

1901.

NEW ZEALAND.

DEPARTMENT OF PUBLIC HEALTH

(REPORT OF THE), BY THE CHIEF HEALTH OFFICER.

Presented to both Houses of the General Assembly by Command of His Excellency.

The Hon. the MINISTER OF PUBLIC HEALTH to His Excellency the GOVERNOR.

MY LORD,—

Public Health Office, Wellington, 6th November, 1901.

I have the honour to submit to your Excellency the report of the Public Health Department for the year 1900-1.

I have, &c.,

J. G. WARD,

His Excellency the Governor of New Zealand.

Minister of Public Health.

The CHIEF HEALTH OFFICER to the Hon. the MINISTER OF PUBLIC HEALTH.

SIR,—

Department of Public Health, Wellington, 21st May, 1901.

Although this department has only been established for a short time, and consequently the amount of work done this year is not as great as it will be in future years, I have thought it well to submit for your consideration an account of what has been accomplished, and to indicate briefly the scope of the work which lies before us. Not a little of our energy and time has been spent in laying down the lines upon which it seemed the work of the department could be most efficiently and economically carried out. In this I have received much help from Mr. Horneman, and Dr. Valintine, since his appointment as District Health Officer.

As you are aware, a vast amount of excellent work was done by the various Sanitary Commissioners appointed under warrant by His Excellency last year—viz., Dr. Mason and J. A. Gilruth, general Commissioners for the colony; Dr. P. E. Baldwin, Auckland District; Dr. De Lisle, Hawke's Bay District; Dr. W. K. Fyffe, Wellington District; Dr. C. Morice, Westland and Nelson District; Dr. Syme, Canterbury District; Dr. Roberts, Otago District, and Dr. Torrance, Southland District. In the brief general survey of the sanitary conditions of the colony which I have sketched, I have availed myself of the valuable information contained in the reports of these various gentlemen. The greater part of the colony—certainly all those parts important from a sanitary point of view—were carefully inspected and reported upon, and much good was the result. Some of the conditions discovered were such as ought not to be allowed to exist—meat kept within a few feet of a privy, milk stored beneath beds, fruit covered with rags which had been gathered off the street, houses unfit for habitation, water-supplies in constant danger of pollution by filth of the most dangerous nature. Such were some of the menaces to the health of the people that the investigations disclosed. The data thus obtained, combined with the occurrence of the bubonic plague in the neighbouring colonies, were the causative forerunners of the new Health Act and the constitution of this department.

The Public Health Act of 1900 puts the colony in the van as regards the conservation of the public health. For many years the medical profession and those interested in health matters at Home have been striving—so far in vain—for the appointment of a Minister of Health. By the Act passed last session this has been accomplished for New Zealand. For the first time in the history of Great Britain and her colonies has the physical welfare of the people been elevated to a first place in the consideration of the Government. Foreign affairs, mines, and agriculture have all had their importance marked by the creation of Ministers holding Cabinet rank to look after their interest; but it has been reserved for New Zealand to create the first Minister of Public Health.

While the elevation of the physical weal of the people to a first rank in the political order is a matter for sincere congratulation, it is to the machinery of the new Act that we must look for real help in the removing of insanitary conditions and the inaugurating of reforms in matters pertaining to the public health. Under the Act of 1876 many things which it was desirable to do could not be done, and what could be done could only be effected after much labour and delay. While the present Act is undoubtedly at once the most complete and comprehensive of any that has been placed upon the statute-books of any English-speaking country, still it is capable of improvement. It is only after an Act has been in force for some time that its defects are found out—like a newly built house, a door wants lifting here, or a window wants tightening there before its occupant can be quite comfortable, so with an Act of Parliament. The recent refusal of a passenger to submit

to examination by the Port Health Officer disclosed the fact that the machinery for carrying out this most important part of the Act was not of the best. As the doors jamb and the windows creak they will be noted and as soon as may be put right.

The cumbersome machinery of previous Acts, which, even when necessity for immediate action arose, could only be brought into force after delay, and in some cases with difficulty, has given way to the more rapid method of disposing of the matter by Order in Council. The advantage of this course over the older methods was well exemplified in the measures taken to protect the colony from bubonic plague. While, of course, the centering of such power in the hands of His Excellency, the Minister of Public Health, the Chief Health Officer, and the District Health Officers might be open to grave complaint if unfairly used, I feel certain that so far it has enabled us to effect reforms which otherwise would have been impossible, without in any way detracting from the powers or lessening the influence of the various bodies whose duty it is to look after such matters.

As there seemed a general impression among some of the members of the various local bodies that the Health Department intended to entirely abolish their powers as sanitary authorities, a circular was issued by your authority explaining that this department desired in no way to interfere with such bodies so long as they did what was right. They were asked to look upon the officers of this department in the light of expert advisers on all sanitary and health matters. I am glad to say that the majority of the authorities has shown towards the department a most friendly and helpful attitude, and, so far, we have not had to invoke any greater power than persuasion.

For the purpose of this Act the colony has been divided into six divisions of much the same area and description as the old provincial districts (see attached map). Each of these districts will be under the charge of a District Health Officer, who must be a duly qualified registered medical practitioner. He must possess a special qualification in public health or sanitary science, or have special knowledge of sanitary and bacteriological work. He must be able to decide, by cultivation, diseases such as diphtheria, so that any medical practitioner in his district may be able to receive an authoritative and absolute diagnosis within, say, twelve or fourteen hours of the specimen being received by the District Health Officer. He will be required to do such simple bacteriological work as "Widal's reaction" for enteric fever. He will inform himself, as far as practicable, respecting all influences affecting or threatening to affect injuriously the public health within the district. He will inquire into and ascertain by such means as are at his disposal the causes, origin, and distribution of diseases within the district, and ascertain to what extent the same have depended on conditions capable of removal or mitigation. He will, by the inspection of the district both systematically at certain periods and at intervals, as occasion may require, keep himself informed of the conditions injurious to health existing therein. He will be prepared to advise the various local bodies on all matters affecting the health of the district, and on all sanitary points involved in the action of the various local bodies. He will advise the various local bodies on any question relating to health involved in the framing and subsequent working of such by-laws and regulations as they may have power to make.

On receiving information of the outbreak of any contagious, infectious, or epidemic disease of a dangerous character within the district, he will visit without delay the spot where the outbreak has occurred, and inquire into the cause and circumstances of such outbreak; and, in case he is not satisfied that all due precautions are being taken, he will advise the persons competent to act as to the measures which may appear to him to be required to prevent the extension of the disease, and take such measures for the prevention of the disease as he is legally authorised to take under "The Public Health Act, 1900."

He will direct or superintend the work of the Inspectors of Nuisances when such are appointed within his district, and on receiving from the Inspector of Nuisances information that his intervention is required in consequence of the existence of any nuisance injurious to health, or of any overcrowding in a house, he will, as early as practicable, take such steps as he is legally authorised to take.

In any case in which it may appear to him to be necessary or advisable, he will himself inspect and examine any animal, carcase, meat, poultry, game, flesh, fruit, fish, vegetables, corn, bread, flour, or milk, &c., exposed for sale, or deposited for the purpose of sale, or for preparation for sale, and intended for the food of man, which is deemed to be diseased, or unsound, or unwholesome, or unfit for the food of man; and if he finds that such animal or article is diseased, or unsound, or unwholesome, or unfit for the food of man, he will give directions such as may be necessary for causing the same to be dealt with according to the Act. He will inquire into any offensive process of trade carried on within the district, and report on the appropriate means for the prevention of any nuisance or injury to health therefrom.

He will report monthly to the Chief Health Officer his proceedings, and the measures which may require to be adopted for the improvement or protection of the public health in the district. He will also report with respect to the sickness and mortality within the district so far as he has been able to ascertain the same.

He will prepare an annual report, comprising a summary of the actions taken during the year for preventing the spread of disease, and an account of the sanitary state of his district generally at the end of the year. The report shall also contain an account of the inquiries which he has made as to the conditions injurious to health existing in his district, and of the proceedings which he has taken part or advised under "The Public Health Act, 1900," so far as such proceedings relate to those conditions; and also an account of the supervision exercised by him, or on his advice, for sanitary purposes, over places and houses that the various local bodies in his district have power to regulate, with the nature and result of any proceedings which may have been so required and taken in respect of the same during the year. He will keep a record of the number of specimens sent to be examined by him, with the result of the examinations. He will also record the action taken by him, or on his advice, during the year, in regard to

offensive trades and to factories and workshops. The report will also contain tabular statements of the sickness and mortality within the district, classified according to the diseases, ages, and localities.

With an officer able to perform all these varied duties located in each district, it may fairly be expected that ere long many, if not all, of the conditions which militate against the health and well being of the community will be removed. That there is a vast amount of work to be done ere this desirable condition of affairs will be attained is clearly demonstrated by the reports of the various Inspectors.

PRECAUTIONS AGAINST PLAGUE.

Much of our time and energy has of necessity been devoted to the forming of an efficient first line of defence against the introduction of bubonic plague. This disease, which at various times of the world's history has claimed its victims in such wholesale numbers as to occasionally strike terror to the hearts of the inhabitants of these countries in which it made its appearance, is essentially a disease of warm climates. It is a well-known fact that it has long been epidemic in certain parts of the Eastern world, such as the province of Yun-nan, certain parts of Siberia, Mongolia, and the southern parts of China and Central India. There is now absolutely no doubt but that the specific cause of this disease is an organism discovered by Kitasato in 1894, during the Hongkong epidemic. This organism always occurs in great profusion in the swellings (buboes), which are one of the most constant symptoms of plague.

Roughly speaking, there are three well-defined types of this disease—the bubonic, the pneumonic, and the septicæmic. The bubonic variety of the disease, although possibly the more common, and undoubtedly a very fatal form of plague, is not, from a general health point of view, nearly as dangerous as the pneumonic form. There are not many cases on record where plague has been transmitted from a human being suffering from the bubonic form of the disease—that is, before the swelling has burst—to another; but there is undoubted testimony to the fact that the germs can be sown broadcast by means of the sputa of a person suffering from the pneumonic form. Whatever may have been the case in the year 1665, in London, when so many people died of plague, this reassuring fact may be frankly accepted: that comparatively few human beings have contracted the disease from their fellows unless the type has been pneumonic. If this be borne in mind it will tend to allay unnecessary alarm; at the same time it will help to indicate the nature of the precautions which ought to be adopted, in order—firstly, to prevent, and, secondly, to combat, the incursions of this disease.

To a careless reasoner, it might seem that a good argument against the quarantine of "contacts" is here furnished, but that is not so. The separation and observation of those persons who have been in attendance or in contact with a victim of this fell disease is as much, nay, far more in the interests of such people themselves as in that of the rest of the community.

Special regulations have been drawn up for the direction of all who have to deal with cases of dangerous infectious diseases such as bubonic plague:—

ISOLATION OF PERSONS.

9. (1.) As soon as it is known that a person is suffering from a dangerous infectious disease, the local authority shall take immediate steps so to isolate that person that he cannot endanger the safety and health of the rest of the community.

(2.) Where a hospital exists in the neighbourhood for the reception of such cases, the patient shall be conveyed there as soon as practicable in a properly constructed and suitably furnished ambulance.

(3.) Where it is impossible to remove the patient to a suitable hospital, precautions shall be taken to the satisfaction of the District Health Officer to prevent any communication between the patient and any other person except those in actual attendance on him.

(4.) All persons who have come in contact with the patient shall be removed to a suitable building, where they shall remain under observation for such period and subject to such restrictions as the District Health Officer directs.

(5.) It shall be the duty of the local authority to see that every person being a patient suffering from a dangerous infectious disease, or a person who has come in contact with such patient, is immediately provided with proper and skilled medical aid.

DISINFECTION OF BUILDINGS AND THINGS.

10. (1.) The room in which the patient lived shall be disinfected in the following manner:—

(a.) All soiled carpets, rugs, bed-linen, and other soiled materials shall be burned.

(b.) The wall-papers (if any) shall be removed and burned.

(c.) The walls shall be sprayed and the floors well washed with a 1-5,000 corrosive-sublimate solution.

(d.) The room shall then be closed up and well fumigated with sulphur-dioxide, produced as prescribed in the Second Schedule hereto.

(e.) After fumigation for twenty-four hours all windows and doors shall be opened to allow the fresh air to freely circulate.

(2.) The room must not be reoccupied for ten days after being vacated by the patient unless with the consent, in writing, of the District Health Officer.

11. All outbuildings connected with the house in which the patient lived shall be whitewashed with chloride of lime of the strength of half a pound to a gallon of water.

12. All drains, gullies, sinks, &c., shall be flushed with a 1-1,000 corrosive-sublimate solution, followed by a sufficient quantity of hot water in which soap and ordinary washing-soda have been dissolved.

DISPOSAL OF THE DEAD.

13. In all cases where a person has died of a dangerous infectious disease the following provisions shall apply:—

(1.) The body shall not be unnecessarily touched.

(2.) The body shall be wrapped in four layers of sheeting soaked in a 1-200 solution of corrosive sublimate.

(3.) Where it is possible the body shall be cremated, but where not possible it shall be placed in a coffin together with quicklime in the proportion of 1 lb. for every 14 lb. of body weight.

(4.) The coffin shall be watertight, and shall be wrapped in a sheet soaked in a 1-500 solution of corrosive sublimate, and placed in a wooden shell or covering, which shall be burned immediately after the burial.

(5.) No person other than the medical attendant and the nurses shall be allowed to touch the body.

(6.) The body shall not be carried to the place of burial in a hearse or other conveyance ordinarily used for burial purposes.

14. Every care shall be taken in the case of Chinese and others who lay stress on the non-mutilation of the dead to satisfy the relatives and friends of the deceased that no portion of the body is being removed.

15. In no case shall the grave of any such person be opened until at least five years have elapsed from the date of interment.

TO PRODUCE SULPHUR-DIOXIDE.

Break roll or rock sulphur into pieces between the size of a cherry and a loquat, place the pieces in an iron vessel supported over a tub of water, wet with a little methylated spirit, and set on fire.
One pound and a half of sulphur is sufficient for a room of 1,000 ft. cubic capacity.

With precautions such as these, and complete destruction of all sputa by burning, there is next to no chance of any of the attendants suffering in any way.

Hospitals of a more or less temporary nature have been erected at the various possible points of attack; quarantine-stations have been appointed; the cargo of all ships coming from infected ports is carefully fumigated, and a most careful inspection of all passengers and crew is carried out. The inspecting officers, while fully alive to the importance of the duty intrusted to them, are careful to interfere as little as possible with the despatch of business. The public are not infrequently apt to overlook the responsibility and onerous nature of the work performed by the Port Health Officer. They are apt to grumble at a work, the value of which they are unable to estimate. Let a case of smallpox be admitted into the colony through the want of care of one of these oft-abused officers, and what would be the result? Apart from the awful consequences of the introduction of such a disease among an unprotected population such as ours, the very men whom they now grumble at they would condemn—and rightly—for their want of care. When shippers and the world at large realise that these unavoidable delays must take place in order to prevent greater losses, maybe of life as well as money, things will run much more smoothly.

I am very pleased to say that, although now and then a little friction arises, the shipping companies generally have lent us great help, and if the same spirit of give-and-take which now exists continues we will hear less and less from the anonymous correspondent.

Method adopted for Fumigation.

The method adopted for fumigation of cargo was by means of sulphurous-acid gas. Several forms of apparatus were tried. Pans containing rock sulphur were placed in the holds of the ship and set light to, while all the hatches were battened down. This, though a tedious method, was fairly effectual, many dead rats being found near to the few air-inlets which had not been blocked up. I had an apparatus made in Auckland, whereby SO_2 gas was evolved on the deck of the vessel, and then led by means of a pipe into the hold of the vessel. This answered the purpose fairly well. I question, however, if anything approaching real disinfection—that is, the destruction of disease-producing organisms—can ever be accomplished by any agency which will not in some measure destroy the material of which the cargo is composed. As the action of the gas on the metal fittings of the saloons would have been disastrous, a solution of formalin was used for the disinfection of cushions, &c.

Fumigation of Mails.

As you will see by the following extract from the report of the Venetian Convention which was appointed to consider the whole question of plague-prevention, mails were exempted from fumigation:—

“Les lettres et correspondances, imprimés, livres, journaux, papiers d'affaires, &c. (non compris les colis-postaux), ne seront à aucune restriction ni désinfection.”

Believing strongly, however, that by means of letters, papers, and books, &c., which have been handled by persons suffering from an infectious disease, danger of transmitting it might arise, all mail matters from infected countries were subjected to fumigation. The method adopted was to wet the bags, spread the letters upon a grid, and sulphur in the proportion of $1\frac{1}{2}$ lb. to the 1,000 cub. ft.; was burned in a close chamber. This was not, as might be expected, quite successful, so steam under a pressure of 3 lb. to 5 lb. was used instead. This was undoubtedly the only effectual way; but it was found that the steam affected leather goods, such as gloves, feathers were uncured, and samples of tea and tobacco were spoiled; and in some cases, where sealing-wax had been used, one or two of the letters were found to be fixed together. Despite these disadvantages, I consider that until we get the apparatus whereby we can expose the mails to formalin gas, *under pressure*, disinfection by steam is the only method of any value, the others being more of the nature of a *placebo*.

There is one thing to be borne in mind in estimating the value and cost of the precautions taken in this colony, and that is, that no single State in the Australian Commonwealth has as many possible points of infection as we have. When Victoria has guarded Melbourne, when New South Wales has cleaned up Sydney, these States are fairly safe; but here we have not one but many vital parts which must be carefully watched. But while we guard against the enemy from without, let us not forget that our main danger lies within our walls. Plague, like typhus and some other infectious diseases, while it cannot be produced by filthy habits and insanitary surroundings *per se*, still finds in these that *optimum habitat*, that best of all conditions, wherein it may flourish and thrive.

The power which insanitary conditions, the breathing of impure air, or sewer gas, has in lessening the vitality of animals, and thereby rendering them more liable to infectious diseases, has long passed the stage of speculation. The experiments of Sydney Martin and others demonstrate clearly that animals which have been exposed to sewer-gas can be killed by a dose of animal poison, which otherwise would have had little or no effect upon them. This is a truth which cannot be too strongly insisted upon, for we find, not infrequently, that this powerful factor in the causation of ill-health is overlooked and occasionally denied. A sewer or drain which

permits of the escape of sewer-gas into the subsoil is an agent for evil, the potency of which is rarely realised by the public at large. Not only by actual pollution of the water-supply does a leaky sewer militate against the welfare of the people, but by the saturation of the soil in the vicinity of dwelling-houses. In obedience to the law which regulates the expansion of gases, no sooner is the temperature inside the building raised, by means of fires, &c., above that of the outside atmosphere, than the house becomes nothing more or less than a ventilating-shaft for the area surrounding it. It offers, so to speak, an invitation to the sewer-gas which passes through the house as it ascends. I wish to emphasize this point, because not rarely are local bodies to be found who excuse their faulty sewers on the score that all diseased germs will be filtered out of the sewage ere it reaches the surface.

Then, again, the danger of filthy surroundings is not to be measured only in this way. Accepting, as we must, in the face of evidence from all parts of the world where plague has appeared, that it is mainly through the mediation of the rodents that this disease has been spread from one country to another, the immediate destruction of all garbage upon which such animals live, combined with an active campaign against the rodents themselves, is a matter of the very greatest importance. It is gratifying to be able to report that the local authorities all over the colony fully realised the urgency of the need there was for stringent and continuous efforts for their destruction, and did not hesitate to set to work. Prices varying from 1d. to 4d. were offered by the various municipal bodies for rats delivered at their destructors. Directions were issued detailing the precautions which should be taken in the handling of such animals, so as to prevent infection in case the rats were infected with plague. The bodies were required to be scalded with boiling water, or dipped in kerosene and singed before being touched, and then the rats were to be cremated. Poison was distributed free of charge to all that cared to accept it, and in most districts a day was set apart for the laying of the poison, so that as far as possible it might be simultaneous. This is most important, as otherwise the rats take fright and simply make for more hospitable quarters. That the various methods were productive of much good is undoubted, but a fortune still awaits the piper who shall discover the tune that will charm these plague-bearers from our shores.

The experiments made by Dr. Danysz, of the Pasteur Institute, seemed to indicate that in his *cocco-bacillus* a powerful agent for the destruction of these pests had been discovered, and I asked Mr. Gilruth to obtain a small quantity when in Paris, so that it might be tried here. The use of this material has not, however, been attended by a great measure of success in Sydney, so that in the main we had far better rely on cleanliness, destruction of all garbage on which the rodents feed, systematic poisoning when possible, and the keeping of ferrets, dogs, and cats. Careful and extensive experiments are now being conducted by Mr. Gilruth in the laboratory in order to test the value of *Cocco Bacillus* as a rat exterminator, and a *résumé* of them, with the results, will be published later.

CASE OF PLAGUE IN AUCKLAND.

It is a matter for sincere congratulation that, despite the opposition and apathy displayed by some people in Auckland, no other cases occurred. The moral support which His Excellency the Governor, yourself, and the Right Hon. the Premier gave us in the handling of this case is, I consider, worthy of being put on record.

Mr. Gilruth in his full and exhaustive bacteriological report on this case, and the presence of plague among the rats, has in a measure dealt with this aspect of the case, and I will not dilate further on the matter, but simply state that not one medical man on whose opinion the medical world of New Zealand puts the slightest weight took part in the plan of campaign against us.

The facts in reference to the unfortunate man Kelly are as follows:—On the 17th June, 1900, Dr. Moir was called to see a Mr. H. C. Kelly, residing in Upper Queen Street. He found him presenting symptoms which led him to suspect that the disease the man was suffering from was bubonic plague. It was not, however, till the 20th that he felt justified in notifying the case as plague. This regrettable delay was occasioned in part by the fact that Dr. Moir had not previously seen a case of this disease, and partly by his knowledge of what the proclamation of the existence of plague meant to the colony from a commercial as well as a psychic point of view. He tried to find Dr. Baldwin, the District Health Commissioner, who happened to be absent in the country on duty. He should, of course, have notified the City Council, but he did not do so. On Friday, the 22nd, he asked Dr. Girdler to see the case in consultation. Dr. Girdler at once agreed that Kelly was suffering from plague. In company with Drs. Baldwin and Girdler, Dr. Moir again went to see Kelly that evening, but by this time the patient was dead.

The clinical history of the case was that until the 16th June Kelly was perfectly well. He was suddenly seized with pains over the lower part of the body; sickness followed, gradually increasing drowsiness and apathy, and the development of swellings in his left groin and right axilla.

In the presence of Dr. Baldwin, Dr. King (Medical Officer of Health for Auckland), and Dr. Moir, Dr. Girdler made a *post-mortem* examination of the body, and the following is his report:—

SIR,—

Auckland, 24th June, 1900.

At your request I made a *post-mortem* examination on the body of Hugh Charles Kelly, of Upper Queen Street, who was reported to have died of bubonic plague. This examination was made on Saturday, at 2 p.m., 23rd June, 1900, about eighteen hours after death, in the presence of Dr. Baldwin, Plague Commissioner; Dr. Moir, medical attendant on the case; and yourself, as Health Officer.

The body was clean and well nourished. There were no bruises or marks of violence on body or head. The *post-mortem* staining was well marked on back and sides. *Post-mortem* rigidity was well marked. There were no spots on the legs, abdomen, sides, or back. There were a number—about twenty—spots on the upper part of the chest and shoulders and face. These spots were red, irregular, somewhat like inflamed flea-bites, and on the face they were more irregular, and inflamed from rubbing. There was no secretion of pus. There was a small abrasion on the skin on the left ankle about the size of a sixpence. It was scabbed over. There was no redness or cedema of the skin, no inflamed lymphatics, no enlarged glands on that leg. The glands of popliteal space were not enlarged.

The eyes were engorged, and the pupils dilated. There was no other abrasion of the skin. In the upper left thigh there was a bubo, the size of the palm of the hand. The left femoral and inguinal glands were enlarged, the skin around red and inflamed, the tissues around swollen and cedematous. The skin over the groin was well cleaned with carbolic acid 1-20, and then with turpentine. A crucial incision was made through the skin, of the skin reflected, a quantity of yellow serum exuded from the tissues. The glands were enlarged and matted together. An incision was made through them—they were reddish-black in colour and full of very dark extravasated blood—there was no pus in the tissues around or below the glands. Dr. Baldwin took several specimens in sterilized tubes. The incision was now soaked with pure carbolic acid and covered with carbolized cloths. On opening the abdomen, the omentum and large and small intestines were found covered with small spots of extravasated blood. The omental and lumbar glands were enlarged, varying in size from a split-pea to the size of a shilling; some were livid, others black in colour from extravasated blood. The peritoneum and intestines were healthy in appearance, with the exception of the blood spots. The appendix and Peyer's patches healthy, no evidence of typhoid fever. On the outside of the stomach were several blood spots; the internal coating of the stomach was covered with small punctated blood spots, otherwise apparently healthy. The liver was slightly enlarged, apparently healthy. It had no blood spots on the surface, or in the substance; no evidence of alcoholism. The spleen slightly enlarged, very dark in colour, very soft, and broken down into a pulsatous material. Dr. Baldwin took samples in sterilized tubes. The kidneys normal in size, apparently healthy. The bladder healthy. On opening the thorax, the pleural membrane were found covered with blood spots. The right lung was bound down with old adhesions, which broke down with difficulty. They were both healthy in appearance, with the exception of numerous small blood spots. Bronchial tubes normal. There was no evidence of pneumonia—the lung tissue floated easily. The heart was slightly enlarged, but healthy; valves normal. There was no pus to be found in any part of the body. There was no sore on penis, or signs of discharge from the urethra. The glands of the right axilla were enlarged. The glands of the right femoral and inguinal region were slightly enlarged and hard. The head and spinal-cord were not opened. Dr. Baldwin did not think it necessary. The body was covered with pure carbolic acid, and the outside coverings over the clothes of all present were put into the coffin, soaked with carbolic acid, and then fastened down. This examination was carried out, as directed by Dr. Baldwin.

I have, &c.,

G. TOUSSANT GIRDLER, L.R.C.P., L.R.C.S.

Dr. King, Medical Officer of Health to the City of Auckland.

Several of the pipettes containing fluids from the bubo, and also some smears, were sent by hand to Wellington to Mr. Gilruth, one of the General Health Commissioners for the colony, for examination. A pipette and smears were kept in Auckland by Dr. Baldwin. I proceeded to Auckland as soon as the case was reported. I arrived there on the 25th. By this time Kelly had been buried, and Drs. King and Baldwin had taken all the proper steps for the isolation of the "contacts," and also for the disinfection of the room in which the patient had died. I at once proceeded to make cultural and other experiments, the result of which convinced me that the decision arrived at by Mr. Gilruth was absolutely and without doubt correct.

Realising the importance of at least convincing the authorities of the truth of the danger that was in their midst, I invited Professor Thomas, of the Auckland University, to examine the various steps and results of my examination, after which he was good enough to write the following report:—

SIR,—

Auckland, July 3rd, 1900.

I have the honour to forward you a statement with regard to the reported case of bubonic plague. You will remember that I last week examined several slides prepared from the case referred to. These slides were the only preparations which Dr. King was able to submit to me at the time, and I stated then that I did not consider that they afforded independent evidence of the occurrence of a case of plague. Dr. Mason has seen the same slides and he informs me that he agrees with that decision.

I have to-day, at Dr. Mason's request, examined certain preparations from a guinea-pig which he had inoculated with a pure culture of bacillus obtained from the *post mortem*. The guinea-pig died to-day, and Dr. Mason states that it showed all the required evidence for the diagnosis of a case of plague. So far as I saw the organs they bore out the statement. A slide of bacilli prepared from the guinea-pig presented all the features characteristic of the true plague bacillus. I should not be, however, disposed to accept the microscopic evidence as binding by itself. But taken in conjunction with the fact that the guinea-pig has been inoculated with a pure culture of a bacillus from the reported case of plague, and that the guinea-pig has died of a disease which produced the symptoms and lesions of bubonic plague, it must be admitted that Dr. Mason has adduced very strong evidence in favour of the diagnosis of bubonic plague. The only loophole of escape from the conclusion is perhaps as follows:—

Plague is, after all, only a particular form of blood-poisoning, and belonging to the same group of bacilli are many forms which cause blood-poisoning in one way or other. Is it possible that we are dealing here with a bacillus which, though very similar to the plague bacillus and the actual cause of death in the recent case, is not the true plague bacillus? There is always a bare possibility of this, but it must be admitted that the close similarity in appearance of the specimens to micro-photographs of the plague bacillus, and also to specimens from Sydney, do not support the theory. Further, the result of experimental inoculation would be accepted by bacteriologists generally as sufficiently proving the diagnosis.

Accepting, as I must do, the complete accuracy of the statements made to me by Doctors Baldwin and Mason as to the history of the specimens examined, I am unable to question Dr. Mason's diagnosis.

I have, &c.,

A. P. W. THOMAS.

The Chairman, Local Board of Health.

The following letter from Dr. Beaumitz, of the Pasteur Institute, to Mr. Gilruth, who submitted the organism isolated from Kelly for his examination, may be of interest:—

[Translation.]

DEAR SIR,—

Institut Pasteur, Rue Detot, Paris, 27th April, 1901.

The following is the result of the experiments made with the microbe isolated from Kelly:—

Mouse A received preventively 1/10 c.c. of antipest serum; there was inoculated with one drop of an emulsion of microbes cultivated on agar,

Mouse B did not receive any preventive serum, and was inoculated with one drop of the same emulsion. This mouse (B) died four days afterwards. *Post mortem* showed the inguinal and axillary glands much enlarged and purulent. The spleen was hypertrophied and interspersed with pseudo-tubercles. The gland-pus, spleen-pulp, and the blood contained an immense quantity of cocco-bacilli, taking well the aniline colours, and presenting a bipolar colouration but discolouring by the method of Gram.

Mouse A resisted:—The serum antipestique has thus a preventative action against the microbe. Besides the characteristics of the cultures are absolutely the same as those presented by the cultures of plague bacilli, of different origins, which I possess.

All these results confirm the conclusions of your report, and the microbe which comes from New Zealand, by its appearances in cultures and its pathogenic action, is identical with the microbe described by Yersin in "Bubonic Plague."

Accept, dear sir, the expression of my best sentiments.

Dr. BEAUMITZ.

Mr. Gilruth, 13, Victoria Street, London, S.W.

Before finally leaving this subject, I would like to point out that the statement made so frequently that, because none of the "contacts" developed the disease, that therefore it could not have been plague, is a statement which contains no truth whatever. As well might it be said that A did not die of consumption because his wife living with him does not always contract the disease. All that the non-infection of the "contacts" proves is the truth of the statement already made, that the bubonic form of plague is the least infectious variety of the disease. Our danger lies not so much in the landing on our shores of a case of plague, but in the thousand-and-one insanitary conditions which exist all over the colony, conditions which make for the depreciation of the individual's power of resistance to disease, and at the same time affords a happy hunting-ground for that most energetic of colonisers—the rat.

Not from plague have we most to fear. Let but one case of small-pox escape the grasp of the inspecting officer, and within a few months there would be raised to that reaper, who plies his sickle without note of season, a harvest before which the number of victims of plague would pale in insignificance. The responsibilities of the opponents of vaccination are great, and "conscientious objectors" are many, but it will be found if ever that scourge comes amongst us that assuredly the one will not be allowed to forget what he has sown, though the other may disappear.

I have suggested to the District Health Officers that when once the Department is in full swing, in addition to the general work which falls to them to do, they should devote at least one report to the consideration of some large question affecting the health of the people. Meanwhile I offer the following brief remarks on the subjects of pollution of rivers and streams; drainage; water-supply; meat-supply; milk-supply; disposal of house-refuse; disposal of nightsoil; health of the Natives; and, finally, consumption.

POLLUTION OF RIVERS AND STREAMS.

For a young country like this, with its comparatively diffuse population, there is, strange to say, a very considerable contamination of the rivers and streams. The concentration of factories of all descriptions within the borough area is an invariable feature of all older and closely settled countries, but why it should be so in a country like New Zealand is as unexplainable as it is unfortunate. Streams which, but for the impurities which are constantly being thrown into them in the shape of waste products from factories, and sewage from towns, would be healthful as well as beautiful, are converted into nothing more or less than open sewers. That vigorous steps ought at once to be taken to at least prevent the further pollution of all our water-ways is agreed upon by all, the only point in dispute is how to effect the desired end. The Public Health Act gives power to local bodies to make by-laws to prevent the throwing of untreated sewage into rivers or streams, the water of which is used as a water-supply for either man or other animals. The position with respect to pollution by factories is not quite so definitely laid down. Even if it were, it would be wise to clearly distinguish between the two kinds of pollution. It has been the custom here, as it was in most of the older countries in the days of their youth, so to speak, for cities when they had advanced far enough to employ a system of sewerage, to seek the nearest way to a river or stream, and the pursuance of this policy has cost them millions of money to rearrange their sewers so that their contents could be treated in some way ere being run into the streams. It behoves us to profit by the experience of these older countries, and whenever opportunity offers adopt some method, septic-tank, irrigation, or whatever modern science suggests is best, for the treatment of all sewage before it is allowed to enter any of our rivers or streams. Local authorities have been warned that no new scheme of drainage will be considered safe or allowable unless provision is made for the treatment of the sewage before it enters the natural waterways. It is not unfrequently urged by local authorities that it is unfair to ask them to go to the expense of purifying the sewage, while other towns are allowed to continue polluting the streams; but our answer is that while it might be unfair to require sewerage schemes which have already been laid down to be taken up and rearranged, the same objection does not apply to those bodies which are introducing new systems of drainage. In some instances, however, it has been necessary to draw attention to the necessity of remodelling in the near future some of the systems already laid down, but I urge most strenuously that no new system be approved of unless provision be made for the treatment of the sewage before it enters the river.

DRAINAGE.

The absolute inutility of allowing suburban local bodies to act as Boards of Health is in no way emphasized so strongly as in this all-important Department of Public Health. An area containing, say, a large city and some half dozen satellites in the shape of suburban boroughs, each with its Mayor and Councillors, all striving, not so much for the common weal as for what they consider will most benefit their own particular portion—imagine such a picture, and it takes no "seer of old" to prognosticate what will happen. The greater part of their time is taken up by what they term "guarding the interests of their constituents." This is generally construed to mean seeing that the adjoining boroughs do not take advantage of them, and trying, if possible, to move their own burdens on to the shoulders of some one else. Take any of the large cities, and what do you find? Important sanitary works delayed year after year, because of want of agreement among those intimately concerned.

The remedy is simple, and its administration ought not to be delayed. Decide what districts have a community of interests, from a sanitary point of view; this done, place the administration of such districts into the hands of central governing bodies, and require them to proceed with the work. Of this I feel sure, no real progress will take place until this is done. As it is at present, a city wants to put up a destructor, or arrange for a nightsoil depot. The best site, from a health and engineering point of view, is decided upon; but the body under whose control this area of

land is placed objects, and this necessary work cannot be gone on with. Undoubtedly, in many cases great hardships result from the selection of a site, because, as a general rule, the part which is chosen for any one of these sanitary purposes is not infrequently the most convenient for the others. Depreciation of surrounding property in most cases results from the concentration of such works in any one particular district, and, unless some one entirely outside local prejudice decides the question, the best scheme infrequently gives place to another whose only claim is that it has roused less opposition.

By another year I hope to present for your consideration a report in detail of these important matters. As it is mainly by the agency of water that such preventable diseases as enteric fever are conveyed, it is of the utmost importance that all water-supplies should be, like Cæsar's wife, "above suspicion." The permissive nature of past health laws is in the main responsible for the want of progress seen in some parts of the colony. Coupled to this is the apathy of the general public in respect to matters of sanitation. To have laid down a tramway during his reign or donated a park to the public are claims for enrolment in the niche of fame which the civic magnate knows can be seen of all men; and the Fathers of the City are unfortunately, in some instances, not immune from that frailty which requires the ordinary man to avoid hiding his light beneath a bushel. As our King recently said, "To the man who discovers the cause and cure of cancer a statue ought to be erected in every capital in the world," so to the councillor who turns the flank of diseases such as diphtheria and enteric fever assuredly will honour come.

During the short course of our existence we have spent a great deal of our time in advising and helping local authorities in respect to these matters.

Although the remarks upon the drainage of the larger cities are few and brief, the inspection and inquiry was not of that nature. Only the main features have been dealt with, and of necessity those points wherein the city failed have been noted in preference to those which claimed praise. Thus, in a certain way, the whole picture of the colony may appear blacker than it is, but with this caveat in mind no real injustice can result.

Auckland.—Here, as in some other respects, this, the most beautiful city in the colony, occupies an unenviable first place. Main sewers emptying themselves in the centre of inhabited areas, and sewage deposits forming an odoriferous fringe along its foreshore, and all this in the face of constant and vigorous complaints both from the people and the Press. It is the same old story—Auckland is trying to be comfortable in a garment which barely fitted her when she was half her present size. As with the water-supply so with the sewage—a complete and satisfactory system ought at once to be undertaken. Never until this is done will enteric fever cease to figure as largely in their hospital and death returns as it does at present.

Wellington.—Previous to the completion of the present sewerage system, enteric fever used to occupy a not insignificant position, both in the hospital records as well as the death-rate. At the present time, even although the house-connections are far from complete, this disease, which is one of the best barometers—so to speak—as to the sanitary condition of a community, has in a great measure disappeared.

Christchurch.—The sewage, along with the storm-water, is led to a pumping-station situated some distance from the town, where it is treated in a manner as nearly approaching the "bacteria bed" system as exists in the colony. There are several settling-ponds, or, rather, natural hollows which act as such, and the effluent is allowed to irrigate the various paddocks of the sewage farm.

I went over the whole system. Although the day on which I inspected the settling-ponds and farm was a very hot one, there was not the slightest smell or nuisance. The beneficent action of the saphrophytic organisms was well illustrated. Large portions of faecal matter, which had sunk to the bottom of the pond by reason of their weight, were constantly being floated to the surface and blown to powder by means of the gases generated by these organisms and without the slightest smell. A paddock was flooded with the effluent, and in the course of an hour the whole party walked over it without the slightest discomfort.

The cattle on the farm looked healthy and well, and we were informed always fetched the best prices.

If the storm-water could in any way be separated from the sewage, and the settling-ponds properly formed and aerated, Christchurch, I consider, would have solved, in a great measure, the difficulty which confronts all large centres: how to dispose of its sewage without danger to the health of the community and with some profit to the Corporation.

Dunedin.—The greatest and most evident defect and offence against sanitary laws in this city is the method of disposing of the sewage. Ever since a system of reticulation has been adopted the whole effluent has been discharging into the harbour without any treatment whatever, the result being that the entire foreshore is saturated by sewage, which, when the tide (which recedes for a considerable distance) is low, constitutes an offence to the senses, as well as a danger to public health. A palliative remedy which could be applied, by removing the present outlet to a point below low-water mark, is negated by the (natural) objection on the part of the Harbour Board to have their channels filled up by the depositions from the sewage and storm-water of the town, though they do not apparently object to have their foreshore reclaimed for them by the same method.

There is no remedy for this state of things, and no method of diminishing this grave sanitary defect without having resort to a complete drainage scheme, having for its purpose the collection and removal of all sewage from further deposition on the shores of the harbour.

To give proper effect to any drainage scheme that may finally be determined upon for Dunedin there is one thing essential, viz.,—the amalgamation of all the suburban boroughs into one Drainage Board, or Board of Health. In the case of Dunedin there arises the question as to whether the whole of each suburb should be included in such Board, or whether the area included of each borough should be determined by the physical condition or watershed of each.

With regard to the system to be adopted, one of two methods present themselves for selection:—(1) Adoption of the septic-tank system; (2) the erection of a pumping-station and the removal of the whole sewage, with or without treatment, to the ocean at Lawyer's Head. Both of these methods present much that can be said in their favour, and the City Council have in their possession elaborate reports from highly qualified engineers bearing on these questions. The adoption of a scheme of some kind, subject to the aforesaid amalgamations of boroughs, has been determined on by the City Council, but it is quite recognised by them that the matter of a final selection of a scheme is one for careful consideration.

WATER-SUPPLY.

Leaving out the larger towns which have installed a general water-supply, it may be accepted as a fact that the great majority of our population obtain this most necessary article of food from shallow wells. Now, while this is unavoidable in many instances, it cannot be gainsaid that such a system of supply is fraught with the greatest danger. The popular superstition that because the pipe has been sunk some 10 ft. or 15 ft. that therefore the water must be pure, is just as inaccurate as it is universal. The false sense of security which this error brings has given rise to some most remarkable experiments being made by householders upon themselves. It could hardly be believed by those who have not investigated these matters that a man would be foolish enough to drink water obtained from a tube sunk only 12 ft. deep in a porous-gravel soil, surrounded on all sides by privies of the most ancient and dilapidated nature. In one instance there were no less than six such sources of pollution within a radius of 16 ft., and the well was in the centre. This of course was an exceptional condition of things, but it serves to point the moral, if it does not adorn the tale. In order to help our rural population to avoid the dangers so often attendant upon the use of shallow wells, I have drawn up and had circulated a series of suggestions and notes, the gist of which is as follows:—

- (1.) No shallow well should be sunk at less than 150 ft. from a cesspit, midden, or stable.
- (2.) The trend of the ground should be noted, and the site of the well ought to be higher than the house and privy to allow of the surface-water to drain away from, instead of towards the well, as is so commonly the case.
- (3.) The ground about the well for some 100 ft. ought to be kept clean, no slops should be thrown upon the ground, nor should poultry, pigs, or animals of any kind be housed on that area.
- (4.) It would hardly be necessary, one would think, to warn people against burying nightsoil close by the well, but the fact remains that a very large number of people are so situated that, because it is difficult to otherwise dispose of the nightsoil, this foolish and dangerous practice is indulged in. In such cases the water from the well ought never to be used for potable purposes. The better plan is to use tank water.

The best plan of all is, where possible, to convert the shallow well into a deep well—that is, drive the pipe deep enough to tap a water which is cut off from the surface-water by means of an impermeable layer of soil.

Water from streams should not be drunk without previous filtration, as the eggs or ova of many of the parasites, such as tape-worm, hydatids, &c., are deposited upon the surface of the water.

Water-supply for the Larger Cities.

Special attention has been given by the various Commissioners to this most important matter. It is a well-recognised fact that, more than anything else, an adequate supply of pure, wholesome water is an absolute necessity for any community. The supply must be generous and ample, or uncleanness and ill-health result; it must be free from all contamination with sewage and surface-water, or preventable diseases, such as enteric fever, &c., immediately begin to claim their victims.

While acknowledging that the time at the disposal of the various Commissioners for inquiry into the various water-supplies was, in some instances, not so great as might have been desirable, this I will say: the pictures presented can be accused of incorrectness only on the score of incompleteness. All the statements made are accurate.

Auckland.—While of late strenuous and earnest efforts have undoubtedly been made in the matter of public hygiene in the northern capital—while there are, indeed, ardent reformers upon the Council of that city—the fact remains that in many respects Auckland is far behind. In respect to the water supplied, she is unquestionably far behind all the other large centres. It is neither adequate in quantity, nor is the quality above suspicion.

At the present time the people of Auckland draw their water-supply from what is termed the Western Springs. On the occasion of one of my visits there had been a protracted drought, and in consequence of the limited supply the water was cut off every evening at 6 o'clock for a number of hours. The main conduit leading from these springs is composed of earthenware-pipes joined together by cement. This main conduit passed through the centre of a lagoon formed by the waste water from the engines and pumping machinery. At the time of my visit a considerable portion of this lagoon was covered with a green scum. The upper third of the pipe which conducted the water from the springs to the pumping-station was uncovered, and therefore exposed to the sun, while the lower two-thirds were below the water-level. I drew attention to the danger there was of leakage from this lagoon into the main water-supply owing to the cement cracking at the point of junction of the upper and lower two-thirds by reason of the unequal contraction. It was suggested that the pressure inside this conduit was such as would prevent the soaking in of any of this impure water. This doubtless might be the case while the pipe was running full, but I found on inquiry that such contamination had actually taken place, the result being expressed in an outbreak of enteric fever. As a matter of fact, owing to the shortage of water, this pond actually has been used to augment the general water-supply.

It has been asserted that this spring could not be contaminated by surface-water by reason of the nature of the strata. This I do not believe. The whole of the catchment area of which this spring is the central and nearly the lowest point consists of rough scoria, with wide intervals between the blocks. Into this area until lately a portion of a cemetery drained. An open sewer, which was choked up with filth, encircles more than half the catchment area. Draining into this creek was a considerable number of piggeries and Chinamen's houses of the usual unsavoury description that obtains in most large towns.

An absolutely new source of supply must at once be obtained in order to insure that the people of Auckland may be provided with an ample supply of pure and wholesome water. Even should an empowering Act be obtained, giving full control of the catchment area to the City Council, the gathering-shed has already been so polluted that I consider it would be unsafe, even should all these nuisances be at once removed.

I am glad to be able to inform you that tenders have been let for portions of a new scheme. The Council has decided to bring water from the hills. A considerable portion of this work has been done, but I would urge most firmly that all despatch be taken in this most important work. It has been suggested that the new supply should be used to augment the present supply. I think this would be a most unfortunate and unsafe plan. Looking to the amount of possible pollution with which the present water-supply is surrounded, and granting that the Nihotapu water is absolutely pure, the mixing of it with the old supply would in no wise decrease the danger of pollution which at present exists.

It is only fair to state that there are great difficulties, both financial and engineering, in the way of the projected new scheme; but, unless strenuous and continuous effort be made in the direction of supplying Auckland with water from this projected new source, the City Council are incurring a responsibility which I suggest no local authority should be allowed to do.

Wellington.—The water-supply of this city is of good quality, if not quite adequate in quantity during the drier parts of the year. It has been alleged that owing to the non-supply of the higher levels with water, enteric fever and diphtheria have been the result. Whatever truth there may be in this statement, there can be no question whatever that while a water-carriage system, with an ample supply of water, is one of the best means of carrying sewage, it has its dangers if the water-supply be deficient. Should the water-supply be cut off for any lengthened period the water in the various traps becomes evaporated, and the closet is turned into nothing more nor less than a ventilating shaft. The Council, however, have under consideration the augmentation of the present supply.

Another matter of importance which, unless there be some insuperable engineering objections to it, should receive early consideration from the Council, is the putting in of a filter-bed between the source of supply and the consumer. When this is done Wellington will have a water-supply which will answer to all modern requirements.

Christchurch.—This city is fortunate in having an excellent and abundant supply of artesian water. The main disadvantage is the want of sufficient "head" for flushing and fire purposes. A scheme, however, is on foot for tapping the Waimakariri higher up, and thereby removing this disability. From a health point of view there is little to remark, except that until some system of storing the water is introduced water-closets cannot be used with safety in many parts of the city.

Dunedin.—Dunedin at present owes its water-supply to two sources—(1) To the north of the town from a reservoir supplied by Ross Creek; (2) to the south by a reservoir supplied by an open water-race of several miles in length, which brings in the water from a pure stream called the Silverstream.

The catchment area of the northern water-supply is not subject to more than average pollution, there being few houses in its neighbourhood, and no pollution of the stream. The water from the reservoir, as supplied to the town, varies in its quality, being at times clear, and at other times much discoloured. There is no system of filtration employed.

In the case of the southern supply, the length of open water-course, which passes through a country in which there are cattle, sheep, and rabbits, renders it liable to pollution from these sources; otherwise the area is free from the accidental pollution by dwellings. Again, there are no filtration-beds in connection with this reservoir.

The combined supply from these two reservoirs has occasionally, during the occurrence of continuous dry weather, shown itself to be insufficient for the needs of the population; moreover, the levels from which the two supplies come are not sufficiently high to permit of a service to the suburbs of Mornington, Roslyn, and Maori Hill, which are situated on the hills surrounding Dunedin, and which have, in consequence, to rely on rain-water alone. For this reason the City Council have recently adopted a scheme for the further extension of their area of water-supply. The new area embraces the watersheds of the rivers Waitati and Leith, the water from which is to be collected in a reservoir, whence it is to be conveyed by pipes to the city, and to various contributing reservoirs divided amongst the higher suburbs, which will result in securing for the city and suburbs an ample water-supply, and favour public health by the facility, hitherto non-existing, of flushing gutters, &c.

MEAT AND MILK SUPPLY.

Meat.

By the passing last session of the Slaughtering and Inspection Act it is to be hoped that much of the illtreatment which the staple article of our diet received, and still receives, will be diminished. The conditions under which the slaughtering of animals intended for food purposes took place were, in many instances, of the most primitive and most disgusting character. Pigs could be seen wallowing up to the shoulder in liquid filth, drinking the blood as it ran from the floor of the slaughterhouse; the whole place greasy and slippery with offal; no drainage in many cases, and a

very imperfect water-supply. As, however, the control of this has been placed in the hands of the Agricultural Department I shall not further remark upon it. There is one phase of the question, however, the treatment of which I consider devolves upon this department—*i.e.*, the conservation and care of the meat when it is passed from the slaughterhouse to the butcher's shop. Were the retailers of any other article of diet to expose their wares in the way in which the butchers, large as well as small, do, there would at once be a great outcry. Take even the best shops that we see in any of our large towns. The meat is exposed to every wind which blows, and to every particle of dust which is carried by that wind. There is no question whatever but that disease can be spread in such a way, and I feel it my duty to draw your attention to this most important matter. To remedy this should not be a difficult problem. The meat could be enclosed between two layers of glass, which space could be properly aerated by means of a fan. The meat would in this way be protected completely from contamination by the hundred-and-one forms of filth which is blown about in every large town, while the appeal to the customer's eye would still be as strong as it is now, and far more pleasing would be their reflections.

Milk.

The consideration of the milk-supply occupied the attention of Parliament last session. The result was expressed in the Dairy Inspection Act. Under this Act the Agricultural Department require all dairies, or places where milk, butter, &c., is deposited or exposed for sale, to be registered. They also require that these places shall be constructed according to a certain model, which is a very good one. So far so good. They endeavour to insure that no contamination can take place during its journey from the cow to the dairy; but it must not be forgotten that its journey from the dairy to consumer is attended with very great risk.

There is, unfortunately, not the slightest room for questioning the truth of many of the statements which have been made in reference to dirty milk. It cannot be otherwise when one considers the slipshod methods in use by the retailer as well as the buyer of the milk. It would be unfair to a great number of milk-vendors to say that all are dirty, but the fact remains that not a few of them take little or no trouble to profess the virtue of cleanliness, even if they have it. The cans are not bright, the carts are often dirty, and the clothing of the dispenser not infrequently shows unmistakable evidences of a rubbing acquaintanceship with cows and cowbails. Then, again, the customer does what he can to aid and abet the vendor by providing an open vessel like a jug to receive the dust and dirt as well as the milk. It seems marvellous that no company has seen its way to undertake the retailing of milk in the tasteful, cleanly way in which one sees it done on the Continent or in some parts of London—bright clean carts, clean polished pans, pasteurised milk from guaranteed herds, and, above all, clean, tidy servants dressed in spotless linen, and success, I feel sure, would be attained.

The local authorities have power to control and prescribe the conditions under which the sale of this article of diet alone can be conducted. The department has in many cases urged upon local authorities the necessity for constant and careful supervision of this important article. We have offered to analyse any samples of milk they care to send to us, and we trust by this means many complaints which are now, with more or less justice, urged against the condition of the milk, as supplied in some of the large cities, may be removed.

HOUSE-REFUSE.

The common practice of burying house-refuse, in close proximity of dwellinghouses, is not always the innocent-looking innocuous operation it would seem. It has been suggested that this method of disposing of house-refuse, consisting of papers, rags, old boots, &c., can do no great harm. If the composition of this mixture was always of such a nature, possibly there might not be. Any one, however, who has visited a house-refuse depot will have seen that the contents of such places are not in any sense such as described. Dead cats, unsound meat, potatoes, portions of uncooked food, all go to form this mixture which is termed "house-refuse." There are only two ways in which this can be at all satisfactorily disposed of. First, by means of a destructor. There can be no doubt that this is the best way, and it is only a matter for the near future when every town of any importance will be required to establish such a factory. I do not intend here to enter into the varying qualities of destructors, but there are several kinds upon the market, each one of which is able to do the work required of it. Secondly, house-refuse may be got rid of by burying it. If this mode of disposal be decided on, the cemetery ought always to be some considerable distance from any dwellinghouse. The plan of making up land or reclaiming boggy city areas by means of house-refuse is one to be condemned. Only by a liberal mixture of good soil, and daily burning and burial can all nuisance be avoided. The building of houses over such made-up ground ought not to be permitted until several years have elapsed.

NIGHTSOIL.

The disposal of house-refuse naturally leads us to the consideration of how to dispose of the nightsoil. The best method of removing and destroying excrementitious matters in places where no water-carriage system is in vogue is one of those sanitary problems which seem well-nigh impossible to answer with any sense of finality. In New Zealand many methods are in vogue—from the self-willed advocate of freedom, who buries it in his own backyard as an odorous protest against what he terms an interference with his rights as an individual, to the local authority which collects and disposes of it without nuisance or danger.

In sparsely populated districts, where houses are far apart, no better plan can be adopted than the burying of the nightsoil in the garden; but even here there is a right and a wrong way. The practice often followed of digging a deep hole, and simply throwing in the stuff until it becomes full, is the wrong way. As the destruction of all faecal matter is effected through

the agency of small organisms—the so-called nitrifying organisms—and as these minute scavengers live only in the superficial layer of the soil, the inutility of burying such matter at the depth of, say, 6 ft., 7 ft., or 8 ft. is at once seen. The proper way to dispose of nightsoil is by placing it about 1½ ft. beneath the surface. By continually changing the place of deposition every opportunity is given these organisms of doing their beneficent work. The destruction of faecal matter treated in this manner is very rapid. In the course of some three, four, or five days—should the soil be of the proper loamy description—absolutely no trace of nightsoil can be detected.

From the individual who has enough surrounding ground to dispose of all such matter by burying it, we come to a section of the community who, while they have quite outgrown this method of disposing of nightsoil, by reason of the increase of the population, still persist in its practice. In many cases the persistence is not so much the fault of the individual himself, but is due to the inertness and want of progressiveness on the part of the local authority in whose district he resides. All over the Colony of New Zealand there can be found places where the residents, with houses situated on an eighth and sixteenth of an acre, are forced, by want of a common system, to continue this insanitary method of disposal. When we remember that the people resident on these small areas have not only to dispose of their nightsoil, but often also to draw their water-supply from the same small place, the chances of their obtaining pure water are, as Mr. Snagsby would say, “not to put too fine a point upon it, rather remote.” The department has been urging upon all local authorities having control of tenements situated upon such areas the absolute necessity of at once instituting a system whereby the nightsoil can be removed at regular, and not infrequent, intervals. Most local authorities are able to see not only the advantage, but the necessity, of doing so.

If there is one thing more important than another in the carrying-out of a system of collection of nightsoil, it is that the kerosene-tins and the oil-drums must give way to a properly constructed pan. In the first place, the kerosene-tin is never properly cleaned. Filth accumulates and the place smells, and, consequently, depreciation of health results. The only way in which this system can be carried out, without nuisance and danger to the health of the people, is by means of the so-called “sealed-pan system.” This system, described shortly, consists in a properly constructed enamelled pan. Once a week the contractor removes this pan to the depot, leaving a clean pan in its place. In order that no nuisance may arise—such as frequently takes place when nightsoil is removed in open vessels—a lid is placed upon the pan which, practically, hermetically seals it. There is no danger with these pans. They can be carried through the streets without causing any nuisance, or giving rise to any complaint. The pans are emptied at the depot, cleansed, disinfected by steam, and are ready for the next service. The contents of the pans may be taken either to the destructor where such exists, or to the depot where it is spread upon the land and ploughed in daily.

CONSUMPTION.

That it might have been better to have waited for another year, when data from amongst our own people could have been obtained and submitted for your consideration, before dealing with the question of consumption, I do not deny; but the desire felt by all the civilised world that something ought to be done will, I think, justify what otherwise might seem a premature suggestion.

The recent pronouncement by Dr. Koch at the Congress lately convened in London for the consideration of how best to limit the ravages of this all-prevalent disease has, to say the least, disturbed the scientific world. Until a few weeks ago there was not, I suppose, a single individual who would in speaking of consumption have considered it necessary to attempt to prove that human and bovine tuberculosis were due to one and the same organism. Now all this is changed; but while it would be in the highest degree impertinent to doubt the truth of any statement made by so distinguished a bacteriologist, there is no need, it seems to me, to alter our plan of campaign until at least further data is supplied.

The attitude of the ordinary individual, no less than that of the scientific world, has undergone a remarkable transformation during recent years. Time was—and that not so long ago—when to tell a patient that he had consumption was considered tantamount to telling him to put his house in order that he might be ready for the end which was not far off. It is not so now. *Post-mortem* examination has shown us that not nearly all who have suffered from tubercle of the lung die of that disease, while from the discovery and subsequent observation of the particular entity which causes the disease, and the conditions which favour its development, there has been evolved a more scientific and beneficial mode of treatment.

No longer is it considered necessary to close up every outlet through which fresh air can reach the invalid in order to help him in his search after health. The old order has given place to a new and more enlightened one. Fresh air and sunlight have taken the place of the close room and overcoats.

It is not, however, upon any line of treatment *per se* that we must congratulate ourselves most, but rather to the altered attitude which has been taken up all along the line in respect to this modern scourge. That prevention is better than cure is a true, if a trite saying, and it is in this direction, as well as the others, that our efforts as a department of State ought to be directed.

The factors which go to make up that sum which is termed “predisposition” and “predisposing causes” are many, and, fortunately, a few of them are capable of removal. The masterly investigation of the late Dr. Buchanan into the relation which exists between a damp subsoil and phthisis has demonstrated a truth of a far-reaching and valuable character. He demonstrated beyond all doubt that a lowering of the subsoil-water was always followed by a decrease in the mortality from consumption. It has been found that by draining the soil the temperature in summer is raised as much as 3° Fahr., which is in effect the same as transporting the land 150 miles nearer the equator.

Another point which is of the greatest interest from a preventive point of view is the almost universal recognition by all and sundry of the infectivity of consumption. Now that it is recognised that the disease is spread principally through the agency of the billions of bacilli which are daily coughed up by the sufferer from consumption, the sphere of action—the arena, so to speak—is more defined, and consequently it becomes easier for us to defend ourselves.

The inclusion of consumption amongst the list of notifiable diseases is an important step in the right direction, because through this we are enabled to gauge accurately the number of cases which yearly occur in the colony; and, most important of all, we are empowered to require every landlord in whose house a person suffering from consumption has lived to have it properly disinfected before it can be relet to another tenant.

It has come to the knowledge of this department that cases have occurred where, through the non-disinfection of rooms which had been occupied by persons suffering from consumption, tenants have contracted the disease. Under the new law this evil will be greatly lessened. I look upon this as one of the most important weapons granted us with which to combat the spread of the disease.

Another point which is worthy of the most serious attention of the Government is the great number of people suffering from consumption who yearly land in the colony in the search after health. It has been urged by some that we ought to exclude every one suffering from consumption. This attitude has the support of many, but I think in most cases it comes of ignorance or non-appreciation of the true facts of the situation.

If the colony were as free from consumption as it is from small-pox or rabies it would still be a matter for careful consideration as to whether it is wise—reckoning on the lowest of bases, namely the monetary one—to prohibit the sufferers from incipient phthisis, who are able to pay for their keep and attendance, from coming to New Zealand in order to avail themselves of the benefits of our climate.

Viewed from the point of international equity, it seems to me it would be as unfair as it would be unchristian to deny any fellow-creatures the privilege of sharing the beneficent effect of our climate. On the other hand, there need be no hesitation whatever in pointing out to the world at large the unfairness to us, as well as the inhumanity to the sufferers, of consigning a person in an advanced stage of consumption to the irksomeness of a long sea-voyage, and the divorcement from all he holds dear, in the vain Will-o'-the-wisp pursuit of the recovery which can never be his. But, when we add to this impossibility of cure the fact that the sufferer is next door to penniless, there need be no hesitation on the part of the State to interfere and say, "We shall not permit the importation of such unfortunates."

Any medical man in practice in the colony could, from his case-books, collect many cases of people who when they landed had no possible chance of recovery, and the only part of New Zealand they ever saw was the inside of a ward in a general hospital. That the exclusion of such cases can be justified on humanitarian as well as economic grounds I have not the slightest doubt. Another point, more perhaps pertaining to the outside world than to ourselves, but still sufficiently proximate to justify our paying it attention, is the indiscriminate way in which the sick and the hale are mixed up on board ship. Picture, for example, the condition of affairs on board, say, a sailing-vessel, which invites first-class passengers desirous of availing themselves of the recuperating effect of a long sea-voyage. One such ship I knew well. Of the ten saloon passengers three were suffering from phthisis in an advanced form, one was a dipsomaniac, and one was practically insane. All the cabins, in addition to the two water-closets, ventilated into the saloon. Two of the passengers were perpetually surrounded with an atmosphere of creosote and its allied smells. Cabined with one of these sufferers, who was constantly expectorating large quantities of the tubercle bacilli, was a gentleman who was travelling because of a bad family history and a slight sore throat. Had he of his own free will wished to select an experiment whereby his power of resistance to tuberculosis could be determined, I can honestly say he could not have chosen a better set of conditions. Constant companionship in a close stuffy cabin with a man suffering from consumption, coupled with the disgust and consequent want of appetite owing to the inhalation of second-hand creosote, were just that congeries of factors which would try a man's power of resistance to that disease. The abolition of such conditions—the precluding of the possibility of such sources of infections—is, I consider, justly within the range of practical politics.

Sanatoria.

While I have dwelt at some length on the removable factors of consumption, and while prevention is indeed better than cure, it is certainly not both. The purely medical treatment of consumption is now almost a thing of the past. The recognition of the great value of fresh air, sunlight, and judicious feeding have replaced the hundred-and-one vaunted specifics for the disease. The so-called open-air treatment has almost universally been adopted. I must not be taken to mean by my insistence upon the value of fresh air and sunlight that drugs have no place in the management of such cases; in all cases of consumption they have a value, but whatever value they may have is greatly enhanced by the conjunction of plenty of fresh air. The establishment of sanatoria for the treatment of consumption has, on the Continent of Europe and in America, been accepted as a legitimate tax upon the general public, and I think justly so.

Recognising, as we must, that tuberculosis is a common disease among our people, and bearing in mind the great infectivity of the disease, it profits us from every point of view to, firstly, use every means in our power to prevent its spread; and, secondly, to adopt the best and cheapest method of curing those who are suffering from the disease.

There are in New Zealand many situations where such institutions might be erected with the greatest possible benefit, but I would suggest that we move with caution in this matter. For that reason I recommended that a sanatorium capable of accommodating twenty males and twenty females be established by way of experiment. Bearing in mind the beneficent effects of fresh air

and sunlight, I proposed that the institution should consist of a brick administrative block, containing rooms for doctor, nurses, and all the accommodation necessary for the treatment of forty patients. So far there is nothing special in the character of the building. It is in the arrangements of the bedrooms, however, that the special feature of the building will lie. The plan I suggested was to arrange the corridor so that the rooms, which are movable, could be unhooked in the morning, turned round so as to expose the occupant to the sun, and yet shelter him from the wind. With grounds properly laid out, the patient could be wheeled about, and as night came on his bedroom would be taken back and hooked on the corridor again.

The estimated cost of such a building would be somewhere about £10,000. This sum, though considerable, is small in comparison to what is being spent by many of the separate States in America. As an offset against this expenditure, the lessened number of patients now being treated in general hospitals would have to be considered, and, what is far more important, the segregation of those unfortunates who at present have added to their physical sufferings the constant dread of injuring those that are nearest and dearest to them.

When we remember that, of a very truth, a nation's health is a nation's wealth; when we come to consider the relative capitalised values of all wealth as against the capitalised value of a people as a working machine; when we find that statisticians of such world-wide reputation as Mr. Giffen, tell us that the value of the people in Great Britain as working animals far exceeds the total wealth of the whole country,—it behoves us to inquire if it be not more profitable to expend money in order to keep our workmen well than allow them to drift into such a state of ill-health as will require the expenditure of all their energy and attention in order to prolong, it may be for years, a life which has little or no commercial value. I am, as you can see, discussing the question from a purely utilitarian point of view.

Taking as truths, for truths they are—(1) That consumption in the early stages is curable; (2) that treatment in a properly equipped sanatorium gives the best results; (3) that a nation's health is its greatest asset—the advantages to be derived from such a place are at once apparent.

To cure a man of consumption—that is, to retain him for the State as a worker—is worth to his country, say, at least, £135. To allow a man to pass from the first to the second or third stage of the disease, and then attempt to cure him is, in nine cases out of ten, to simply transfer this £135 from the credit to the debit side of the ledger. Nor is this all. Humanitarianism has decided that we must strive to prolong the lives of these unfortunates, and this we do, knowing full well that they can never play their full part again in the work of the body politic.

A common error is to suppose that the worst has been stated against a disease when the number of deaths which has been caused by it has been enumerated; but that is very far from the truth. If for every 100 persons who suffer from enteric fever one dies, that represents the case mortality; but before one can estimate correctly what this disease has cost the country you have to put down, say, three months' abstinence from work for each of the sufferers. Nor is the sum complete even yet, for all that suffered from the disease do not return to the field in as good a condition as they were in before.

The department has already entered upon the campaign against consumption by the issuing of leaflets and posters drawing attention to the nature of the disease, and the precautions which should be observed by those suffering from the disease; but until some place has been erected where patients can be treated in accordance with the latest scientific manner, the best results cannot be hoped for.

In accordance with your instructions careful and exhaustive inquiries are being made all over the colony, in order that the most suitable site for the erection of an open-air sanatorium may be selected. I have personally visited many of the suggested places, and each of the District Health Officers are actively inquiring into the matter. I hope to be able to lay the result of these investigations before you shortly. I trust that before another yearly report is made I may be able to inform you that, at least one such necessary institution has been erected.

NATIVE AFFAIRS.

Profiting by the experience of other countries, realising to the full the danger to which the Native race here would be exposed should plague once find a footing, special precautions were taken. The Maoris were invited to *korero*, at which sanitation was the chief topic. These meetings were productive of great good, so much so that it was decided to continue the work of physical salvation amongst the Natives. Dr. Pomare has been appointed Health Commissioner for the Natives throughout the colony. His duties are to go amongst the Natives, visit their various paha, inquire into their general health, condition of the water-supply, and the diverse ingenious, if not scientific, methods employed in the disposal of nightsoil. Already he has travelled over a considerable part of the North Island, and everywhere he has been received with open arms and enthusiasm. The advantage of having an adviser able by reason of his nationality to enter into their thoughts and minds, able to view objects from the Native point of view, is undoubtedly great.

As is well known, that total disregard of most hygienic conditions which obtains in many Native settlements is responsible for much of the disease which, unfortunately, exists among them.

Owing to the fact that death certificates are not required, it is difficult to arrive at absolute certainty as to the causes and number of deaths, but that chief among these is consumption cannot be denied. That this is so is not a matter for surprise, when one contrasts the picture seen on feast-days or race-days with that of ordinary times. Swarthy maidens, dressed fully and completely in ordinary attire in the early morning, in the evening can be seen sitting about on the damp ground with little else than a petticoat and bodice on, and these of the flimsiest nature. It is to this attempt to face both ways at once, so to speak, that not a little of the pneumonia, bronchitis, and consumption is due. Until the Maori becomes convinced of the necessity of living either as a Maori or as a pakeha, no great diminution of the death-rate can be hoped for. The practice of wearing warm

woollen clothing one day, and discarding it the next, is the commonest cause of the colds from which they suffer. Repeated attacks of cold bring about that depreciation of tissue which makes them easy victims to the bacillus of consumption.

Then, again, their reluctance to burn anything which has come from them, such as blood, &c., prevents the best mode of disposing of the infected sputa from being adopted—namely, cremation. As it is, you will often find an old crone coughing up millions of bacilli, which she distributes impartially over all parts of the whare—except the fire.

Another factor which will in the near future make for the physical welfare of the Maori is his increasing necessity for work. The indolence and laziness seen among the Natives in older settled places is undoubtedly productive of much poverty and consequent sickness.

The abolition of the tangi, with its lavish and reckless expenditure, and consequent semi-starvation and physical depreciation; the relegating of pigs and other animals to quarters other than those occupied by the owners themselves; the construction of watertight, yet ventilated, whares; the proper disposal of nightsoil: these are some of the important reforms which the department hopes to see effected ere long among the Native as well as the pakeha.

DEPARTMENTAL.

A tabulated statement of the whole of the work done by the department will be submitted to you in the next report. We are gradually getting the various offices filled.

The under-mentioned gentlemen have been appointed:—Dr. Makgill, District Health Officer, Auckland; Dr. Valintine, District Health Officer, Wellington; Dr. De Lisle, District Health Officer, Napier; Dr. Ogston, District Health Officer, Dunedin; Dr. Roberts, Acting District Health Officer, Nelson; Dr. Anderson, Acting District Health Officer, Blenheim; Dr. Symes, Acting District Health Officer, Christchurch; Dr. Pomare, Health Officer to the Maoris.

The appointment of the Inspectors for the several districts is now a matter of urgent necessity. When these have been gazetted we will then have a staff of workers which will, I feel satisfied, fully justify by their labours the creation by Parliament of a Department of Public Health.

I have, &c.,

J. MALCOLM MASON, M.D.,
Chief Health Officer.

APPENDIX.

BACTERIOLOGICAL REPORT ON KELLY CASE AND PLAGUE AMONG RATS, BY J. A. GILRUTH.

These were received by me in Wellington on the arrival of the Wellington-Manawatu train at 9.50 p.m., 25th June, having been transported by hand from Dr. G. P. Baldwin, Health Commissioner in Auckland. They consisted of smears from the lymphatic gland and spleen, and pus from the affected gland, spleen, and lung, in specially prepared hermetically sealed Pasteur pipettes.

The smears on the slides were rather thick for satisfactory examination, but they showed the presence of bacilli which, so far as could be observed, were fairly characteristic of those of bubonic plague. Other micro-organisms, such as putrefactive germs, were also present. On opening the pipettes, however, and examining the contents under the microscope, bacilli in every way typical were seen to be present in considerable numbers, they having increased evidently in number after the pipettes were filled. Tubes of nutrient agar and of blood-serum were inoculated from the pipettes.

A guinea-pig and a full-grown rat were each inoculated with about three drops of the contents of the gland pipette; and a rat (No. 2) was inoculated with some of the contents of the spleen pipette. In fifteen hours the guinea-pig was evidently *in extremis*, and was killed by chloroform. As the animal had probably been affected principally by the toxine formed in the tube by the growth of the bacilli, there were practically no pathological lesions. However, a few bacilli were found in the spleen and the blood. At twenty hours a very faint slight growth was apparent in one of the agar tubes. This on examination proved to consist of short oval coccobacilli, some so short as to almost resemble cocci in appearance, while others were longer. As there were evidently other foreign bacilli present a fresh guinea-pig (No. 2) was inoculated in the thigh with a small quantity of this growth by means of a platinum needle. Unfortunately a sub-culture was not made at the time, and by next day all the tubes with the exception of one showed a more or less luxuriant growth of foreign organisms, due to the contamination of the pipettes' contents, *post mortem*, or at the time of filling. One tube, however, showed on the last streak a few separate, almost invisible, points of growth which were pure colonies of the bacillus pestis, and from this fresh sub-cultures were made.

Rat No. 1 died about forty-eight hours after inoculation, and, on *post-mortem* examination, enlarged gland above seat of inoculation, swollen and dark spleen, were observed. The gland and spleen contained numerous characteristic bacilli, but some foreign micro-organisms were also present.

Rat No. 2 died about eighty-six hours after inoculation. *Post-mortem* examination showed gland above inoculation point very much enlarged and inflamed, spleen much enlarged, soft and dark, liver congested, and lung with patches of congestion here and there. Typical bacilli were present in bubo and in organs.

Guinea-pig No. 2 (inoculated with culture) died eighty hours after inoculation. *Post mortem* showed enlarged inflamed precrural gland (above seat of inoculation); other glands slightly enlarged; hæmorrhagic areas in intestines; spleen enlarged and mottled with greyish patches; Liver enlarged and showing a few whitish points about the size of a pin-head. The bubo was crowded with typical bacilli, which were also numerous in the spleen, especially in the whitish degenerated portions. The blood contained but very few bacilli.

Guinea-pig No. 3 (inoculated 27th June from gland pipette) died sixty-four hours after inoculation. *Post mortem* similar to above as regards swollen glands, &c., but the spleen, though larger than normal and very dark in colour, did not exhibit the mottled appearance, which was also typical, as the mottled condition rarely appears before the lapse of three days. All the organs, and even the blood, contained large numbers of the typical bacilli, this infection of the blood having evidently been the cause of the rapid death.

Cultures were made on agar, serum (coagulated), and other media from all of these animals, and later on other experiments were conducted on rats and guinea-pigs with sub-cultures, the result being invariably the same, viz., the development of a bubo above the seat of inoculation, and death in from three to five days (unless later when cultures of less virulence were used), and the typical *post-mortem* appearance as described above. Every experiment proved that the contents of the tubes forwarded by Dr. Baldwin, from the case Kelly contained the bacillus of bubonic plague. The experiments detailed above were conducted in the presence and with the assistance of Dr. Kingdon Fyffe, Health Commissioner for the Wellington District, and, in so far as the effect on guinea-pigs was concerned, were controlled by Dr. Mason's independent experiments in Auckland with material which had been retained there in a Pasteur pipette by Dr. Baldwin. They also bore out the opinion expressed by Dr. Challoner Purchas, of Auckland, as a result of the *post mortem* on Kelly and the microscopic appearance of the bacilli in the pus and spleen.

PLAGUE AMONG RATS.

Auckland.—The day after our arrival in Auckland we were informed by the harbour authorities that a sickly rat had been observed in broad daylight crawling along the floor of one of the sheds on the outer tee of the wharf, and had been kicked to death by some of the wharf labourers. On visiting the shed in question we found the body had been kept for our examination by the foreman. The rat was killed between 7 and 8 a.m., and we received it about 12.30. *Post-mortem* examination showed that the animal was well developed, and fairly well nourished. There was a severe contusion with hemorrhage in the inferior and posterior portions of the abdomen, as a result of the kick, with considerable displacement and laceration of the abdominal viscera. The lymphatic glands of the precrural and subscapular region were larger than normal, and congested, notably the right subscapular lymphatic gland, which was about the size of a pea, inflamed, and degenerating in the centre. The liver was lacerated, congested, and exhibited small whitish points about the size of a pin's-head. The spleen was enlarged and dark in colour. On making a microscopical examination of smearings, enormous numbers of bacilli, short, with rounded ends, staining readily with weak fuchsine and carbol-theonine, but not by the method of Gram, were found in the right subscapular lymphatic gland. Large numbers of bacilli exhibiting the same characteristics were found in the liver and spleen, accompanied in the latter cases by a few long putrefactive organisms, which had evidently gained entrance more readily than usual through the lacerations in the abdominal tissues. Besides the characteristics mentioned above, in less heavily stained specimens, many bacilli could be seen stained most distinctly at the ends, although this was not a general feature. Tubes of ordinary nutrient agar-agar media (which I had brought from Wellington) were inoculated from the spleen and gland pulp, and immediately conveyed with all precaution to the hospital, where they were placed in the incubator at 37° C., by the kind permission of Dr. Baldwin, the Medical Superintendent. A guinea-pig was procured and inoculated under the skin of the thigh with a small quantity of spleen pulp, while more of the same material was preserved in a previously sterilised Pasteur pipette, hermetically sealed, for subsequent inoculation into a rat. At the conclusion of the examination the remains of the rat were burned in a furnace.

Next day (the 20th April, 1900), a live rat was procured from the country, some miles from Auckland. This animal was apparently healthy and in good condition. It was inoculated with some of the spleen pulp from the pipette, and placed in a cage. The guinea-pig now showed signs of illness, hair standing on end, &c., and only partaking of food sparingly. The inoculated tubes of nutrient media practically remained sterile, though in one a very slight indication of growth was evident.

On the 21st there was little change in the guinea-pig, while the rat was observed to be breathing rapidly, but still lively. The inoculated tubes showed a number of faint, almost circular points of nearly transparent growth, possessing, as a whole, an almost powdery appearance. Microscopical examination of these colonies showed them to consist of short bacilli similar to those found in the rat, but staining more distinctly at the end and non-mobile.

On the morning of the 23rd, the experimental rat was found dead. Examination showed considerable swelling with oedema at the seat of inoculation, while the gland of the region (the precrural) was much enlarged. The liver was congested, and the spleen slightly enlarged. Enormous numbers of bacilli similar to those already described were found in the gland, while they were also numerous in the spleen and blood. On this day the guinea-pig was very much worse, being huddled in a corner, and refusing to eat or move.

On the morning of the 24th, the guinea-pig was found dead in the corner of the box, death having occurred over four days after inoculation.

Post-mortem examination: Slight swelling around seat of inoculation, with very much enlarged precrural gland (about twice the size of a pea). The other glands were slightly enlarged and cedematous. The peritoneum contained a small quantity of clear effusion. The liver was congested, the lungs normal, the intestines slightly congested. The most striking pathological change was in the spleen, which organ was enlarged to four or five times its normal size, dark in colour and mottled with peculiar greyish-white patches, varying in size from a pin-point to twice the size of a pin's head. The tissues at the seat of the inoculation, the bubo, and the spleen contained very large numbers of the same bacilli as those found in the rat, these being also present in considerable quantity in the liver and blood.

It was not until the death of the guinea-pig that we expressed a decided opinion as to the nature of the disease from which the rat suffered, although the microscopical and macroscopical examination of the rat left no reasonable doubt that it was bubonic plague. However, the results of the experiments on the rat, the typical *post-mortem* appearance of the guinea-pig, the period which elapsed between inoculation and death, the characteristic appearance of the bacilli, and the characteristic appearance of the cultures, so far as we were allowed to examine them, were compatible with absolutely only one conclusion—viz., that bubonic plague existed amongst the rodents in Auckland. It is interesting to note at this stage that these experiments were made before any decision was announced, in view of the remarks which have been since made regarding our so-called hasty diagnosis, and it is amusing to recall the charming pertinacity of the reporters of the Auckland Press in their endeavours to elicit a definite statement in those days when experiments were being made.

As it has been freely iterated by the Auckland Press and public that the first affected rodent, that just described, came from the South in the s.s. "Flora," which at that time happened to be berthed further along at the same wharf, it may be well to here state that, although we thoroughly cross-examined all the men who had anything to do with the killing of the rat *immediately* after the occurrence, there was no mention even of a *possibility* of any connection with the "Flora." Yet nearly two months afterwards this contiguity of the "Flora" leads gradually up to the actual statement that the rat in question was *known* to have come from that ship.

But even admitting this for a moment, it could not account for the other plague-infected rats which were found on the following days and brought to us by the Harbour Board officials, and ultimately duly chronicled in the Press.

On the 20th, the day succeeding that on which the first was found, a rat was found dead in the afternoon in a shed (F) on another wharf altogether, and brought to us for examination by the Board's official rat-catcher. This was a half-grown animal. There were no external glands swollen. The liver was enlarged and pale. There was a large quantity of sero-sanguineous peritoneal fluid present, spleen dark and enlarged, and intestines congested. The spleen proved to contain, when smearings were examined under the microscope, large numbers of bacilli characteristic of those of plague, many showing distinct bipolar staining. The shed in which this rat died was that in which the sacks from the Pacific islands were found and destroyed a week previously.

On the 23rd four rats were brought for examination, results of which were as follows:—

(3.) Large brown rat, which emerged from shed which was undergoing fumigation and died afterwards. Small bubo left crural region; spleen and liver enlarged; the spleen containing a number of typical bacilli. Death probably hastened by effects of fumigation.

(4.) Small black rat from shed F. Bubo in left subscapular region; spleen enlarged and black; liver congested and enlarged; typical bacilli in spleen, bubo, and liver.

(5.) Small black rat from Quay Street Wharf. Liver and spleen slightly enlarged, the latter very dark in colour; bacilli found in spleen.

(6.) Small brown rat. Had been injured. Result of examination, negative.

Note.—Quay Street Wharf is distinctly separate from new Queen Street Wharf, and is distant about five minutes walk from where the first rat was found.

On the 26th two rats were brought:—

(7.) Brown rat found in shed F. Crural bubo; spleen enlarged, &c.; bacilli present in spleen, &c.

(8.) Black rat, Quay Street Wharf: Similar to above on *post-mortem* examination.

(9.) Brown rat found dead in street. Death due to injuries; no bacilli present in spleen or tissues.

Besides the above, several rats were brought in which putrefactive changes were too far advanced for any definite decision to be arrived at regarding cause of death.

West Coast of North Island.—While in Auckland Dr. Valintine, of Inglewood, advised us that a considerable mortality among rats had been observed in the district around Mokau. At our request Dr. Valintine kindly undertook the long journey to the locality in question, and although the deaths had diminished greatly, he succeeded in securing two specimens, which he carefully preserved for examination. At the same time he elicited some definite information regarding the phenomenon. It appears that the rats were migrating in a large body from the north, that they suddenly invaded the district in question, and almost as suddenly disappeared, but many sick and dead rodents were left in the train of the main band. Numbers of dead rats had been observed in both banks of the Awakino River and along the seashore. The visitation appeared first about the middle of May, and by the end of the month had almost disappeared. The animals evidently came from the bush lying to the northward. One individual assured Dr. Valintine he had counted over a hundred dead rats in two days. An examination of the two rats secured by Dr. Valintine disclosed the following:—

(1.) Found dead. No bubo. Spleen enlarged, other organs about normal size, though all considerably altered by putrefactive changes. The spleen and blood contained numbers of micro-organisms with similar microscopical characteristics to those of plague bacilli; many putrefactive bacilli present.

(2.) Caught and killed. *Post-mortem* examination showed no abnormality, and no bacilli could be found when tissues were examined microscopically.

As these rats had been *in toto* preserved in formalin solution no cultivations could be made. I requested Mr. F. E. Orbell, Stock Inspector for the Taranaki District, to visit Mokau and endeavour to secure specimens of the spleen-pulp of affected rats for experiment and examination. He did so, and secured specimens which he forwarded. The spleen-pulp showed microscopically bacilli similar to those of plague, and when a small quantity of the contents of the pipette was introduced under the skin of rats death resulted in from three to five days, the *post-mortem*

appearances being characteristic of those of plague. Cultures were successfully made, which had also the characteristic peculiarities, both to the naked eye on the various media, and under the microscope, of the bacillus pestis. Guinea-pigs inoculated with the material morbes and with cultures did not succumb. For the first day or two slight symptoms of illness were exhibited, then rapid recovery took place. Regarding the origin of these infected rats at Mokau nothing definite is known. The assumption is that they were travelling overland from the direction of Auckland. At all events they were flying from the epidemic, leaving their dead and dying en route.

At Wanganui and Aramoho a similar occurrence was observed. From subsequent inquiries it would appear that the first sick rats were noticed about March in the vicinity of the Castlecliff Freezing-works. It was not, however, until a similar occurrence around the Aramoho Freezing-works was observed by Mr. J. F. McEachran, M.R.C.V.S., Government Veterinary Inspector there, that our attention was drawn to the matter. Mr. McEachran forwarded several specimens of rats and their tissues to Wellington, as a result of the examination of which I visited Aramoho and secured further specimens. After an exhaustive examination of many of the affected rats both at Aramoho and in Wellington, I arrived at the conclusion that they were suffering from bubonic plague. The organism isolated had this in common with that of the Mokau rats: that it was not fatal to guinea-pigs. Neither was it so virulent even with rats as the germs isolated in Auckland, and those subsequently isolated in Wellington from affected rats in those centres, for some of the experimental rats soon recovered.

Regarding the origin of the outbreak among the Aramoho and Wanganui rats, it is again difficult to decide. It is a curious coincidence, however, that the sick rats were only observed around the Aramoho works a few days after the arrival of two ships at Wanganui wharves from New South Wales. Of course, presuming that the epidemic originated at Castlecliff works in March, and that the affected rats travelled from the one establishment to the other (the Town of Wanganui lying between), these ships would not have had necessarily any connection with the occurrence. Assuming the landing of rats carrying infection from a ship lying at the wharf, the most likely point to which they would travel would be one or other of the freezing-works lying on the river bank (in the case of Aramoho, only a mile or so from the wharves) where an abundance of food, in the shape of blood, offal, &c., is readily obtainable.

Credit is due to Messrs. Mitchell and Co. for the energetic warfare they conducted against the rats when they were made aware of the circumstances. Drains, burrows, and other harbours of rats were thoroughly flushed out with boiling water containing strong antiseptics, poison was everywhere distributed, and dead rats were always cremated in the engine-furnace. By these means in a short time there was barely a rat to be found in the place. Naturally such places as freezing-works will always be a favourite locality for rats, and from time to time they reappeared, but the vigorous onslaughts kept down the numbers, and now for months past I am assured by the Inspector no sickly rats have been seen.

Wellington.—Although numbers of dead rats had been brought and sent from various portions of the Wellington District suspected of being plague-infected, it was not until the middle of July that a true case was submitted for examination. This animal was reported to have been found dead in the street in front of a certain warehouse in the city, whence it was sent to me for examination. On *post-mortem* examination the animal was found to be poor in condition. The left subscapular gland was enlarged to about the size of a marble, and suppurating in the centre. The lungs were affected, especially towards the base, where they were undergoing caseation, while both pleuræ were inflamed. Microscopical examination disclosed the presence of numerous bacilli morphologically characteristic of those of plague, as well as many other apparently accidental micro-organisms in the degenerating lymphatic gland. The caseated material of the lung contained very few bacilli, and very few could be detected microscopically in the spleen.

Tubes of culture media were inoculated with material from the bubo, the lung, and the spleen. A guinea-pig was inoculated in the thigh from the bubo, and a rat similarly inoculated from the lung. Naturally the cultures were at first impure, but eventually the bacillus of plague was isolated. The guinea-pig died in three days and a half, and on *post-mortem* examination presented the typical lesions of plague—*i.e.*, swollen lymphatic gland above the seat of inoculation, spleen very much enlarged and mottled, &c. The bubo, the spleen, liver, and blood contained numbers of the characteristic bacilli, which grew in the characteristic manner on the various media. The rat inoculated succumbed on the fourth day, and presented the usual typical *post-mortem* appearances.

Unfortunately the name of the firm who sent me the rat appeared in the Press with my memorandum reporting same to the Hon. the Colonial Secretary, and, whether as a consequence or not, no other dead rats were handed to me from business premises.

The only other specimen of an affected rat was received from premises in Molesworth Street. The rat had been observed for two days previous crawling about as if sick, and finally came out during broad daylight, lay down, and died in the passage. This animal was in poor condition and suffered from skin eruption. There was a large swollen gland in the subscapular region, and both precureal glands were enlarged and inflamed. These glands and the spleen contained the characteristic bacilli, which were isolated and cultivated.

Characteristics of the Bacillus.

Morphology.—Polymorphic, varying from almost a coccus, or at least a cocco-bacillus, to a bacillus almost as long as that of typhoid, in relation to which, however, it may be said generally to be about the same breadth and about half the length. The polymorphism is more distinct in cultures than in the tissues. It stains readily with ordinary aniline dyes, and, in my experience, is very readily decolourised by light. Occasionally it stains more readily at the ends, but this characteristic I have found to vary considerably, in some cases the bipolar staining being very distinct, in others

absent, or present only in a few bacilli on the slide. If care be taken not to stain too heavily, or to remove excessive stain with alcohol very carefully, the peculiarity may be demonstrated. In smears it often occurs in pairs. It does not stain by the method of Gram. In broth, it generally occurs in chains of very short coccus-bacilli, which have almost the appearance of a chain of streptococci. In old cultures, especially those on dry agar, involution forms readily occur. These are large organisms of various distorted shapes, and frequently stain very indistinctly. The formation of these involution forms is very characteristic.

Effect on Animals.

In guinea-pigs and rats death generally occurs in from three to five days, although my older cultures have taken as long as eight and even ten days to cause death in the guinea-pig, and fully seven days in the rat. This is when a small quantity of culture or of infected material is inserted by means of a needle in a "pocket" underneath the skin.

The symptoms exhibited are not very characteristic. Generally in from twenty-four to thirty-six hours after inoculation, the animal shows signs of febrile disturbance, refuses food, or eats but daintily, and a slight swelling of the nearest lymphatic gland becomes evident. A catarrhal discharge from the eyes is generally present. At times a slight recovery may take place (in the case of the West Coast bacillus, with guinea-pigs, always) to be followed by a relapse with prostration and paralysis of the affected limb. Towards the end, convulsive paroxysms may be evinced, and at times the animal may be found after death presenting the appearance of having succumbed in a paroxysm of pain.

Post-mortem Appearances.

Rats.—Lymphatic gland above seat of inoculation is enlarged, and inflamed with œdema of the surrounding tissues. The alimentary canal may show a few hæmorrhagic spots. The spleen is generally dark, and is frequently enlarged, but by no means invariably so. The liver is often congested. The lungs are generally healthy, with the exception of patches of metastatic congestion. I have never found, in the many rats with which I have experimented, true pneumonia as a result of plague.

Guinea-pigs.—Lymphatic gland above seat of inoculation enlarged to four or five times its usual size, and inflamed, the surrounding tissues being also inflamed and more or less œdematous. The other lymphatic glands are also frequently enlarged. The intestines may be slightly congested, and exhibit petechiae, but are generally normal. The spleen, if death is delayed after three days from inoculation, is swollen to an enormous extent, with greyish-white, more or less circular patches, varying from the size of a pin-head to a millet-seed, showing up against the dark substance of the congested spleen. If death occurs before three days, the spleen will be found enlarged, and dark in colour, but not mottled. The liver is generally congested, and frequently presents a few greyish-white points similar to those in the mottled spleen, generally about the size of a pin-head. The lungs, if death occurs before five or six days after inoculation, are, in my experience, always normal, or practically so. Later, pneumonia, affecting more frequently the base of the lung occurs, with a few greyish-white areas of degeneration, as in the spleen.

The attached reproduction of a beautiful drawing in colour by Mr. H. C. Wilkie, F.R.C.V.S., of a guinea-pig, which succumbed in seven days and a half after inoculation, will convey more to the reader than any description that could be given by the pen, as it is an exact representation of what may be seen on *post mortem*. Moreover, I believe that such lesions are absolutely characteristic alone of plague infection in the guinea-pig. In tuberculosis of the guinea-pig, it is true, there is also a mottled spleen, but it is not produced nearly so rapidly. Besides which, in tubercle, there are other great distinctions, such as the infection of the lymphatic system and other general appearances which no one could mistake.

Location of the Bacilli.

In the affected gland (bubo), and in the spleen they are present in enormous numbers, so much so that a thin smearing has almost the appearance of a smear from a pure culture under the microscope. In the spleen of the rat they are generally fewer in numbers comparatively than in that of the guinea-pig, where the whitish patches consist almost solely of bacilli. The liver generally contains a large number. The blood at the time of death may contain, as in guinea-pig No. 3, very large numbers, but usually there are comparatively few present. Microscopical examination alone will often fail to discover any, and even inoculation of media by the needle may not succeed in disclosing the presence of any; but if a drop from the Pasteur pipette be distributed evenly over the whole surface of an agar plate it will be found to contain from fifty to two hundred bacilli, even when none may have been detected in the smears.

Cultures.

On solidified blood-serum the bacillus grows as very small separate colonies almost transparent, and if streak cultures are made it shows in a narrow streak with irregular borders. On agar agar media, it appears as very small, circular, moist-looking, semi-transparent colonies, after a lapse of thirty-six hours from the time of inoculation from an affected organ. If very careful examination of a tube be made at twenty to twenty-four hours after inoculation, small, almost completely transparent points may be distinguished, but even if present they are generally overlooked. Sub-cultures grow much more readily and definitely than first cultures, and show as a narrow streak with irregular borders. If the culture be pure, the liquid of condensation at the bottom of the tube remains clear, but on the surface of this liquid a thin pellicle may be seen which is easily precipitated, and at the bottom and sides there is generally a slight growth. After the lapse of four or five days, if left at a suitable temperature, many of the colonies become less readily distinguishable, while thick

gelatinous looking circular growths, distinctly raised from the surface of the media, may appear. I have observed this peculiar growth appear frequently on pure cultures, and have experimentally demonstrated that they are composed of plague bacilli. Under the microscope the bacilli of these colonies show the characteristic appearances, and they have been found to occur on sub-cultures from the more transparent and thinner growths before described. Moreover, these cultures have in common with the others the peculiar characteristic sticky gummy consistency. This sticky consistency is even the more decided in the thicker and more opaque cultures, and it is remarkable how, when the growth is touched with the needle, in order to secure some for examination, a thin band as of caoutchouc stretches out between the colony and the particle on the needle as the latter is removed. A slight growth occurs along the track in slab cultures. Involution forms, larger, broader, and of various shapes, staining, as a rule, less readily, are very frequent, more especially on dry agar. These occur most frequently after the third day, but a few may be seen before.

On gelatine, at room temperature 18° C., about four or five days after inoculation, a thin ragged growth takes place along the track of the needle. The medium is not liquified. Involution forms also occur. In broth the growth is very characteristic. The liquid is found to remain clear, if care be taken in handling the tube. Provided a thin coating of fatty material be present on the surface of the fluid a faint pellicle of culture will grow thereon, and should the flask be perfectly steady small growths, arranged like inverted cones, will be found depending from the surface growth. These, however, are readily disturbed and precipitated to the bottom of the tube. Flakes of culture will also be found adhering to the sides of the tube, and a deposit will be found at the bottom of the liquid. In an ordinary test-tube with broth I have generally found that at first sight there seemed no growth whatsoever, but if the tube be shaken the flocculent material will be found disengaging itself from the sides and bottom of the tube, rendering the liquid cloudy. Provided the culture is pure, the liquid soon regains its clearness. In broth the bacilli grow in chains, and are so short that at first sight under the microscope they appear to be streptococci.

Virulence.

My experiments point to the virulence being slowly lost. Two months after the Kelly pipettes were received I reopened one, and found the contents non-fatal to guinea-pigs, although kept in a dark cool place meanwhile. It must be added, however, that these pipettes were contaminated originally. As regards cultures, I found one to be non-virulent at the end of a week. Others retained the virulence for a longer period. Gradually, however, the bacillus with which I experimented, in spite of the fact that it was frequently passed through guinea-pigs and rats,* was reduced in virulence, until at the time of writing the same dose that formerly caused death under four days now only does so after a lapse of nine to ten days.

Regarding methods of increasing the virulence of cultures: I have in no case succeeded in producing death, or the pneumonia form of the disease, by smearing the nostril of the guinea-pig or rat with a culture, even with virulent culture, as is reported by Montenegro and others.† Nevertheless, I have found that a weakened culture could readily be made very virulent by mixing it with another organism. In one case I added to the bacillus pestis of small virulence a culture of streptococcus (isolated some days previously from a pharyngeal false membrane), and death resulted in four days with the typical *post-mortem* appearances of bubonic plague. In another case a culture which had lost all virulence was mixed with a five days old culture of diphtheria bacillus, and death resulted in three days with typical *post-mortem* appearances. In still another case a culture which normally required ten days to kill a guinea-pig was mixed with a virulent culture of diphtheria bacilli, with the result that death supervened in forty-eight hours. The cultures from this when inoculated in the usual way into another guinea-pig showed that the virulence had increased from ten to six days. In all those cases the bacillus pestis alone was found in the spleen, and bubo above the seat of inoculation. In the first two bacilli were found in the spleen in enormous numbers, but in the last they were comparatively few in number.

Contagion.

So far, my experiments do not indicate that there is much danger. In ordinary guinea-pig hutches when I have placed a live animal in that previously occupied by one that had succumbed, or even with one affected with the plague, the second has remained healthy. The same circumstance has occurred with rats. With the latter animals I have had one or two peculiar experiences which are worth recording. In two instances a rat was inoculated with a virulent culture, and placed along with another rat in a cage. In one the healthy rat killed and ate the inoculated animal during the first night (only the skin and few bones being found when the cage was finally emptied), and did not die. In the second, the two rats lived peaceably for two days, but on the morning of the third day the inoculated rat was found with the whole of the viscera removed, the other having commenced the meal at or about the point of inoculation. Whether the inoculated rat died or was killed by the other is doubtful, but the probabilities were it was attacked on evidencing symptoms of illness, and devoured by its companion. The cannibal did not succumb by reason of his contaminated food.

In another case a rat was fed on the whole viscera of a guinea-pig which had died of virulent plague four days after inoculation. The spleen, liver, &c., contained myriads of organisms (which by subcutaneous inoculation of a very small quantity produced death in a control rat in three days), yet the rat in question did not die until eight days had elapsed.

These cases demonstrate that the bacillus is not so deadly for the rat, at all events, when entrance is gained by the alimentary tract as by the skin. Under natural conditions, amongst rodents, the spread of the contagion is generally attributed to skin parasites, such as fleas and lice, and it has been asserted that these same agents carry the disease to man. Such is very probably the case, for the germ has been proved to exist in parasites from an affected rat, and Professor

* It is interesting to note that the bacillus rapidly loses its virulence when passed directly from rat to rat.

† In Paris I was informed that to succeed in this method of inoculation it was advisable to introduce the bacillus to the nostril by means of a small plug of cotton-wool, as otherwise it does not remain in the nasal chamber.

Benham, of Dunedin, is reported to have recently discovered the human flea on the skin of rats. In the case of the rats which I have experimented with and had under observation here, I have never found any infested with these skin parasites, which may account for the few found affected, and the results of the experiments shown above. In Auckland the dead rats, when found, were immediately placed by the rat-catcher in a strong solution of crude carbolic acid, so that no observations could be made. One rat, however, which had been found dead in the street (having been killed evidently by a dog, and not plague-infected) was infected by lice to a great extent. But in Wellington, so far as I observed, the rats were practically free from skin parasites.*

It seems fairly evident that the result of these experiments indicate that the entrance of the bacillus pestis to the alimentary tract is not attended by the same danger as a subcutaneous inoculation; also, that when the bacillus pestis is mixed with other organisms the virulence is increased. Now, under natural circumstances a pure culture may be confidently asserted never to be introduced subcutaneously by means of parasites of the skin or a contaminated wound, and the less cleanly the skin the more likelihood of a fatal termination to an inoculation of plague bacilli. This conclusion is also verified by clinical evidence on the history of this disease.

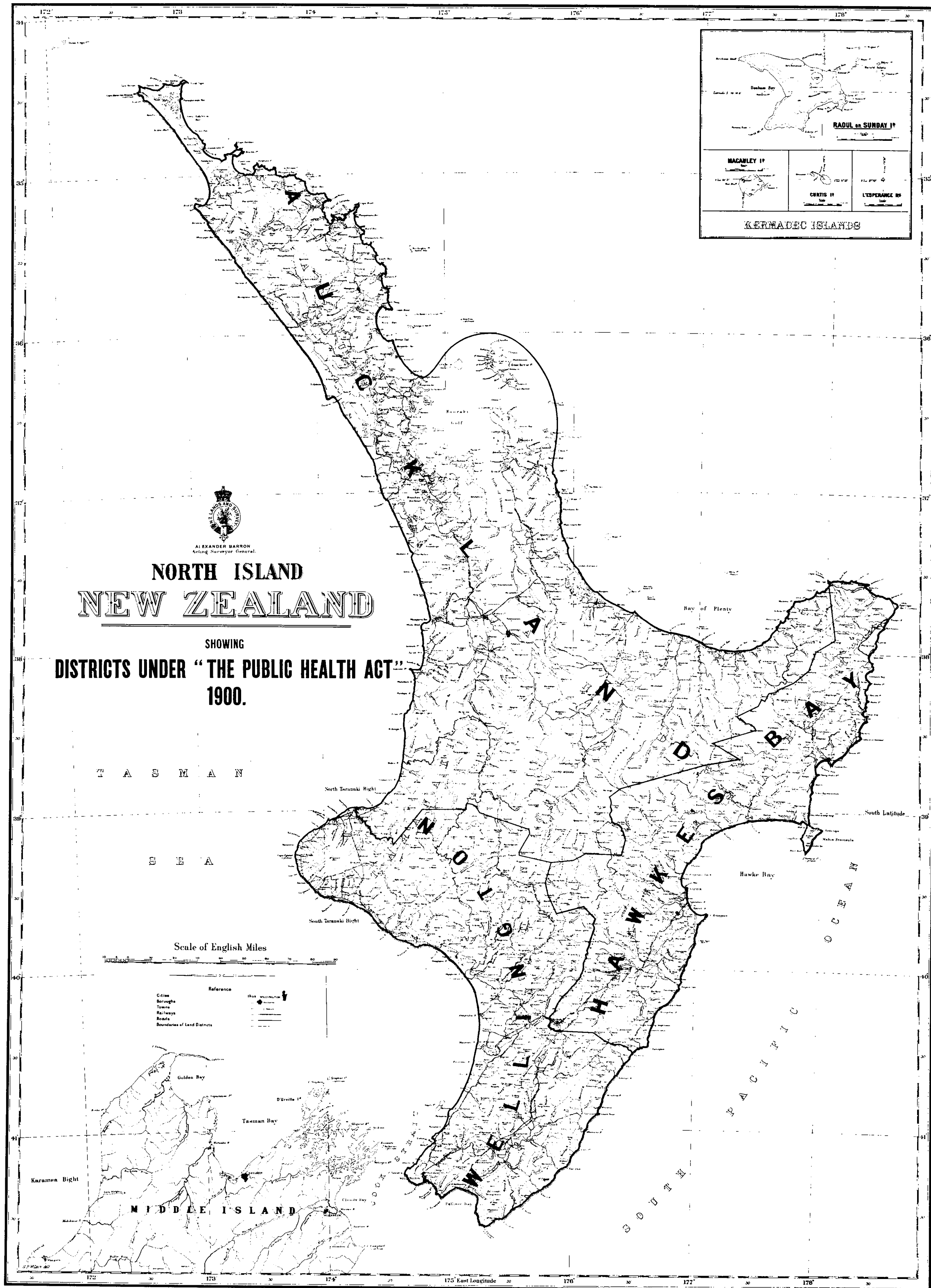
* In many of the rats with which I experimented in Wellington trypanosomes were found in the blood.

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ALEXANDER BARRON
Acting Surveyor General.

MIDDLE ISLAND NEW ZEALAND

SHOWING
DISTRICTS UNDER "THE PUBLIC HEALTH ACT, 1900."

Reference thus

Cities	thus	thus
Boroughs	thus	thus
Towns	thus	thus
Railways	thus	thus
Roads	thus	thus
Boundaries of Land Districts	thus	thus

Scale of English Miles

10 5 0 10 20 30 40 50 60 70 80 90

T A S M A N S E A

South Latitude

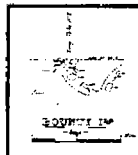
S O U T H P A C I F I C

(T E M O A N A N U I - A - K I W A)

O C E A N

N O R T H A G O

Stewart Island



AUCKLAND 125

CAMPBELL 125

CHATHAM ISLANDS

Scale of English Miles

