or three days longer. The vomiting rarely persists, constipation is the rule, though diarrhœa is occasionally seen, the headache which is principally fronto-temporal is

much complained of, and the bubo is more or less painful. This swelling which at first was distinct soon enlarges owing to the inflammation spreading round the gland and serous effusion taking place in the adjoining tissues. The skin becomes red, tense and shining and the mass is doughy to the feel. The least pressure then gives rise to acute pain. Should the sub-maxillary glands be involved, as is not unusual in children, the case resembles at first sight, and in its outward aspect, a case of diphtheria. If the swelling attacks both sides of the neck the pressure on the windpipe may rapidly bring on suffocation. The patient often lies in a drowsy, if not comatose condition, with his mouth partially open and his eyes half closed. The conjunctivæ are found very frequently suffused and red, and in those cases where there is delirium this feature is well marked. The urine is scanty, high coloured, and albuminous in the majority of cases. When recovery follows it takes place gradually, the fever remits, the tongue gets cleaner, the pain and swelling in the bubo diminish, and the patient is convalescent in a few days, but the gland may remain enlarged for a long time. Debility and anæmia may however delay the return to health for weeks. It should be noted that Kitasato is reported to have found the bacillus in some patients some six weeks after apparent recovery.

The adenitis instead of going on to resolution, sometimes ends in suppuration. In those cases the ordinary signs and symptoms of inflammation and abscess become superadded. In spite of careful surgical treatment the wound, after the operation, occasionally takes many weeks healing up.

When the course of the disease is unfavourable, high fever persists, delirium of an acute character supervenes and the patient falls into a state of deep coma. The pulse which in ordinary cases is quick and full at first is altered, it is easily compressible, dicrotic and sometimes filiform. The area of cardiac dulness is increased owing to degenerative changes in the heart muscle, and sudden death from syncope may occur at any time. This fatal termination has been occasionally seen in patients who seemed otherwise to be doing well, when they attempted to sit up or get out of bed. Death may also result from exhaustion, while pyæmia may follow in cases where the glands have suppurated. Besides the above described forms usually seen in plague epidemics, the disease presents itself under other aspects, but the three varieties hereafter described require special notice, they may be designated as the pulmonary, the cerebral, and the abdominal forms of plague.

The dangers due to pulmonary complication in those attacked by plague have been noted in the early accounts of the disease, and fatal hæmoptysis has been a common feature in some epidemics. But primary plague pneumonia had not, till lately, been sufficiently recognized, and mistakes, especially at the beginning of the epidemic, have not infrequently been made.

A diagnosis of such cases without a microscope is not easy, but with the aid of such an instrument the detection of the bacillus in the sputa is not a matter of difficulty even at an early stage of the attack.

Some clinical phenomena however may give rise to suspicion as to the real nature of plague pneumonia.

Thus there is an evident disproportion as a rule, between the local pulmonary mischief and the dyspnoea as well as the alarming gravity of the patient's condition. While the physical signs in the lungs are slight the breathing is greatly distressed, the patient is anxious and the pulse very rapid. The fever need not be very high but the sufferer appears very ill without a sufficient cause being found in any of the organs to account for his dangerous state. There is no external glandular enlargement in many cases. The cough is short and brings up easily a loose watery expectoration. The rusty sputum of ordinary pneumonia is rarely seen and not till a whole lobe is affected, but the serosity brought up is tinged pink by liquid blood. The condition of the tongue is not so characteristic in these cases, the redness of the conjunctivæ exists however and helps in the diagnosis. This is a highly infectious form of plague and it is all the more necessary to keep it in mind that there is nothing to indicate the real nature of the affection when plague does not actually exist in a locality. Health Officers when making inquiries concerning the state of health of a ship's company, coming from an infected port, should give special attention to the occurrence of lung complaints during the voyage.

In the cerebral form of plague the onset of the disease does not differ from that of the ordinary cases. The temperature however rapidly rises to a maximum 104 F. or more, the eyes are greatly congested, the delirium is often very violent, the patient struggles to get out of bed, he throws his arms and legs about, picks at the clothes and passes urine and fæces involuntarily in bed.

In this form again no external glands may develop into buboes and the patient frequently dies suddenly, sometimes after a few hours' illness only. A bacteriological examination of the blood alone can reveal the nature of the disease.

This variety of plague is different from the nervous type in which there is insomnia, difficulty of speech and incoordination of the movements while the intellect remains unimpaired.

The abdominal form of plague is a type of the disease which is becoming better known, and which deserves full notice owing to its close resemblance to typhoid fever, and the serious consequences which might result from mistaking the one for the other. The disease begins, as is usual in plague cases, by a rigor soon followed by headache and vomiting. There is however frequently diarrhœa during the first days of the sickness, but this condition of the bowels does not last, and constipation occurs. A lumbar pain is frequently complained of, the face is generally flushed, and the tongue presents the characters of the "plague tongue" for some days before becoming covered with a brown fur. Tympanitis is not rare, and even the rose colored spots, often seen in enteric cases, may exist. No buboes can be detected, but, in most cases deep pressure will reveal some tender spot on one or both sides of the umbilicus. This pain is apparently due to inflammation of some of the deeply seated glands of the mesentery. Both the spleen and the liver frequently appear enlarged on percussion and palpation.

The importance of an early and correct diagnosis of this form of plague is evident, and at the same time the difficulties of a differential diagnosis are apparent. The following points

may be of some use to detect the pestilential nature of the disease :—

1o. The sudden onset of the illness.

2o. A rigor at the beginning of the attack.

3o. The high temperature shortly after the commencement of the sickness, differing markedly from what obtains in the typical curve of typhoid fever.

4o. The condition of the tongue.

5o. The congestion of the conjunctivæ.

6o. The appearance of the diarrhœic stools which are not pea-soup like as in enteric fever.

7o. The lumbar pain.

The ambulatory cases of plague have been fully dealt with at the beginning of this report, and attention has thus been called to the principal as well as to the insidious forms of plague which the sanitarian should be prepared to recognise from the very first.

The complications of plague are not numerous, neither are they of as much importance as the complications and sequelæ of similarly acute infectious disorders.

The enormous death rate of the serious cases at an early period of the disease accounts for this.

During the Bombay epidemic, keratitis and hypopion were frequently noted in the course of the malady, but panophthalmitis was rare as far as I could learn and observe.

In the respiratory system besides the primary pneumonia already described, bronchitis and secondary pneumonia, which may be lobar, have been observed. Pleurisy, sometimes so extensive as to cause displacement of the heart, and empyema have been noticed.

Hæmoptysis does not appear to have been frequent. Epistaxis was sometimes met with, but like hæmatemesis hæmaturia and true intestinal hæmorrhage, it was rare. Petechiæ were not common. Menorrhagia and metrorrhagia were also seldom observed. But abortion or premature labour were the rule when pregnant women contracted the disease. The fœtus however apparently escaped infection *in utero* judging from the two following occurrences. In one case both the mother, affected towards the end of her pregnancy, and the child, born somewhat prematurely, did well. In the other case no bacilli could be detected in the organs of the six months' fœtus which was born dead. It should be stated however that bacilli could not be detected at any time in the blood of the mother who died from exhaustion and com-

plications some weeks after her delivery. The patient had had a bubo and other plague symptoms.

Retention of urine and cystitis were not very unusual, and albuminuria, as already mentioned, was the rule. But though in such cases the microscope frequently revealed tube casts &c., œdema of the ankles and anasarca were hardly ever noticed during convalescence.

The effects of the fever and of the infection on the central nervous system in plague were indicated by the peculiar gait of the patient, the difficulty of speech and the tremors of the hands. A certain degree of paresis was a frequent complication, while aphasia, hemiplegia and dementia were not uncommon sequelæ. Boils were sometimes seen but true carbuncles, which are almost invariably described in the definitions of plague, never came under my notice. I believe that in the Bombay epidemic several Medical Officers, who were in charge of hospitals throughout the prevalence of the disease, and thus had exceptional opportunities of seeing all the forms and complications of the affection, have had a similar experience.

Superficial and deep seated abscesses and periostitis had to be treated in a few cases.

Lastly otorrhea, parotitis and mastitis should be mentioned as rare complications.

Besides albuminuria, found in three-fourths of the cases, the following changes have been detected in the urine of plague patients. The quantity is diminished, the acidity is increased, urea is less than normal and there is a marked reduction of chlorides. When the proportion of the salt was found to return towards the normal, an improvement tending to recovery could be noticed at the same time in the condition of the sick.

The post-mortem appearances of plague are generally sufficiently well marked to permit of a correct opinion being formed as to the cause of death, even when the deceased has not been seen during life.

In most cases a bubo or enlarged glands are to be found. The lymphatics going to the affected glands are congested and distinct. The bubonic swelling consists of a serous or sero-sanguinolent exudation in the connective tissue round the glands. This infiltration occasionally extends to a considerable distance beyond the glands themselves. The latter when dissected out from the exudation, not always an easy matter, are found to be enlarged and congested. On section, punctiform hæmorrhages are frequently seen in the glandular tissue, which may further have become softened and may then contain purulent foci.

Head.—On removal of the skull cap the meninges are in most cases found congested, there is serosity in the arachnoid and the brain itself is more or less congested.

Thorax.—The heart is generally found to contain dark liquid blood in its right cavity, the muscle is flabby and dilated, and petechiæ or ecchymoses may be seen in the pericardium.

The condition of the lungs varies. In cases of pneumonia these organs would be œdematous and contain sero-sanguinolent

liquid. There may be lobar or lobular patches of consolidation. The bronchical glands are then enlarged. There may be effusion into the pleuræ, and, even when the lungs have not been specially attacked by the disease, punctiform hæmorrhages may be found on the pleural surface.

Abdomen ;—Extravasations of blood in the peritoneum and in the omentum are frequently met with. The spleen is always enlarged and bacilli are invariably obtained from the organ in fatal cases when examined soon after death. In the stomach, hæmorrhages into the mucous membrane are as a rule noticed. The same phenomena are to be observed in the intestines, while the mesenteric glands are generally affected to some extent. Peyer's patches, it must be remembered, may be the seat of pathological changes not unlike the lesions of typhoid fever. Hæmorrhages into them may even occur.

The mesentery is sometimes studded with enlarged dark bluish red glands, the seat of hæmorrhages, while the retroperitoneal glands are swollen and inflamed. The changes in these parts are fortunately well marked in the cases of abdominal plague unaccompanied by external buboes.

The kidneys are hyperæmic, and on section punctiform hæmorrhages may be observed under the capsule and in the pelvis itself. The liver, pancreas, bladder, &c., are frequently altered, but the changes in these organs are not so constant and so important as those described above.

The condition of the dead bodies varies according to the period of the disease at which death takes place, but there is nothing particular in the degree of emaciation, the expression of the countenance, the rigor mortis or post-mortem lividity to indicate the nature of the illness when external buboes are absent.

Age and sex seem to possess no influence on the incidence of this disease. It has been calculated that in the Bombay epidemic 10 to 12 o/o only of those exposed to the contagion of plague, under the ordinary circumstances of life, are susceptible to the disease.

These figures are based on the statistics of the outbreaks recorded in Kamatipura and Sewree. It seems to me however that the number of facts are too small to be of any value, and I am afraid that when the exact figures regarding the population, attacks and deaths in the case of Cutch Mandvie are obtained a more deplorable percentage will be found.

In the Hong Kong epidemic of 1894 the percentage of deaths to attacks has been given as 90 o/o—The correct figures for Bombay are not yet available, and though the statistics of some hospitals indicate more satisfactory results, I am afraid that the absolute mortality will be found to reach a high figure. Certain treatments have been credited with doing much good, but many factors, which it is impossible to discuss here at present, will have to be taken into account when these statistics are drawn up. At the close of the epidemic, when the cases got milder, some drugs however seemed to exercise a beneficial influence on the course of the disease. I shall not attempt to review here all the treatments that have been tried to cure plague in Bombay. It is to be hoped that the Medical Officers in charge of hospitals will publish complete reports at no distant

date and that the various methods of treatment, their results, &c., will be carefully and thoroughly discussed.

I must however call attention to two antiseptics which seem to have found favour with a large number of practitioners in the medical treatment of the disease—one is carbolic acid given by the mouth in various mixtures, and the other is bichloride of mercury similarly administered. Both drugs seem to have been prescribed in, what under ordinary circumstances would be considered, large doses, a careful watch being maintained on their effects. The changes in the urine quickly indicated when the carbolic acid had to be discontinued, and no special tolerance appears to exist for this drug in the plague-stricken. The case seemed to be altogether different as regards the bichloride of mercury. Full doses of the liquor Hydrarg. Perchlor, two & three drachms, repeated several times during the 24 hours, were apparently easily tolerated by the plague patients. No salivation nor stomatitis were observed by me among those who were subjected to the treatment for several days, and in not a few cases a rapid recovery took place. A ten-grain dose of calomel followed by an aperient at the beginning of the disease, or as soon as the patient was admitted into hospital, was frequently given with apparently much benefit, the nausea and headache being thereby relieved. The value of attentive and careful nursing is nowhere better exemplified than in the treatment of plague. The patient must be kept perfectly quiet in a recumbent position till convalescence is well established. Cold or tepid sponging seems to do good when the fever is severe. Liquid nourishing food and some stimulants must be given in small but frequently repeated quantities even when the patient is comatose. Whenever solid food can be taken there is no objection to the sick getting it. Antipyretics and especially those which exert a depressing action on the heart should be avoided. They seem to have no effect on the temperature but increase the risk of cardiac failure. Strophanthus has been favorably spoken of, and along with various other drugs may be used according to the indications and the symptoms present. As regards the buboes various proceedings were adopted in their treatment. Excision was tried by some Practitioners, injections of Carbolic acid, Iodine, &c., in their substance to destroy the poison was attempted by others, but I believe that the majority of careful observers agreed latterly that active interference of any kind with them was to be condemned. The danger of extravasation of blood in the vicinity of the glands and its contamination by the bacilli when the buboes are punctured is evident. A little glycerine of Belladonna on the affected part proved a useful and soothing application when the swelling was painful. The usual incision and strict antisepsis, with Iodoform as a dressing powder, are to be resorted to when fluctuation and suppuration have become clearly established.

Cocaine and boric lotions were beneficial in the treatment of the eye complications. Catheterism was sometimes required for retention of urine.

The cause of plague has been clearly proved to be due to the bacillus discovered by Kitasato and Yersin at Hong Kong. The micro-organism is always found in the buboes of the sick, and has been detected in the blood and fæces in severe cases.

Cultures can always be obtained from blood or tissues removed from the spleen in the post-mortem room if the autopsy is made before putrefactive changes have taken place.

The bacillus has also been found in the saliva and in the secretions from the lungs. In those cases where plague infection has started from a wound in the skin, the bacilli can usually be discovered in the contents of the vesicles which form at the seat of inoculation.

The microbe of plague is a short bacillus, having the outline of an elongated oval, and is easily stained by most aniline dyes. But it cannot be stained by Gram's method. Under the microscope the two poles being more deeply colored than the intermediate parts make it look like a diplococcus. The bacilli possess a capsule, but no spores have as yet been discovered. In preparations from the tissues a method of double coloration by means of an alcoholic solution of Eosin and a concentrated solution of methylene blue render it very conspicuous.

This bacillus grows well on blood serum and agar-agar, but it appears to thrive specially on peptone agar to which 5 o/o of gelatine has been added. Mr. Haffkine has described a stalactite-like growth of the bacillus in broth when the flask is left in a perfectly quiet condition.

In the cultures, plague bacilli appear like small translucent faintly grey, irregularly rounded colonies.

Plague is easily contracted by rats, mice, rabbits and guinea pigs. Monkeys also may contract the disease by exposure to it, but react very quickly when inoculated. Other animals, pigs, cattle, goats, &c. ; birds and poultry also, have been mentioned as liable to it. This does not appear to be the case under the ordinary circumstances of life. At any rate the vultures which have fed extensively on the bodies of the Parsees dead of plague and exposed on the towers of silence on Malabar hill, Bombay, have enjoyed a remarkable immunity.

The life history of the plague bacillus has been carefully studied since 1894 and the experiments performed in laboratories show that, however terrible its ravages may be among people living in insanitary places, the bacillus is not endowed with much resistance, and that its vitality can easily be destroyed by chemical agents, heat and light.

Bichloride of mercury, as might be expected, in this case again, is an excellent antiseptic. Solutions of 1 to 1000 are perfectly reliable for disinfecting articles contaminated with plague virus. Carbolic acid solutions (1 in 100) destroy the bacillus in an hour, while a one to fifty solution produces the same result in a few minutes. Quicklime is a very good disinfectant. Potassium permanganate of Potash, even in a 1 in 10,000 solution, if I remember correctly, destroys the germs in a very short time.

Chloride of lime freely sprinkled on the floor is not only a useful disinfectant, but an antiseptic which may keep away rats.

Most acid solutions are antagonistic to this microbe, and it does not live long in the dead bodies of animals when putre-

factive changes have begun, probably on account of the formation of acid by-products.

Heating up to 58 ° C. for one hour absolutely destroys the germs of plague.

Articles of clothing, &c., contaminated with plague germs, are found to be innocuous after four days' exposure to diffuse sunlight and air only. These factors are apparently the active destructive agents in such cases, seeing that clothing similarly infected, and not so exposed, has been found by a German investigator, to be infectious for a month. I should think that such clothing must have besides been soiled with organic filth in which the plague germs could find the necessary conditions of food and humidity to remain alive. It is reassuring, however, to know that four hours' exposure to the direct rays of the sun, in the East, is sufficient to destroy the vitality of the same microbes.

Laboratory experiments indicate that the microbe lives only for a few days when dried. Animals inoculated with the viscera of other animals dead of plague but which have been dried for a week have not become infected thereby; the microbes having apparently lost their virulence.

According to the second report of the German Commission, which has studied the disease in Bombay for some months, the bacillus does not preserve its infectious power outside the human body more than seven days. These observers are of opinion that the bacillus loses its powers of infection in tap water in one day, while in sterilised water three days are necessary for this to take place.

It is desirable however to call attention to Abel's recent paper on the bacteriology of plague; his results differ in some important particulars from those obtained by others, and point to the serious dangers arising from contaminated water. He agrees with Yersin in considering flies as possible agents of transmission of the disease. This and some allegations concerning other insects call for further investigation.

Experiments specially undertaken by Professor Hankin, in the Municipal Laboratory at Bombay, apparently establish that the vitality of the microbe in grain does not exceed a week. I extract the following notes from one of his reports which he kindly gave me.

The bubonic microbe derived from pure cultures perishes within thirteen days after being added to specimens of grain and seeds comprising linseed, ground nut, wheat and flour. The microbe apparently had died in the flour and wheat on the fourth day. When the infective agent was derived from organs of animals dead of plague the grain thus contaminated lost its infectious power completely within six days. Lastly, the same substances infected with plague from the sputum of a human patient, which contained the microbe in a very virulent form, appeared to be free from danger after six days. An important exception however in the last series of experiments was met with in the case of flour. In this article of food some virulence appears to have been retained from the human secretion containing plague, for the mouse experimented

upon died after an injection made with an extract of flour infected six days previously. Professor Hankin, judging from the post-mortem appearances, did not however consider that death in this case was due to plague. In another report the learned bacteriologist states that he could never find plague microbes in grain and flour coming from infected places where dead rats had been found, and which were soiled with the dejecta of these animals. In a report dated 31st. March, the danger of infection by contaminated wool, cotton and gunny cloth is discussed by the Professor, and his researches at that time indicated that the plague microbe uniformly died on these articles within six days. But in presence of the epidemiological evidence that clothing may in rare cases convey infection during a longer period, Professor Hankin was unwilling to draw definite conclusions at that time. Further investigations were being carried out on those subjects and on the effects of antiseptics on plague germs when I left Bombay. We may therefore look to the publication, at an early date, of valuable information on these questions. I was unable to obtain any precise expressions of opinion on the subject of dates, onions and certain other Indian products occasionally imported from Bombay to this port. I could hear of no experiments made with these food stuffs, but some bacteriologists told me that they did not appear to be proper media for the growth of the plague microbes and that their infective powers would hardly last several days in those articles.

It now remains for me to discuss the very important question of the danger of the introduction of plague into Mauritius.

Judging from the foregoing remarks on the behaviour of the microbe and the mode of transmission of plague, it must be recognized that the chances of the disease being introduced into the Colony are not great. Mauritius, owing to its insular position, and the duration of the voyage between it and all ports (except those of Reunion and Madagascar), has every reason to hope that it may escape contamination even if plague, which is one of the slowest travelling diseases, were to spread to other Indian ports and countries.

It has been repeatedly said that plague has a well defined zone, and one cannot help noticing that, so far, the disease appears to have kept within the limits assigned to it by some epidemiologists. In spite of daily communications by rail with Bombay, the Presidency of Madras has up to now entirely escaped contamination. In Calcutta, which has escaped the previous epidemics of plague from which Sindh has suffered, the cases of *pestis ambulans* have not been followed by any local outbreaks. In Singapore, which seems to have been infected from the Chinese ports, in January last, the disease has not resisted the sanitary measures adopted to eradicate it. In Ceylon where serious, not to say excessive, precautions against the disease were only taken long after it had existed in Bombay, not a single plague patient has arrived by any of the numerous steamers calling there from the West coast of India and from China. On the other hand, the tendency of the epidemic to spread to places north of the 19° N. latitude has been manifest, and Kurrachi, Cutch Mandvie, Damaun have suffered terribly, in spite of energetic attempts to combat the plague. Still it must be noted that the plague bacilli cultivated in laboratories situated outside the plague belt have not shewn any sign of degenerescence, while the disease itself, according to Dr. Lawson, exists in Uganda in Equatorial Africa.

In order to diminish the risks of transmission of plague by human beings, the Government of India has established a system of Medical supervision over all emigrants from Bombay and the other infected centres. Travellers by rail are examined at several stations during their journey, by Medical Officers specially appointed for that purpose. Suspicious cases are detained in segregation camps and the sick are immediately transferred to isolation hospitals. From Bombay to Calcutta via Jubbulpore no less than five examinations take place; and at Khana junction, some seventy miles from Howrah the terminus, accommodation is provided not only for a period of observation but also for the disinfection of luggage when that step is deemed advisable. The passengers who are detained are not as a rule kept for more than 48 hours, and the names and residence of all the persons coming from infected places, whether temporarily stopped or allowed to proceed, are registered for the purpose of medical inspection during the next ten days.

The measures taken as regards sea going passengers are still more strict. A staff of Medical Officers and lady doctors boards every vessel a few hours before its advertised time of sailing. The temperature of every one is taken, the existence of glandular swellings is inquired into, and any doubtful case is removed from the vessel before it is allowed to leave. To prevent the re-infection of Bombay the same sanitary examination takes place whenever a vessel arrives there from the other infected ports. Doubtful cases are detained under observation in sheds erected for the purpose, and the sick are sent to the plague hospitals at once. Owing to the difficulty of tracing the whereabouts of natives of the lower classes and on account of the virulence of the disease at Cutch Mandvie, the immigrants coming from that port were, during the latter part of my stay in Bombay, submitted to a quarantine of eight days in a segregation camp near the port. I have seen the Port Officer and his assistants at work, their duties were often unpleasant owing to the filthy condition of some natives; hundreds of people had to be examined several times a day when the coasting steamers arrived, but the examination was always careful and I admired the thorough manner in which the Medical staff went through their arduous duties.

If notwithstanding these precautions plague were to break out on board a vessel bound for this port, experience shows that there would be little danger of an extensive outbreak at sea, and the means which it has been proposed should be placed at the disposal of the Medical Department would, I trust, be sufficient to cope successfully with the disease. On the vessel's arrival here, Flat Island Quarantine Station would offer all the necessary accommodation for the treatment of the sick in hospital and the satisfactory segregation of a large number of passengers. The precautions to be adopted with regard to the patient will be described later on. With reference to the disinfection of the contaminated places on board the ship, its cabins, their contents, and the passengers' luggage, I do not think that much need be added to the measures indicated in regulations prepared by a Committee composed of Drs. Barbeau, Bolton and myself—(Vide report No. 17 dated 2.2.97).

After disinfecting the contaminated cabins on board of a vessel, painting should, whenever possible, be resorted to at once.

In dealing with cargo I consider that certain articles coming from infected ports must be prohibited. A full list of these articles is given in the resolutions of the Venice Conference, and until precise information is obtained concerning other products exported from Bombay and Indian ports to this place, I think that the prohibition should extend to the articles mentioned in the above quoted report of 2.2.97.

When steamers leave Bombay for Calcutta, the fore-castle and the crew's clothes are subjected to disinfection and aeration. It would be advisable to have the same measures adopted on board of vessels sailing for this port. The cases of the Goanese boys who contracted the disease in London tend to prove that infection may be produced after more than a fortnight when dirty contaminated clothing has been packed and left undisturbed during the voyage. The clothes of passengers coming from Bombay direct, should therefore be landed at some Quarantine Station, and unpacked in the open air. The clean clothes should be exposed to sun and light, and the dirty or used linen disinfected by boiling or washing in Carbolic or corrosive sublimate lotion. The passage through a steam disinfecter would however be the best measure to be adopted if one were available. With regard to the ship the usual disinfection by sulphur might be continued, as this necessarily carries with it subsequent aeration. Packages soiled with earth should be painted exteriorly with a 5 o/o solution of carbolic acid or 1 o/100 of bichloride of mercury and exposed to sunlight *for twelve hours before landing on the quays*. Steps should be taken to have a thorough ventilation of all the holds while the cargo is being removed. I have already referred to the possibility of the introduction of plague by rats and mice, and I undoubtedly consider that this is one of the greatest dangers that must be guarded against in sea ports. Ships are not berthed alongside the quays in Port Louis harbour, as a rule, and the chances of a sick animal swimming ashore are but small. These rodents might however come to the lighters by means of the ropes which occasionally hang over a ship's side. They would rarely dare do this during the day when people are working, it would therefore be advisable not to allow lighters to remain alongside ships coming from infected ports before daylight or after sunset, and to advise a careful watch being kept to prevent their escape during the day. It is evident that should any number of dead rats be found in a ship unloading cargo, the sanitary authorities should at once be informed, and stringent measures would have to be adopted if the cause of the epizootic were found to be plague.

The dead rats should be burnt, and every attempt made to destroy the live ones.

It is to be remarked that, when sick with plague, rats leave their holes and fearless of the presence of man run about in a dazed fashion till they drop dead.

Even were such an hypothetical occurrence to take place I believe that with strict precautions, i. e. careful disinfection with Sulphurous acid fumes, painting packages exteriorly with the antiseptic solutions mentioned, and, above all, exposure to sun and air, all danger from the cargo might be averted.

In respect to the plague patient himself the danger of

infection may be greatly minimized by taking proper precautions. The sputa, especially in primary plague pneumonia, constitute one of the most dangerous modes of transmission of the disease. The bacilli do not apparently exist in the breath itself, but almost pure cultures may be obtained from the blood tinged expectoration in pulmonary cases. The secretions coughed up should therefore be carefully collected on rags or pieces of cotton wool which should be burnt at once, or the patient should be made to use a spittoon containing a strong solution of Carbolic acid. The urine should be mixed with a powerful antiseptic before being emptied out in a selected place, where strong disinfectants should be used and the fæces should be burnt. In case of the buboes suppurating, the dressings should be destroyed by fire immediately after removal. No one having a wound or suffering from excoriations of the skins should be allowed near the patient, and all attendants should frequently dip their hands in some antiseptic solution. The usual precautions employed in other contagious diseases should be adhered to. It is remarkable how little contagious the disease is in properly ventilated and dry places, and the risks of aerial infection seem to be almost altogether absent under such conditions. During the Bombay epidemic several much to be regretted deaths have taken place among the medical and nursing staff, but the proportion of those attacked among the immediate and constant attendants at the hospitals, has been very small.

I trust that the disease may never be introduced in this Island, but nevertheless this report would not be complete if I did not indicate the means which appear to me best to prevent its propagation. In this, as in all other acutely infectious disorders, an early notification of the disease is invaluable. The loss not of a day but of a few hours, in taking steps to prevent the infection, may be followed by very serious results. In Mauritius, the Sanitary Department has to rely on the good will of the relatives of the sick to get information of any new case of contagious disease. One of the most urgently needed sanitary reforms, I have no hesitation to say, is a law for the compulsory notification of certain contagious and infectious diseases. The Director of the Medical and Health Department has already drawn attention to the matter, and I again beg to urge the pressing necessity of such legislation. Certain powers would have to be conferred on the Medical and Health Department in consequence of the adoption of the desired law. But what is usually prescribed for the more ordinary infectious disorders is not sufficient in dealing with plague. Isolation of the sick, in duly approved of hospitals only, must be a *sine quâ non* provision of legislation. The plague hospitals might be specially reserved for those who would care to provide them, as has been the case in Bombay, the patient might have his own medical attendant, the friends of the sick might be allowed to visit him, under certain restrictions, if desirous to do so, but the site should be a properly selected one and the rules concerning the precautions to be observed as well as those for the management of the institution should have a legal sanction to ensure their being strictly complied with.

A measure of almost equal preventive importance is the temporary vacation of infected premises ; legal powers should be obtained to make this compulsory should any Regulations be framed to deal with an outbreak of plague.

When the plague was getting epidemic in Bombay, the enforcement of similar rules was delayed owing to numerous difficulties. Caste prejudices, the customs and habits of the people and their religious feelings were among the foremost obstacles in the way. However, once the rules under the new Epidemic Act had been applied with a firm hand, the beneficial results obtained therefrom were at once apparent, no serious disturbance ensued, and the search parties and the disinfecting gangs met with little opposition.

Whenever early cases of plague have not been vigorously dealt with owing to their having escaped recognition or notification, the disease has soon assumed the epidemic form. Certain parts of the towns and villages of the Colony would unfortunately, I am afraid, offer a favorable breeding ground for the spread of an epidemic if plague bacilli happened to find their way to them, and I need not insist on the necessity of improving their present condition. It must be remembered that the principal safeguard in this as in other diseases is thorough sanitation in all its forms. But even after the outbreak of the disease, a policy of "laissez aller" should not be followed. Well informed writers have expressed the opinion that an epidemic of plague cannot be "stamped out," and that the disease runs a course of about seven months whenever it has got a firm hold of a locality. The duration of the epidemic in Canton and Hong Kong three years ago is contrasted. In one city the disease was almost unhindered, in the other the sanitary authorities fought hard against it, still, the disease lasted about the same time in both places, but it is however satisfactory to remember that the sufferings and mortality in the latter city were greatly mitigated by the measures carried out. I should think that the experience recently acquired in India should assist in modifying these pessimistic views. Had the spread of plague in Bombay been opposed at first as it has been since the Plague Committee, entrusted with full powers, attempted to stamp it out, a different tale might have been told. The difficulties to be grappled with in Bombay were enormous. Any one who has not visited some of the slums of that city cannot form an idea of the work which had to be done. Much remains to be remedied and improved it is true, but I have little doubt that the satisfactory results which have been obtained, and the rapid decrease which took place in the attacks of the disease in April and May, in spite of the return to their homes, at that time, of many who had fled a few months before, were due principally to the measures adopted. Insanitary houses were thoroughly disinfected by means of a liberal use of bichloride of mercury, gullies were washed out with phenyle solution, the rooms of houses were limewashed, articles of no value were burnt, the furniture cleansed, some parts of the roofs were even removed in certain places to let in air and sunlight, and then the people were allowed to return to their rooms. I have had occasion to see the sanitary staff at work, and I think that much credit is due to the Health Authorities of Bombay for the effectiveness of their operations.

In badly infected dwellings, where dust &c., must be disturbed in the removing of furniture and household articles, a previous disinfection by Chlorine gas, as advised by the Plague Commissioners, is a proceeding of undoubted value which commends itself to the attention of sanitary authorities. So much has been said and written about serumtherapy of late that the

attempts in that direction, for prophylactic and curative purposes, during the Bombay epidemic, must necessarily engage attention.

The prophylactic of Professor Haffkine has been employed in many thousands of cases and has been favorably commented upon by many Medical Officers. How far it is really prophylactic has still to be settled. Only a few cases have contracted the plague after being injected with it. But the susceptibility to the disease and its contagiousness under certain circumstances is so slight that further evidence is required to decide the point.

Fatal cases within a few hours or days after the injection have been noticed, and one cannot avoid the thought that the use of this prophylactic, containing toxins, from the manner of its preparation, is not devoid of danger in the case of persons who have been exposed to contagion and who may be in the period of incubation of the disease.

In the June number of the *Indian Medical Gazette*, the way of preparation of the prophylactic, in broth to which ghee has been added, is explained in an article written by the author of the method.

The antitoxin of Dr. Yersin is both a prophylactic and a curative serum. Its use as a preventive of plague is sometimes attended by some discomfort, but is without danger. It unfortunately confers effective protection against plague for a limited period only extending to three or four weeks at a maximum. This advantage however would be invaluable at the beginning of an epidemic or for persons liable to exposure to plague for a short time only. The preparation of this antitoxin has been described in various scientific journals, and the remarkable results obtained in China have resounded the whole world over, so that it is not necessary here to give further details on the matter.

During the recent trial of this serum in Bombay, I was informed that some remarkable cures had followed its use, but the general results have not, I regret to say, fulfilled the expectations. The cures, which at one time did not reach 40 o/o if I have been rightly informed, however with another series of tubes of antitoxin, ran up to 66 o/o. Various unavoidable circumstances have, it appears, been the cause of this. The serum was not sufficiently strong and large doses were required to produce any result. Besides in many instances, the patients did not come under treatment early enough. The difficulties in the process of immunising horses for the preparation of this serum are not few, and it is only by careful and properly timed injections that horses can be rendered immune. I had the honour to meet Dr. Yersin on several occasions, and this distinguished savant, with his well-known courtesy, having kindly given me highly interesting information on this and the allied subject of plague, I do not think it is a breach of confidence for me to say that he hoped to have a more highly active, and consequently curative, serum in a few months. This assurance is not only comforting, but coming from Dr. Yersin we may expect its realization at no distant date.

Interesting experiments with these serous antitoxins and with others prepared by different investigators, were going on at the time of my stay in Bombay; I do not possess sufficient data to give details on the subject, and the publication of the

results must be impatiently awaited by all those who take an interest in this question. Before leaving the subject of serums, mention should be made of the fact that the blood of the plague-stricken reacts in a manner similar to that described by Widal in the case of typhoid. I was shewn this important sero-diagnostic means by the Russian scientific mission in their laboratory in Girgaum (Bombay), and it was further demonstrated to me there how well the agglutinated bacilli showed their capsules when thus precipitated.

I must take this opportunity of recording my thanks to Professor Wysokowicz and Dr. Zabolotny for the valuable information which they so courteously gave me each time I visited their laboratory.

During my sojourn in Bombay, in April and May last, I had the rare advantage of meeting a large number of the officers of the Indian Medical Service employed on plague duty, as well as several members of the Plague Committee, besides many of the illustrious experts engaged in the study of the disease. I cannot help recording the courteous reception I invariably met from them, though sometimes disturbed by a visit in the midst of absorbing occupations. I must not omit mentioning how often they supplied me with important data and the readiness of the Health Officers in assisting me in my investigations by every means at their disposal. I beg leave to express here my gratefulness and thanks to all these gentlemen.

I further feel it a duty to acknowledge my special indebtedness in this matter to General Gatacre, the President of the Plague Committee, to Mr. Pilinski de Belty "Consul de France" at Bombay, and to Surgeon Captain G. Thomson, in charge of Parel Hospital, for the great kindness they have shewn me and the opportunities they have afforded me to study the plague and fulfil my mission.

H. LORANS, M.B., D.P.H., Ed.

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Medical Inspector.
