Revenue (1897) Department.

MISCELLANEOUS SERIES.

G.O., No. 1511

DATED 19th March 97

[Despatch Abstract.]

Recording Proc: Ld-11 Dept: regarding Bubonic Plague.

BACK PAPERS.

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

FURTHER PAPERS.

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

Rev. Depart.

Government {1897} of Madras.

LOCAL AND MUNICIPAL.

Current No 2292

Recd. 13th March } 1897. *Enclosures*

Regd. *Spare copies*

G.O., No. 367 M., 4th March 1897.

MARCH.

Read G. Nos: 2292 and 2293 of '97.

8/2/19/3/97

Gp. Nos No. 1511 & 19th March '97.

Recorded

List 2 copy to the Board of Rev: Land Rev. Des. 22-3-97

Monsieur Haffkine's Anti-Plague Inoculation.

Communicating to the Surgeon-General and the Sanitary Commissioner letters from the Government of India forwarding an account of the experiments made by Monsieur W. M. Haffkine with prophylactic and curative serum during an outbreak of plague in the jail at Bombay, and requesting the Surgeon-General to communicate this to all District Medical Officers and Surgeons of districts in Madras.

Note. It is thought that a copy may go to the Board of Rev for information

C.R.V.
16/3/97

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following papers:—

From the Secretary to the Government of India, Home Department, to the Secretary to the Government of Madras, Local and Municipal Department, dated 25th February 1897, No. 730-Sanitary.

I am directed to forward, for the information of His Excellency the Governor in Council, a copy of the letters marginally noted from Monsieur W. M. Haffkine, giving an account of experiments made with prophylactic and curative serum during an outbreak of plague in the jail at Bombay.

Letters, dated 16th and 17th February 1897.

ENCLOSURES.

From Monsieur W. M. HAFFKINE, to the Secretary to the Government of India, Home Department, dated Bombay, the 16th February 1897.

In view of the urgency of the case I have the honour to communicate the following information concerning the outbreak of plague in Her Majesty's House of Correction, Byculla, where a considerable portion of inmates had volunteered to undergo the prophylactic treatment, and where the first observations on the effect of this treatment have been collected.

Between the 23rd and 29th of January last nine cases of plague have occurred in the jail, of which five proved fatal, the population at the beginning of the outbreak numbering 345 souls.

The prophylactic treatment has been applied on the 30th January, 154 of a total 337 volunteering to be inoculated.

Occurrences on the day of the inoculation.—In the forenoon of the day of inoculation six new patients have been admitted to the hospital suffering from plague; of these three proved fatal.

The inoculations were applied in the afternoon. One of the inoculated, Kessu Umar Shankar, prisoner No. 672, had at the time of inoculation a painful gland in the left groin; two others, Abdool Karim, No. 1356, and Govind Pandoo, No. 1222, developed painful glands in the left axilla the same evening. These three cases have also proved fatal.

On the 1st day after inoculation there were—
Amongst 177 not inoculated prisoners 2 cases, of which 1 proved fatal.
Amongst 151 inoculated 1 case, who rapidly improved and recovered.
On the 2nd day after inoculation there were—
Amongst 172 non-inoculated 1 case, which proved fatal.
Amongst the inoculated *nil.*
On the 3rd day after inoculation there were—
Amongst 173 non-inoculated 1 case, which proved fatal.
Amongst the inoculated *nil.*
On the 5th day after inoculation there were—
Amongst 171 non-inoculated 1 case, which proved fatal.
Amongst 146 inoculated *nil.*
On the 6th day after inoculation there were—
Amongst 169 non-inoculated 1 case, which proved fatal.
Amongst the inoculated *nil.*

On the 7th day after inoculation there were—
Amongst the 169 non-inoculated 5 cases, of which 1 proved fatal.
Amongst 146 inoculated 1 case, who is alive.
Since the 6th instant, no more cases have occurred in the jail.
The following is a tabulated form of the occurrences—

Date of occurrences.	Amongst the non-inoculated.	Amongst the inoculated.
23rd to 29th January 1897	9 cases, 5 fatal.	....
30th January 1897, the day of inoculation. Forenoon before inoculation.	6 cases, 3 fatal.	....
30th January 1897, the day of inoculation. Afternoon after inoculation.	....	3 cases, fatal.
1st day after inoculation, 31st January 1897	2 cases, 1 fatal.	1 case.
2nd " 1st February 1897	1 case, fatal.	....
3rd " 2nd " "	1 case, fatal.	....
5th " 4th " "	2 cases, 1 fatal.	....
6th " 5th " "	5 cases, 1 fatal.	1 case.
7th " 6th " "	12 cases, 6 fatal in an average daily strength of 173 non-inoculated.	2 cases, in an average daily strength of 148 inoculated.
Total, after the day of inoculation		

The experience gained by the observation in this jail tends to show—

1*st.*—That the injection of 3 ccm. of the prophylactic seems to be sufficient to effect the desired protection, no repetition of inoculation being necessary to arrest the disease during an existing epidemic.

2*nd.*—That the prophylactic is powerless to arrest the symptoms of plague already started, or which develop within a few hours, but there is the possibility of its influencing the disease in the incubation period, in individuals infected 3 or 4 days previously.

3*rd.*—That the time necessary for the plague prophylactic to produce the protective effect is shorter than in any preventive treatment known, this period being in the anti-cholera inoculation of 4 days, in vaccination against small-pox of 7 days, in the inoculations against anthrax of 12 days, in the inoculations against rabies of 15 days, and in the present treatment, apparently less than 1 day.

4*th.*—The question remains open as to how long will the inoculated persons remain proof against the disease, and, therefore, in order to ensure the probability of a more lasting effect, it is advisable to apply repeated inoculations, with doses higher than the above mentioned.

The above conclusions are temporary and refer only to the teaching of the particular outbreak in question. There remains fully the possibility of the future experience compelling us to modify the above conclusions, though the expectation is justifiable that the general bearing of the results as above detailed will remain unshaken.

A copy of this letter forwarded to the Municipal Commissioner for the City of Bombay.

From Monsieur W. M. HAFFKINE, to the Secretary to the Government of India, Home Department, dated Bombay, the 17th February 1897.

I have the honour to communicate the following information on the attempt at curative treatment, which has been made by means of the anti-toxine at present under preparation here at Siwree during the outbreak of plague in Byculla jail.

A patient, called Ganoo Baloo, admitted to the hospital since 3 days, has received one injection of anti-toxine, but died within 11 hours.

The following patients were selected for treatment immediately after their admission to the isolation shed, though after some time has elapsed since the onset of the disease:—

Admissions on the 30th January 1897.—Of six patients admitted in the morning, the two most serious, Jiva Virchand and Syed Jonas Ali, were selected for the anti-toxic injection, the four milder left to the ordinary treatment.

Of the four milder, three have died within 2, 4 and 6 days.

The two others specially treated have survived.

Admissions on the 31st January 1897.—Of the two cases admitted, the most serious one, Annah Vishroa, has been selected for the special injection; the other milder has been left to the ordinary treatment.

The milder case ended fatally after three days' illness; Annah Vishroa is alive.

Admissions on the 1st February 1897.—Of the five cases admitted, the two most serious, Kaloo Bhimsha and Keshao Umar, have been selected for the anti-toxic injections, the three milder left to ordinary treatment.

The two treated cases have ended fatally after 6 and 12 days' illness; of the not treated specially, two died after 4 and 9 days.

II. Analysing the result in connection with the period elapsed between the onset of the attack and the beginning of the anti-toxic treatment, it appears that—

Out of the six patients treated, four have been taken for the special injections within 24 hours after attack, and two patients after 2 and 3 days' illness; of the four patients admitted for treatment within 24 hours, three have survived and one lived for 12 days.

The two, admitted 3 and 2 days after attack, have died 11 hours and 4 days after beginning of treatment.

I believe, from the above results, that there is the possibility of the anti-toxic serum rendering service in the treatment of the disease.

At the present stage of the preparation, for producing any marked effect on the disease, the following restrictions impose themselves: it is necessary to start the treatment within the first 24 hours, and a large number of repeated injections are required.

The possibility remains that, with the further maturation of the fluid, its power will increase, so as to effect an influence on older cases, and when used in smaller doses.

No serum can as yet be issued for the use of the general public.

From R. NATHAN, Esq., Officiating Under Secretary to the Government of India, Home Department (Sanitary), to the Secretary to the Government of Madras, Local and Municipal Department, dated Calcutta, the 25th February 1897, No. 8 Sany.-734.

I am directed to forward, for the information of the Governor in Council, a copy of a letter and enclosures from Monsieur Haffkine, the Bacteriologist who has been deputed to Bombay to make investigations connected with the plague, on the subject of the possibility of protecting the population against the plague by small-pox vaccination. I am to request that effect may be given to Monsieur Haffkine's suggestion that the officers who certify cases and deaths of plague may be instructed to give information regarding the presence or otherwise, on the body of children and adults, of recent vaccination marks and marks from a natural attack of small-pox. I am further to request that any information collected in this manner may be communicated to the Government of India.

ENCLOSURE.

From W. M. HAFFKINE, Esq., to the Secretary to the Government of India, Home Department.

I have the honour to forward copy of a telegram from the Secretary of State for India, No. 4297, dated the 2nd instant, referring to the possibility of protecting the population against the plague by small-pox vaccination.

The following data bearing on the question have been furnished by the recent outbreak of plague in Her Majesty's House of Correction, Byculla.

At the outbreak of plague, on the 23rd of January last, there were in jail 345 inmates amongst whom there were no unvaccinated individuals.

One hundred and sixty-four had been revaccinated in the same jail between 22 and 325 days before the outbreak, and these, as shown below, happened to suffer from the plague to a slight extent more than the non-revaccinated.

Of the revaccinated, 84 have taken vaccination successfully and happened also to suffer from the plague more than the 82 who did not take well, having been vaccinated previously as shown by good marks on the arms.

Eighty-three were not revaccinated in the jail, but are pitted from an attack of small-pox.

Ninety-eight were not revaccinated in the jail, but had been vaccinated previously.

The following is the list of inmates who were attacked by plague during the present outbreak, from 23rd January last up to 6th instant, with details as regards vaccination against small-pox:—

Number in the Jail Register.	Name.	Statement as regard vaccination.	Transferred from the observation ward to the Plague Hospital.	Result.
977	Biva Bagu	Not revaccinated lately ..	23rd January 1897 ..	Died on 27th January 1897.
1093	Rama Govind	Do. ..	26th January 1897 ..	Died on 30th January 1897.
1359	Narayan Dhondu	Revaccinated on 30th December 1896 successfully.	27th January 1897 ..	Do.
1349	Adamji Allibhoy	Not revaccinated lately ..	Do.	
1235	Katan Lakundas	Revaccinated on 24th October 1896 unsuccessfully.	Do.	
1094	Ramgulab Ram Pratab ..	Not revaccinated; well pitted by small-pox.	Do.	
1247	Anton Salvador	Do.	Do.	
1272	Balkrishna Mahadu ..	Revaccinated on 12th November 1896 successfully.	Do. ..	Died on 30th January 1897.
1242	Ganoo Baloo	Revaccinated on 24th October 1896 successfully.	Do. ..	Died on 31st January 1897.
1336	Syed Jonas Ali	Revaccinated on 30th December 1896, modified result.	30th January 1897.	
1312	Vali Chand	Revaccinated on 12th November 1896 unsuccessfully.	Do. ..	Died on 3rd February 1897.
1276	Hoosain Muhamad ..	Revaccinated on 12th November 1896 successfully.	Do.	
1310	Bishram Jairam	Revaccinated on 12th November 1896, modified result.	Do. ..	Died on 5th February 1897.

Number in the Jail Register.	Name.	Statement as regard vaccination.	Transferred from the observation ward to the Plague Hospital.	Result.
1129	Ranji Joti Pawa	Not revaccinated lately ..	30th January 1897 ..	Died on 1st Feb. 1897.
1144	Jiva Virchand	Revaccinated on 28th August 1896 unsuccessfully.	Do.	
1224	Annah Vishroa	Revaccinated on 24th October 1896 successfully.	31st January 1897 ..	
1229	Genoo Tessu	Revaccinated on 24th October 1896 successfully.	Do.	Died on 4th Feb. 1897.
672	Kessu Umar Shankar ..	Not revaccinated lately ..	1st February 1897 ..	Died on 5th Feb. 1897.
1356	Abdool Karim Gulam Hoosen.	Not revaccinated; well pitted with small-pox marks.	Do.	Died on 8th Feb. 1897.
832	Rama Luxman	Not revaccinated lately ..	Do.	
1261	Kaloo Bhimsha	Revaccinated on 12th November 1896 successfully.	Do.	Died on 12th Feb. 1897
1222	Govind Pandoo	Revaccinated on 16th November 1896 unsuccessfully.	Do.	Died on 3rd Feb. 1897.
1252	Jeywan Gunesh	Not revaccinated; well pitted with small-pox.	2nd February 1897 ..	Died on 11th Feb. 1897
988	Mahamad Hoosen	Revaccinated on 4th March 1896 successfully.	4th February 1897 ..	Died on 8th February 1897.
1238	Babuji Sambhaji	Not revaccinated; well pitted with small-pox.	5th February 1897 ..	Died on 7th February 1897.
1136	Manji Bagwan	Not revaccinated; well pitted with small-pox.	Do.	
1297	Dhondu Sukhia, leper ..	Not revaccinated; well pitted with small-pox marks.	6th February 1897.	
1332	Kaloo Luxmon	Not revaccinated	Do.	
749	Ganji Dongerji	Not revaccinated lately ..	Do.	
1267	Baloo Krishna	Revaccinated on 12th November 1896 unsuccessfully.	Do.	Died on 7th February 1897.
1366	Shamrao Sittaram	Revaccinated on 30th December 1896 successfully.	Do.	
933	Munnoo Ibrahim	Revaccinated on 14th March 1896 successfully.	Do.	

(1) There were, therefore, 17 persons attacked, 9 fatally, to whom small-pox revaccination had been applied 28, 31, 38, 76, 77, 79, 79, 79, 81, 86, 95, 95, 99, 99, 155, 329, and 336 days before the plague attack, giving a percentage of attacks amongst the revaccinated of 10·4 per cent., and of deaths 5·5 per cent.

(2) There were 15 persons attacked, 8 fatally, to whom small-pox revaccination had not been applied lately, giving a slightly more favourable percentage of attacks, namely, 8·3 per cent., with also a slightly more favourable percentage of deaths, namely, 4·4 per cent.

(3) A comparison between the successfully and unsuccessfully revaccinated shows:—

11 attacks among 84 successfully revaccinated, with 3 deaths, giving a percentage of attacks 13·1 per cent. and of deaths 7·1 per cent.

6 attacks amongst the 82 unsuccessfully revaccinated with 3 deaths, giving a more favourable percentage of attacks 7·3 per cent. and a more favourable percentage of deaths 3·6 per cent.

(4) A comparison between the non-revaccinated who had not had small-pox and the non-vaccinated who had gone through an attack of small-pox shows—

Eight attacks amongst the 98 who had not had small-pox, with 5 deaths, giving a percentage of attacks 8·2, and of deaths 5·1 per cent.; and 7 attacks amongst 83 who has small-pox, with 3 deaths, giving a slightly less favourable percentage of attacks 8·4 per cent.; and a more favourable percentage of deaths 3·6.

It is obvious that no importance can be attributed to the small *differences* of the figures above, and the conclusion, for instance, that the application of revaccination, or particularly successful revaccination, predisposes to an attack of plague, or increases the mortality, or that an attack of natural small-pox increases the susceptibility to plague, or diminishes the mortality, would not be warranted, as—

1st, these differences in the figures are small; and

2ndly, in certain figures, they neutralise each other by a contradictory bearing.

But the marked *similarity* in the proportions of attacks and deaths in the different groups tends to show that an attack of small-pox, or vaccination against small-pox, stand no connection whatever with the susceptibility to the plague.

Notwithstanding this result, and in consideration of the communication from the Secretary of State for India, I have the honour to suggest that the officers appointed to certify cases and deaths of plague be instructed to answer, amongst other questions, one additional, concerning the presence or otherwise, on the body of children and adults, of recent vaccination marks and of marks from a natural attack of small-pox, by which measure, in the course of time, a larger material would be accumulated relating to the questions at issue.

II. With regard to the theoretical basis of the question, it has been found by Professor Klein in London, and afterwards confirmed and generalised by a series of observers, that the artificial introduction in certain ways of a virus of a given kind, and even of many neutral, not microbial products, had a temporary effect on the susceptibility of the organism to other virus, introduced in similar or modified ways; but in no instance did this effect extend over a very limited number of days, and no specific modification, with regard to the other views; was demonstrable in the organism as the result of the treatment.

Judging, therefore, from the information accumulated up to now, a campaign of artificial preventive treatment to be started amongst the plague-stricken inhabitants is to be made with a vaccine of no other disease except with that derived from the plague virus itself.

Telegram from the Secretary of State, London, to the Governor of Bombay, dated 2nd February 1897.

It has been suggested with some scientific support that recent vaccination confers some immunity against other germ diseases besides small-pox. Suggestion might be laid before your scientific experts for enquiry whether recently-vaccinated children enjoy any apparent immunity from plague and whether matter merits further verification.

Endorsement by the Private Secretary to His Excellency the Governor of Bombay, dated Malabar Point, the 3rd February 1897, No. 51.

Copy forwarded to the Municipal Commissioner for the City of Bombay.

Endorsement by the Municipal Commissioner for the City of Bombay, dated the 4th February 1897, No. 23345.

Forwarded with compliments to Professor Haffkine for favour of opinion.

GOVERNMENT OF MADRAS 13 MAR 97 RECORD SECTION

No. 367 M., 4TH MARCH 189[illegible]

ORDER—No. 367 M., dated 4th March 1897.

Communicated to the Surgeon-General and the Sanitary Commissioner.

2. The Surgeon-General is requested to communicate this to all District Medical Officers and the Surgeons of Districts in Madras.

(True Extract.)

Secretary to Government.

To the Surgeon-General.
" Sanitary Commissioner.
Copy to all Presidents of District Boards.
" " Chairmen of Municipal Councils.
" to the President, Municipal Commission, Madras.
" " Public Department.
" " Marine Department.
" " Revenue Department. ✓

55/1

Exd. P. Seetharam

Rev. Departt

Government {1897} of Madras.

LOCAL AND MUNICIPAL.

Current 1897 No.

Read. [illegible] } 1897. *Enclosures*

Regd. [illegible] *Spare copies*

G.O., No. 395 M., 5th March 1897.

MARCH.

Bubonic Microbe.

Communicating to all Local Boards and Municipal Councils and Municipal Commissioners of Madras, the Surgeon-General and the Sanitary Commissioner letter from the Government of Bombay forwarding copies of Mr. Hankin's two reports on the researches made by him on various articles of produce as regards their susceptibility to engender or support the —.

4/c 15/3/97

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following paper:—

From A. M. T. JACKSON, Esq.. I.C.S., Under Secretary to the Government of Bombay, to the Secretary to the Government of Madras, Local and Municipal Department, dated Bombay Castle, 26th February 1897, No. 1600.

I am directed to forward, for the information of the Government of Madras, copies of two reports, dated the 17th and 19th instant, furnished by Mr. E. H. Hankin on researches he has made on various articles of produce as regards their susceptibility to engender or support the bubonic microbe. It will be seen that in his report, dated the 19th instant, Mr. Hankin shows very clearly that the various descriptions of grain and flour usually stored in Bombay contain no trace of the bubonic microbe, and his other report, dated the 17th idem, proves almost to demonstration that grain purposely infected does not permit of the existence of the microbe for more than about four to six days.

2. I am to add that the results of Mr. Hankin's researches have been telegraphed to Dr. Cleghorn at Venice, with a request that they may be communicated to the Sanitary Conference now sitting in that city. Copies of the reports have also been sent to Dr. Cleghorn.

ENCLOSURES.

From E. H. HANKIN, Esq., Chemical Examiner and Bacteriologist, North-Western Provinces and Oudh, to the Secretary to the Government of Bombay, dated Bombay, 17th February 1897.

In accordance with G.O., No. 564—107-P., dated 2nd February, I have the honour to submit the following report on the vitality of the bubonic plague microbe in the chief grain exports from Bombay.

2. My experiments have been carried out with numerous specimens of the following articles:—

Linseed	Castor seed.
Yellow rapeseed.	Poppyseed.
Brown ,,	Wheat (new hard red).
Tilseed or Gingelly seed.	,, (another lighter variety).
Groundnuts.	Flour.

3. In order to test whether the microbe was still present in a living condition in a specimen of previously infected grain, my method has been to make an extract of this grain and to inject it into a mouse. The great susceptibility of mice to bubonic plague and to infectious diseases in general, while advantageous in one sense, has been disadvantageous in another, in that the mice might have died owing to the presence of other microbes than the bubonic in the grain. In some cases the post-mortem appearances have suggested that this has occurred, but, as it is impossible to give an absolute proof that the bubonic microbe had nothing to do with the death of the animal in these cases, I have in general regarded the survival of the mouse as the only adequate proof that the microbe in question was no longer living in the previously infected grain.

4. My first experiment was carried out with the bubonic plague microbe derived from cultures on agaragar. Two cultures, each about a week old, were employed. Of these, one had been derived from a patient in Bombay, the other had been recently isolated from a rat found dead of the plague. The growth was scraped off the surface of the jelly and well shaken up in 15 cubic centimetres of bouillon. The mixture was then placed in a burette. A sample of the grain to be tested, weighing about a kilogram, was placed in a previously sterilised stoppered foot-glass. One cubic centimetre of the bouillon emulsion of the microbe was then poured into the foot-glass, care being taken that it should fall into the centre of the grain. The stopper was replaced, and the foot-glass was immediately violently shaken for about a quarter of an hour. At the end of this time all traces of moisture from the bouillon that had been added had completely vanished. On shaking, a cloud of dry dust could be seen in the air in the foot-glass. In order to avoid inhaling this presumably infected dust, the next part of the experiment was carried out in the open air. The grain was poured from the foot-glass into the linen bag in which I had received the specimen. From the bag a bulk of about 40 cubic centimetres was poured into a measuring glass that had been previously sterilised. This small bulk of grain was then wetted with sterile bouillon and stirred up with a glass rod. About a half to a quarter of this bouillon was sucked up into a pipette and injected into a mouse. The white mice employed had generally been in my possession for some time. Each lived in a separate cage. The cage before being occupied had in all cases been sterilised in an autoclave. The pipettes employed for the injections were always disinfected by boiling in water previous to use. The skin of the mouse at the point of inoculation was previously to the injection rubbed with a mixture of carbolic acid, water and alcohol.

5. The extracts made in this manner were as soon as possible injected after the infection of the grain were injected into mice with the following results:—

Mouse treated with extract of			Linseed	died within 24 hours.
,,	,,	,,	Yellow rapeseed	died within 72 hours.
,,	,,	,,	Brown ,,	,, 24 ,,
,,	,,	,,	Tilseed	,, 48 ,,
,,	,,	,,	Groundnuts	,, 24 ,,
,,	,,	,,	Castor seed	,, 24 ,,
,,	,,	,,	Poppyseed	,, 24 ,,
,,	,,	,,	Wheat (new hard red)	died within 48 hours.
,,	,,	,,	,, (of another kind)	survived.
,,	,,	,,	Flour	died within 48 hours.

6. Two days after the infection of the grain, specimens were again taken extracted in exactly the same manner as before and injected into another series of mice with the following results:—

Mouse treated with extract of			Linseed	died within 7 days.
,,	,,	,,	Yellow rapeseed	died within 24 hours.
,,	,,	,,	Brown ,,	,, 4 days.
,,	,,	,,	Tilseed	survived.
,,	,,	,,	Groundnuts	died within 11 days.
,,	,,	,,	Castor seed	,, 48 hours.
,,	,,	,,	Poppyseed	,, 48 ,,
,,	,,	,,	Wheat (first variety)	survived.
,,	,,	,,	,, (second variety)	,,
,,	,,	,,	Flour	died within 48 hours.

7. At this time I found out that an extract of castor seeds to which no bubonic microbes had been added was equally fatal as the infected seeds to mice, and consequently was obliged to omit this article from my experiments. The reason of this is that the castor seeds contain a poison, known as ricin, which is intensely active on subcutaneous injection. On stirring up the seeds with bouillon as described caused a fatal dose to pass into solution. The mouse injected with such an extract would certainly die whether or not the bubonic microbe was present. If I made the extract of the seeds so rapidly that a fatal dose of the poison would not be dissolved, I could have no certainty that sufficient time had elapsed to allow the microbes to pass into suspension in the bouillon.

8. Four days after the commencement of the experiment, extracts of the grain were again made as before and injected into mice as follows:—

Mouse treated with extract of Linseed died after 13 days.
" " " Yellow rape seed survived.
" " " Brown " "
" " " Tilseed survived. "
" " " Groundnuts survived.
" " " Poppyseed "
" " " Wheat (first variety) survived.
" " " " (second variety) "
" " " Flour survived.

9. Eleven days after the commencement of the experiments, extracts were again injected. A change in procedure was made in this case in that the grain, instead of being merely stirred in a measuring glass with a glass rod in order to produce the suspension in the bouillon, were slightly ground up in a mortar until the mixture of bouillon and debris was so thick that I could with difficulty suck it up into the pipette. The results obtained were as follows:—

Mouse treated with extract of Linseed survived.
" " " Yellow rapeseed survived.
" " " Brown " died within 24 hours.
" " " Tilseed died within 7 days.
" " " Groundnuts died within 24 hours.
" " " Poppyseed survived.
" " " Wheat (first variety) survived.
" " " " (second variety) "
" " " Flour survived.

10. Thirteen days after the commencement of the experiment, extracts were again injected into mice with the following results. In this, as in later experiments, the grain was extracted by grinding it in a mortar with the bouillon:—

Mouse treated with extract of Linseed survived.
" " " Yellow rapeseed died after 24 hours.
" " " Brown " survived.
" " " Tilseed survived.
" " " Groundnuts survived.
" " " Poppyseed "
" " " Wheat (first variety) survived.
" " " " (second variety) "
" " " Flour survived.

11. The mouse treated with the yellow rapeseed extract showed no appearances microscopically or otherwise of having succumbed to bubonic infection. There was nothing noteworthy at the seat of inoculation in the back, but there was an extensive blood-stained œdema on the underside of the neck, but appearances suggesting that it had died from some accidental infection.

12. The above experiment indicates that the bubonic microbe derived from pure cultures perishes within thirteen days after being added to the above-mentioned specimens of grain and seeds. The question now arises whether the microbe would show a greater or lesser degree of resistance when derived from the organs of animals dead of the disease. A reply to this question is given in the following experiment.

13. The spleen of a rat and the spleen, liver and œdema from a mouse—both animals having died after plague inoculation—were ground up in a sterile mortar with powdered glass and mixed with 10 cubic centimetres of bouillon. One cubic centimetre of the mixture was added to half a kilogram of each of the specimens of grain immediately and violently shaken as in the previous experiment. Extracts were at once injected into mice with the following results:—

Mouse injected with Linseed died within 48 hours.
" " Yellow rapeseed survived.
" " Brown " died in 5 days.
" " Tilseed died in 6 days.
" " Groundnuts died in 6 days.
" " Poppyseed survived.
" " Wheat (second variety) died in 4 days.
" " Flour died in 4 days.

14. The fact that two mice in this series survived and that the others only succumbed after an unusual delay may be due to the fact that the grains were extracted very rapidly with the bouillon and not ground up in it as in the preceding and following experiments. Consequently, it is probable that fewer microbes than usual became suspended in the bouillon extracts.

15. Two days later, extracts were again made and injected into mice as follows:—

Mouse treated with extract of Linseed died within 24 hours.
" " " Yellow rapeseed died within 24 hours.
" " " Brown " " "
" " " Tilseed survived.
" " " Groundnuts died in 24 hours.
" " " Poppyseed " 3 days.
" " " Wheat survived.
" " " Flour "

16. Four days after the commencement of the experiment, extracts were again made and injected as follows:—

Mouse treated with extract of Linseed died in 5 days.
" " " Yellow rapeseed died in 3 days.
" " " Brown " " 2 days.
" " " Tilseed survived.
" " " Groundnuts survived.
" " " Poppyseed "
" " " Wheat "
" " " Flour "

17. The above mice that died showed no appearances under the microscope or inculturally suspicious of bubonic plague. Their spleens were injected into three other mice which have remained in good health.

18. Six days from the commencement of the experiment, extracts were again injected into mice with the following results:—

Mouse treated with extract of Linseed survived.
" " " Yellow rapeseed survived.
" " " Brown " "
" " " Tilseed survived.
" " " Groundnuts survived.
" " " Poppyseed "
" " " Wheat "
" " " Flour "

19. Thus, in this experiment grain infected with the organs of animals dead of the plague lost its infectious power completely within six days.

20. The remaining point of the enquiry is the resisting power of the microbes as it exists in secretions of the human patient. For this purpose I chose the sputum in which the microbe has been shown by Surgeon-Captain Childe, Professor of Pathology in the Grant Medical College, to exist in large numbers and in a very virulent condition.

21. Sputum recently obtained from a patient was mixed with an equal volume of bouillon. One cubic centimetre of the mixture was immediately added as before to each of the specimens of grain. Owing to an accident, the linseed could not be used in this experiment.

22. Extracts made immediately were injected into mice with the following results:—

Mouse treated with extract of Yellow rapeseed died within 24 hours.
" " " Brown " " 24 "
" " " Tilseed " 24 "
" " " Groundnuts " 24 "
" " " Poppyseed " 48 "
" " " Wheat " 24 "
" " " Flour

23. Two days later, extracts were again made and injected. The results were as follows:—

Mouse treated with extract of Yellow rapeseed died within 24 hours.
" " " Brown " " 24 "
" " " Tilseed " " 24 "
" " " Groundnuts " 24 "
" " " Poppyseed " 28 "
" " " Wheat " 24 "
" " " Flour " 48 "
" " " " 24 "

24. Four days after the commencement of the experiment, extracts were again injected as follows:—

Mouse treated with extract of Yellow rapeseed survived.
" " " Brown rapeseed died within 24 hours.
" " " Tilseed survived.
" " " Groundnuts survived.
" " " Poppyseed "
" " " Wheat died within 48 hours.
" " " Flour " "

25. Six days after the commencement of the experiment, extracts were made and injected with the following results:—

Mouse treated with extract of Yellow rapeseed survived.
" " " Brown " "
" " " Tilseed survived.
" " " Groundnuts survived.
" " " Poppyseed "
" " " Wheat "
" " " Flour died in 3 days.

26. No reason could be obtained from post-mortem appearances or cultures for thinking that the last-mentioned mouse had died of bubonic plague. Further, the flour had shown no special capacity for nourishing the bubonic microbe in my other experiments, so that it would appear to be probable that the bubonic microbe had died out in this case as in the other. Nevertheless, I am continuing my experiments with flour and hope to make a separate report to you on the subject in a few days.

27. Earlier experiments carried out with another kind of grain (bajri) has shown me that the bubonic microbe in this case dies out within two days.

28. In these experiments I had kept the grain damp, so that eventually it became covered with mildew. In the experiments now described, by keeping the grain in a dry condition in bags, I imitated more closely the conditions that exists in commerce. Under such conditions the microbe of bubonic plague appears to die out within from 4 to 6 days. In a few instances, my experiments have suggested that it may survive for periods extending up to 13 days. But it must be remembered that my experiments had to be carried out with the aid of mice owing to the impossibility of obtaining a sufficient supply of healthy rats in Bombay at the present time. It is more probable that the death of the mice in these exceptional instances was due to the accidental presence of other microbes than that unusually resistant forms of the bubonic microbe were present.

From E. H. HANKIN, Esq., M.A., Chemical Examiner and Bacteriologist, North-Western Provinces and Oudh, to the Secretary to the Chamber of Commerce, dated Bombay, 19th February 1897.

In reply to your enquiry as to whether I have ever found the bubonic plague microbe in grain and flour, I beg to state that, although I have examined a large number of specimens under different conditions, I have never succeeded in detecting it. My observations have been carried out on both clean and dirty grain, sweepings of granaries under infected dwellings, grain mixed with rats' dejecta taken from near the body of a dead rat, grain that had been carried by rats through a hole in the wall of a granary and stored in a latrine, but in all cases a negative result has been

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obtained. I have also examined weevils and other insects parasitic on stored grain without detecting the microbe. I have recently examined flour from a small godown in the fort in which rats had been dying of the plague with a negative result.

2. It is my opinion that the only connection of grain with the plague in Bombay is that, at the beginning of the outbreak, large numbers of rats were affected, and that these animals were especially common in the neighbourhood of granaries.

ORDER—No. 395 M., dated 5th March 1897.

Communicated to all Local Boards and Municipal Councils, the Municipal Commissioners of Madras, the Surgeon-General and the Sanitary Commissioner.

2. The Surgeon-General is requested to communicate these papers to all District Medical Officers and to the Surgeons of Districts in Madras.

(True Extract.)

Secretary to Government.

To all Presidents of District Boards.
" all Chairmen of Municipal Councils.
" the President, Municipal Commission, Madras.
" the Surgeon-General.
" the Sanitary Commissioner.
Copy to the Public Department.
" " Revenue Department.

Exd. P. Seetharam.

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