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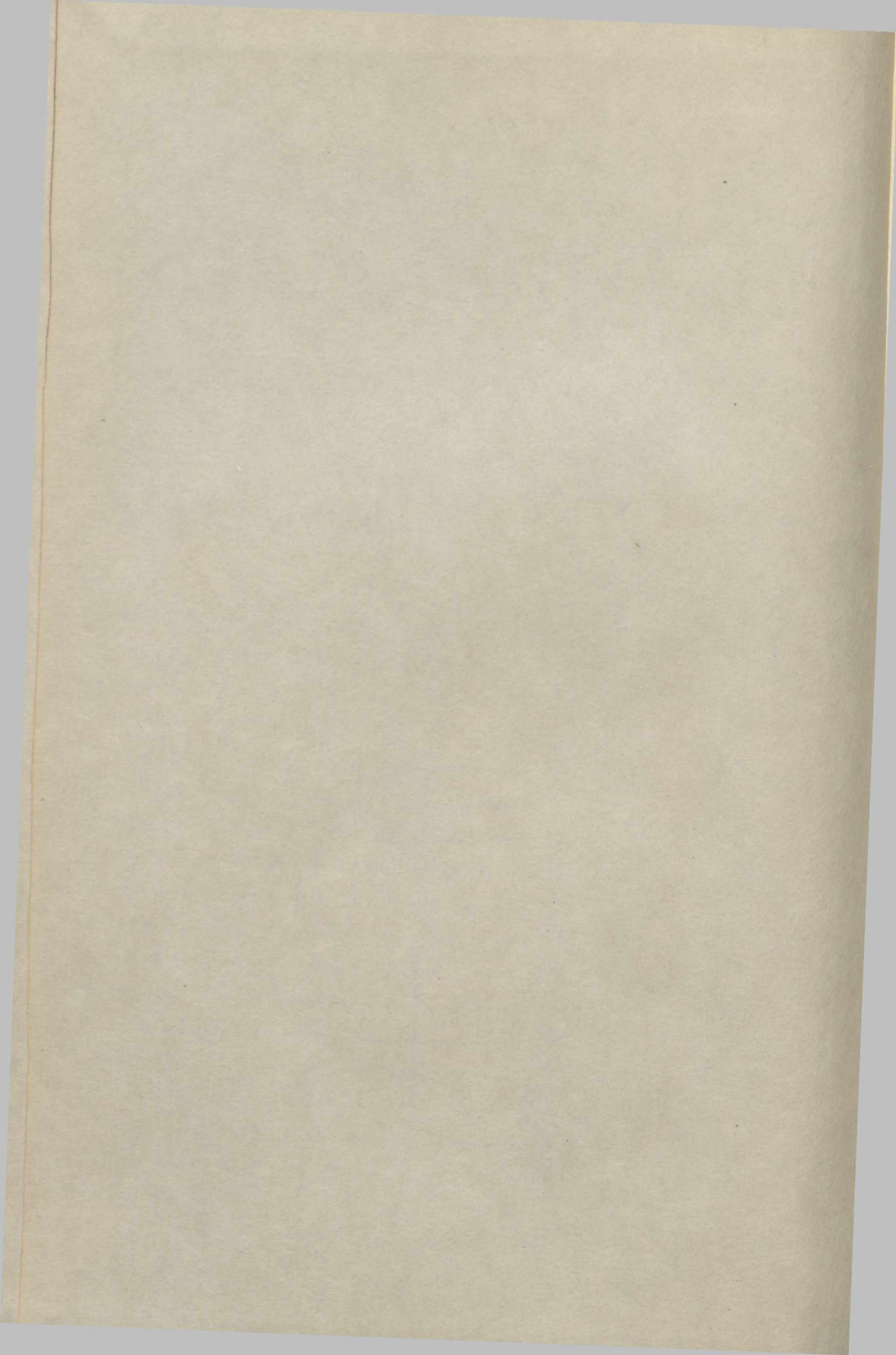
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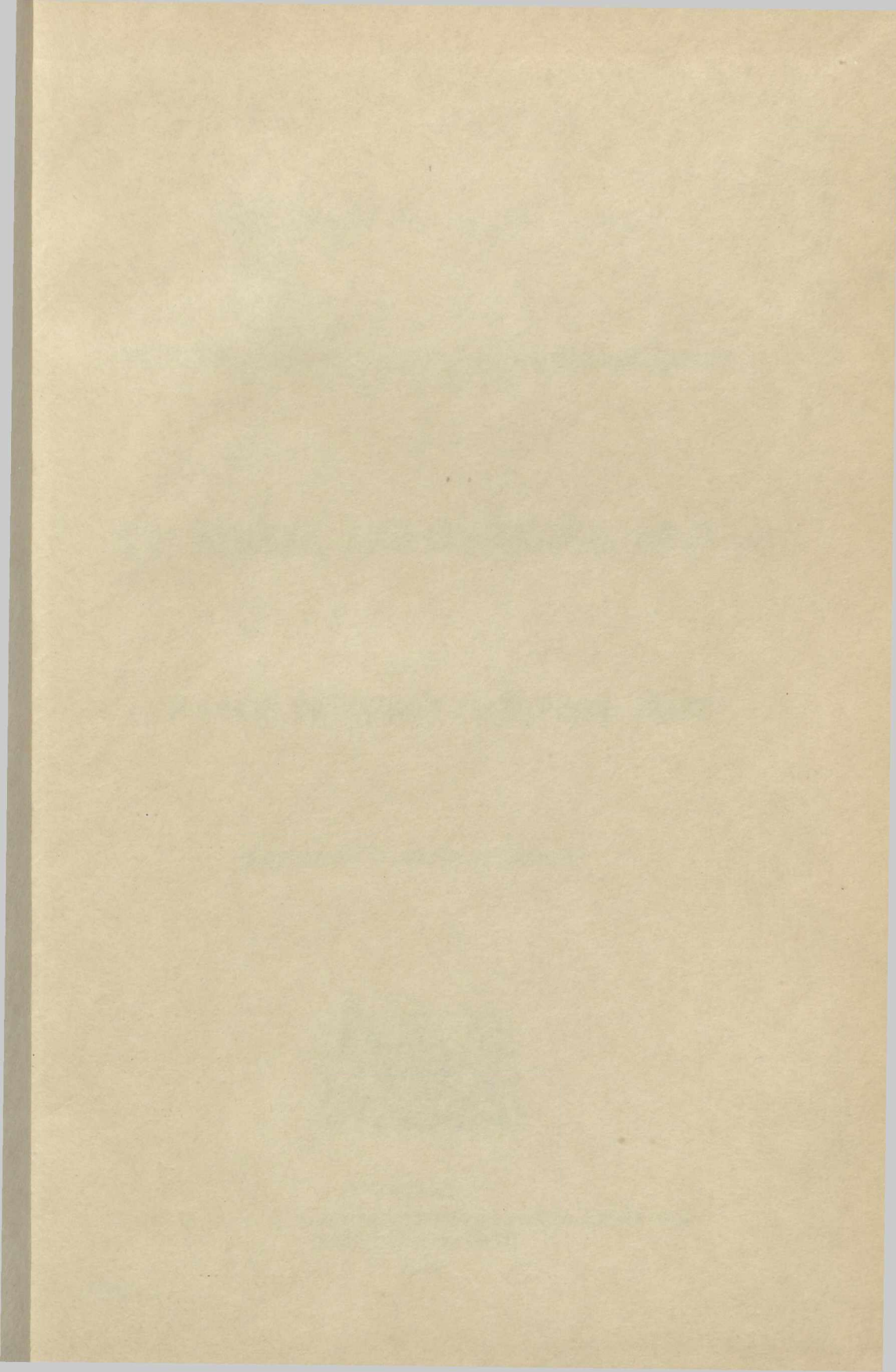
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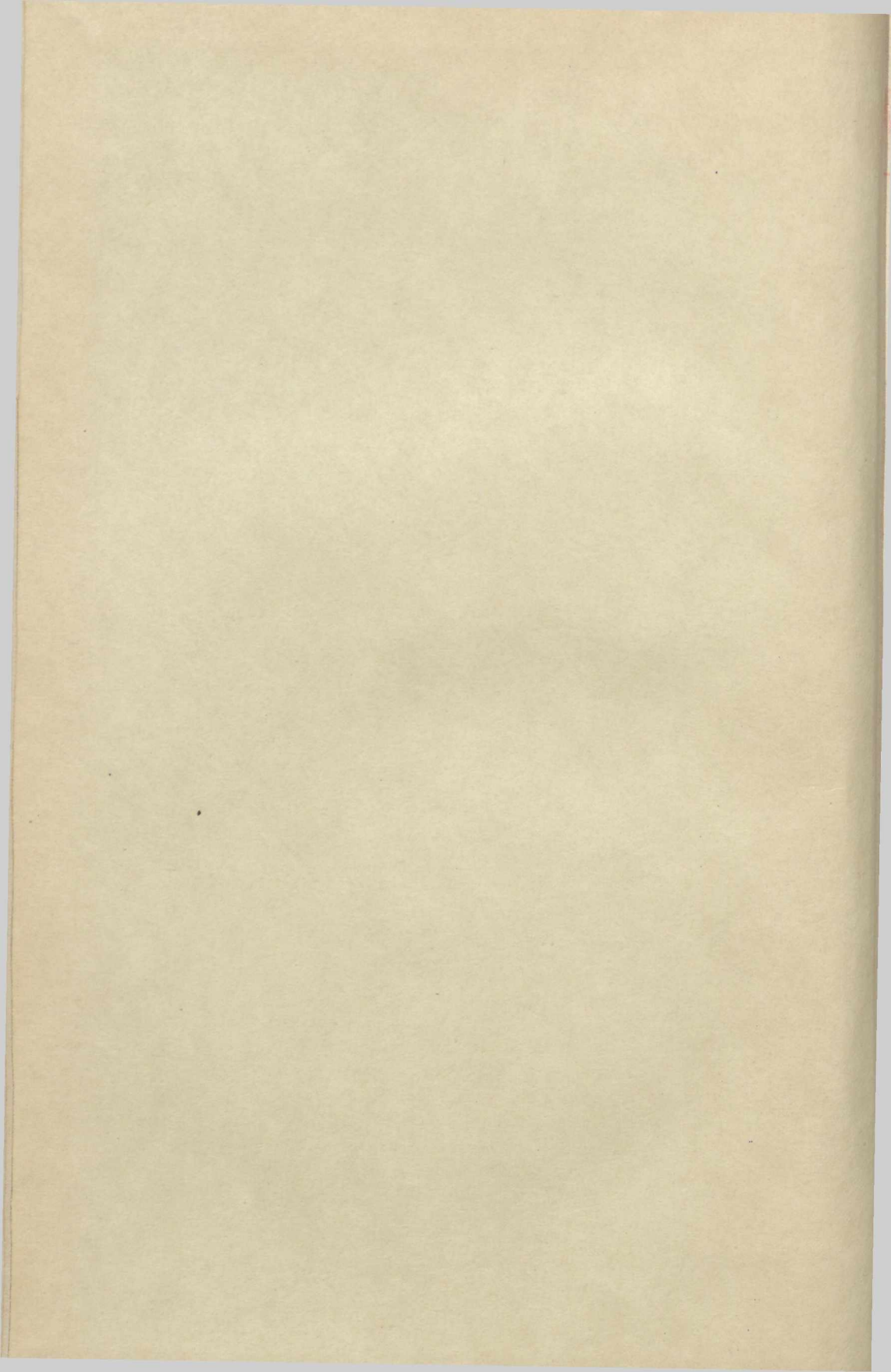
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1914.

3RD SESSION, 12TH PARLIAMENT, 4 GEORGE V, 1914.

THE SENATE OF CANADA

EVIDENCE GIVEN BEFORE THE STANDING COMMITTEE

ON

PUBLIC HEALTH AND INSPECTION OF FOODS

*IN RE*

ANTI-TOXIN TREATMENT OF TYPHOID FEVER

PRINTED BY ORDER OF PARLIAMENT.



OTTAWA

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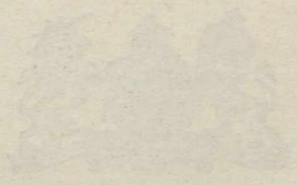
THE STATE OF TEXAS

COUNTY OF DALLAS

BEFORE ME, the undersigned authority, on this day personally appeared \_\_\_\_\_

known to me to be the person whose name is subscribed to the foregoing instrument,

and acknowledged to me that he executed the same for the purposes and consideration therein expressed.



Given under my hand and seal of office this \_\_\_\_\_ day of \_\_\_\_\_, 19\_\_\_\_.



## THE STANDING COMMITTEE OF THE SENATE.

ON

### PUBLIC HEALTH AND INSPECTION OF FOOD

The Honourable Mr. DeVeber, Chairman; the Honourable Messieurs Belcourt, P.C., David, Douglas, Fiset, McKay (*Cape Breton*), McMillan, Murphy, Wilson. at all?

#### ANTI-TOXIN TREATMENT OF TYPHOID FEVER.

SENATE COMMITTEE ROOM No. 43,  
OTTAWA, WEDNESDAY, April 29, 1914.

The Committee on Public Health and Inspection of Foods met at 10.30 A.M., with Senator DeVeber as Chairman.

THE CHAIRMAN.—Gentlemen, for the last two years the Canadian Pacific Railway have been supplying the surgeons of which I am one, with vaccine to vaccinate the men, and our results were so marvellous, added to which the reports of the United States Army and Navy and also some English reports were so marvellous, that I came to the conclusion that the general public of Canada should be made acquainted with the facts, so that if, as in Ottawa, the City Fathers will not protect the citizens, the latter could learn that they had the means of protecting themselves. To that end I looked about for the best man to open a discussion of this kind for us, and on going to Montreal I found that Professor Starkey had fifteen years ago been in British India for the British Government inquiring into this matter and experimenting, and that he was only too willing to come up and give us a little address on the matter. After he has finished I have a few statistics to give that will show you the benefit to be derived from this treatment. Without any further preface I will call on Prof. Starkey.

Prof. Starkey, M.D., D.P.H. (Lond) &c., Prof. Hygiene McGill University, Fellow Royal Sanitary Institute, &c., &c., said:—

Mr. Chairman and gentlemen.—This question of prophylaxis for typhoid is a very important one, as Senator DeVeber has remarked, and I propose to run over a few of the chief points connected with it. The results obtained up to the present day are extremely encouraging and satisfactory. Senator DeVeber has collected all the statistical literature on the subject, and therefore it would be out of place for me to go over those facts, which are available for all of you; but I may remark that within the last five years the treatment has been taken in hand in better shape, and the results obtained have been more and more satisfactory as time goes on. I do not think there is the least question about the success of the treatment. In the face of those results it is curious to note why it has not become more popular; and I propose to go into one or two arguments that have been employed for and against its use.

The chief arguments against its use are as follows:—It is claimed that such treatment, prophylaxis is against typhoid, ought not to be necessary; that is, typhoid being a disease which is easily preventible by good sanitation, &c., that it ought not to be necessary to subject the people in general to its use. Well, that is all right as far as it goes, but it takes for granted that the sanitation, particularly good water supplies and proper sewage disposals, are in vogue, whereas we all know that there

are plenty of places where these conditions do not obtain; for instance in the case of armies going into the field you cannot ensure perfect sanitation; likewise in private life there are many places where those conditions are bad; and it seems only right and proper that we should avail ourselves of any measures which would protect the people under such circumstances. The recommendation for its use is therefore somewhat limited, in this sense, that one would not advise a wholesale inoculation of the general public; it is not necessary. But where you have places notorious for typhoid, and you know that people—it does not matter whether they are men, women or children—are going to be in that place or those places, then this preventive treatment ought certainly to be encouraged under those conditions, and there is very strong argument in favour of it under those circumstances.

Another great objection or argument against its use which is brought forward by many is the reaction that is brought about during the treatment. I may tell you that when this method of prevention of typhoid first started the reaction was very marked. I remember the earlier cultures that were used and the method of making those cultures, and they certainly produced undesirable results. But that argument has lost a good deal of its force because, as I remarked at the beginning, within the last five years or so great strides have been made in bettering this vaccine or prophylactic, and we no longer see the terrible reactions that were fairly frequent in the very early days. I will have a little more to say about the reaction when I come to deal with the method of preparing the vaccine.

Lastly, one other argument against its use that I wish to touch on is the protection afforded by this method of treatment. We may look upon it as very similar to the protection afforded against smallpox by vaccination; and there, as we know, you get undoubted protection for a considerable period. In the case of this typhoid prophylaxis the duration is decidedly shorter, and as far as we can make out, about 18 months seems to be a safe limit. There are a few cases that seemed to show that they retained protection for a longer period than 18 months, but averaging it all round that seems to be the rational figure to adopt. Now, even though you could only rely upon 18 months as being the period of protection, surely that does not militate in any way against its use; at least to my mind it ought not. Bearing in mind the remarks I have already made as regards the conditions under which one would advise its use, the people who are going to stay in places where typhoid is rampant, probably, in the first place, would not stay there 18 months, and secondly, if they did, probably the bad sanitary conditions answerable for the typhoid would not exist for 18 months. Therefore the shortness of the time is not an argument against the treatment.

Hon. Mr. DAVID.—Does it apply to children as well?

Prof. STARKEY.—Oh yes. I would not pick out men only. Children, as a matter of fact, stand the vaccination very well indeed; on the average they do not react like grownups do; they show very slight reaction.

Hon. Mr. DAVID.—Was it not said that they suffer sometimes from the administration—that the effects sometimes were bad upon children?

Prof. STARKEY.—Oh, you get those claims made against it for all—men, women and children; but, as we shall see later on, I doubt whether these reactions, these bad cases, can be looked upon as the result of the vaccine purely and simply. I think there are other factors which creep into it, on which I will touch in a moment.

Reviewing, then, the arguments in favour of its use, I have already pointed out that the vaccination against typhoid certainly protects against that disease—there is no question about it whatever; and in the practice of this protection there are one or two very important points to observe, particularly in connection with the objections which have been raised against it. The very first thing is to procure a good vaccine.

Now, in the preparation of this typhoid prophylactic there are two methods of preparation, totally different in many respects. The early method, and which is still

in vogue in Great Britain, was a pure broth culture of the typhoid organism, just a simple broth culture, and when that had been treated—the germs killed, &c.—that was used as the prophylactic and injected. The other method, known as the German method, differs from that in this respect, that the bacteria are not grown in broth, but are grown on a hard medium, ordinary agaragar medium, and then they are scraped off that and put into plain salt solution, normal salt solution, so that you get rid of the broth by the German method of separation; you eliminate the actual broth, which, of course, is present in the English method of preparation.

Now, I have no hesitation whatever in saying that the presence of the broth in a prophylactic is answerable in a certain number of cases for those bad results which we have mentioned so often under the objection against its use. I have seen these bad results due to broth in other forms of prophylactic treatment; for instance, practically the same method of preparation is employed in making plague prophylactic and cholera prophylactic, simple broth culture—and the extract of meat, which constitutes the broth, every now and then causes decided trouble when injected beneath the skin. It is here, Senator David, that I would draw your attention to one of the factors producing these bad results—that there is a point that has been or can be eliminated. What the nature of that reaction is that is caused by the actual broth we do not know, but every now and then we seem to strike some meat extract which gives rise to trouble. That is quite apart from the germs themselves, quite apart.

The second great point or factor to be noted in eliminating the troubles is the method of application. In all cases of prophylaxis we find that you need a skilled man to administer them. It is a simple operation in itself, but in the hands of the untrained man you find more of those troublesome results arising than you do when it is administered by a man trained to the work. There is another cause of those undesirable results—that every now and then say in the army, wherever the inoculation takes place, you get a reaction which may be due to faulty administration, that is bad technique, bad surgery, to put it in plain terms. Of course, all the objectionable results are put down to the credit of the prophylactic itself, whereas in reality they are extraneous factors. The point that I would like to bring out is that I would strongly recommend the use of the German preparation, or to have the prophylactic prepared by the German method, because thus you eliminate a good many of the causes of trouble, and you certainly get a very fine preparation indeed, much superior, in my estimation, to the English method.

Dr. SCHAFFNER, M.P.—Has it been commercialized? Can you get it in any city?

Prof. STARKEY.—No, there are only one or two places where it is being prepared at the present time. For instance, on this continent, at the Army Medical School; they have a laboratory in Washington where large quantities of it are being prepared. So far as I know that is the most reliable station on this continent; they have some men that have been working on it for several years. And there is another point showing you the importance of having trained men; it is found that men who are highly skilled in the work turn out a very safe, reliable prophylactic, whereas if you put it into the hands of non-trained men you are very liable to get a prophylactic turned out which may cause trouble. It is the perfection of preparation.

Hon. Mr. MURPHY.—It is made by the German method on this side I suppose.

Prof. STARKEY.—Yes.

Hon. Mr. DAVID.—Was it used in Germany before it was used elsewhere? Where was it used first?

Prof. STARKEY.—As far as I know the first application of it was out in India while I was there; I do not know of any earlier application of it. There it was tried on some troops that were in an area very much infested with typhoid fever. It was purely

a voluntary thing on the part of the troops. The results were what you might term moderately encouraging. That was the earliest start of the thing.

Hon. Mr. MURPHY.—How did you make the preparation there?

Prof. STARKEY.—Simply broth culture, killed afterwards, of course.

Hon. Mr. MURPHY.—Killed with heat?

Prof. STARKEY.—Yes, and the addition of a little antiseptic to keep the broth.

Hon. Mr. DAVID.—How long ago was that?

Prof. STARKEY.—In 1898 they began, and they have continued practically ever since with one or two little breaks; but in the British army they have never pushed it to the same extent as they have done in the American army.

Hon. Mr. MURPHY.—The French and German armies push it now?

Prof. STARKEY.—They are beginning to push it there.

Hon. Mr. MURPHY.—What is the reason that the English do not adopt the German method when it appears so valuable?

Prof. STARKEY.—That I cannot tell you.

Hon. Mr. MURPHY.—The same old English conservatism and bulldog tenacity?

Prof. STARKEY.—It may be that; I cannot tell you.

Hon. Mr. MURPHY.—Or jealousy of adopting anything German?

Hon. Mr. STARKEY.—No, I wouldn't say that; I wouldn't say jealousy. They have been accustomed to prepare all prophylactics on that method.

Hon. Mr. DANIEL.—They may think that it is just as good as the other.

Prof. STARKEY.—They do; otherwise they would not stick to it.

Hon. Mr. MURPHY.—It is ascertained that broth has qualities which alone would be liable to cause trouble as compared with the other—an extra irritation?

Prof. STARKEY.—That is the point. Mind you, all broths do not cause irritation; that is the strange thing; it is not every sample of broth that you take that will cause trouble, but every now and then it seems to be something in the meat, some change has taken place in the meat in getting the extract, which causes trouble. Just to prove that to you, that same reaction has been shown when testing gelatines as you get with pure meat extract. Of course, it is a mixed extract, but every now and again you will get a sample of gelatine which, when inoculated into a small animal, will cause decided mischief. Now, apparently, to all intents and purposes, the gelatine is just the same as any other samples that have been treated.

Hon. Mr. DANIEL.—In regard to the agaragar, does that indicate decomposition at all?

Prof. STARKEY.—No, it is quite fresh, and the growth is a 24 to 48-hour growth, and then it is scraped off.

Hon. Mr. MURPHY.—They do not take the agaragar at all; they just take the growth?

Prof. STARKEY.—That is all. You see, the idea there is to get bacteria as pure as you can, and doubtless as time goes on they will improve still further.

Hon. Mr. DANIEL.—What is the name of the doctor out there in India who started this thing?

Prof. STARKEY.—Dr. Wright; he is now Sir Almoth Wright.

Hon. Mr. MURPHY.—The author of the Opsonian theory?

Prof. STARKEY.—Yes; he has given up that work now. Dr. Leishman, who was here in Ottawa not long ago, has succeeded him, and he is practically directing that part of the service now.

Hon. Mr. DANIEL.—I thought it was some other man's name that was attached to the typhoid vaccination?

Prof. STARKEY.—Do you mean the man who prepares those vaccines out there—Haffkine?

Hon. Mr. DANIEL.—That is the man.

Prof. STARKEY.—He was director of the Imperial Research Laboratory in Bombay, where I was. His name was made over the plague prophylaxis and the cholera prophylaxis.

Hon. Mr. DANIEL.—His name was associated with the typhoid?

Prof. STARKEY.—Oh, yes, we prepared typhoid prophylactic at the laboratory there for use.

Hon. Mr. DAVID.—What results do the statistics show?

Prof. STARKEY.—Dr. DeVeber has full statistics gathered by the Americans—they are the best, because they have taken a lot of trouble in compiling them—and roughly speaking I should express the results in this way: that the protection conferred is almost complete; that is, where you take a lot of people who have been vaccinated you will find amongst them very, very few who will contract the disease, very few indeed, showing how complete the protection is.

Dr. SCHAFFNER, M.P.—You said you would refer to the reaction; what is the nature of the reaction?

Prof. STARKEY.—I have used that term, reaction; it is a kind of generic term, really, including several things. For instance, you get trouble caused by faulty technique, that is, dirty instruments, &c.; then again, if the prophylactic had been badly prepared there is a source of trouble; you may get extraneous germs in there, undesirable ones; and lastly, there is a trouble caused by the broth itself sometimes.

Dr. SCHAFFNER, M.P.—That would apply to all vaccines, not particularly to that one.

Prof. STARKEY.—Certainly, but wherever you get any trouble whatever, in any shape or form of vaccination—I would not limit it to typhoid vaccination—you will find that the people who get up the agitation against it put it down to the credit of the particular vaccine being used.

Hon. Mr. DANIEL.—Are the dead bacilli injected, or is it the toxin?

Prof. STARKEY.—The dead bacilli. The toxins in the case of typhoid are mostly inside the bacillus itself; there is very little toxin excreted, very little.

Hon. Mr. DANIEL.—It is different from others, then?

Prof. STARKEY.—Bacteria do differ in that respect. Some of them excrete a lot of toxin. The tuberculosus bacillus, for instance, apparently does not excrete any; it seems to retain it all inside the cells.

Hon. Mr. MURPHY.—What is the character of a sharp reaction after injection?

Prof. STARKEY.—You get headache, a pain in the back, rise of temperature.

Hon. Mr. MURPHY.—Just an ordinary toxemia?

Prof. STARKEY.—That is all, and it passes off very rapidly. The reaction usually appears in about four to six hours if you do get it.

Hon. Mr. DANIEL.—You do not always get it?

Prof. STARKEY.—Oh dear, no.

Hon. Mr. Fiset.—No effect at all?

Prof. STARKEY.—No effect at all. I have had the prophylactic twice myself, and in my particular case nothing happened. I would not have really known from my condition that I had received any at all. There is absolutely no danger. I do not hesitate to say this, that taking it for granted you have the prophylactic properly

prepared, and in the hands of competent men administering it, I feel no hesitation whatever in saying there is absolutely no danger whatever.

Hon. Mr. DAVID.—Not worse than the reaction in the case of smallpox vaccine?

Prof. STARKEY.—The two cases are not quite similar. In the case of vaccination against smallpox you are dealing with the living germ, the vaccine contains living germs, so that when you put them into a body they multiply there, inside the body; but in the case of the typhoid you are dealing with bacilli which have been killed, and they cannot multiply in the body because they are dead. But the mere fact of introducing those dead bacilli into the body brings about a state of immunity in the system.

Hon. Mr. MURPHY.—That immunity is caused by the production of anti-bodies?

Prof. STARKEY.—That is right.

Hon. Mr. DAVID.—Do statistics show that the protection afforded by that vaccination is as good as the protection given by the vaccination against smallpox?

Prof. STARKEY.—Yes, almost as good as that.

Hon. Mr. MURPHY.—It will not last as long?

Prof. STARKEY.—It does not last as long. I have just one other little note here indicating the circumstances under which I would personally advise its use. I do not think there is any call to have everybody vaccinated. Take a town or a country side where there is absolutely no typhoid; I do not see that there is any object in asking those people to undergo vaccination.

Hon. Mr. DAVID.—Then you do not think that all the Members of Parliament and Members of the Senate ought to be vaccinated?

Prof. STARKEY.—Here is a beautiful case in point—

Hon. Mr. DAVID.—Taking the Ottawa water as an example?

Prof. STARKEY.—Here you have a lot of gentlemen coming up to a place where they have to consider in their own minds the possibilities or chances of their contracting this disease, typhoid. If they know that they run a risk, they could protect themselves; they know they are coming into a dangerous zone, so to speak, and they could protect themselves against it.

Hon. Mr. DANIEL.—Has this vaccination any effect whatever in the case of a man who has already got the disease?

Prof. STARKEY.—There you are getting on a little doubtful ground. If you could get hold of a man who has contracted the disease and is in the early stage, and inoculate him, you would probably do some good; but once the disease is developed, then it would be a mistake.

Hon. Mr. DANIEL.—The trouble is, you do not know whether he has the disease until it develops.

Prof. STARKEY.—No, but that is an important point for the public to realize, I think, that prophylaxis is not treatment. I think that is a point that might be brought out.

The CHAIRMAN.—I might say that in the Canadian Pacific Railway, on all the different divisions, we have tried it in the cases of typhoid fever, and we found that if you give it in the early stages you do not abort the disease, and you do not shorten the disease, but you prevent complications.

Hon. Mr. MURPHY.—You find that in actual practice?

The CHAIRMAN.—Well, last year we vaccinated on the Alberta division 8,400 men. Of course the C.P.R. surgeons out there have a great many cases of typhoid in the

hospitals, and we have been trying it in the hospitals in that way, and we find it lessens complications, but does not shorten the disease.

Dr. SCHAFFNER, M.P.—How is that? How could it prevent complications in the typhoid? What complications do you refer to now?

Hon. Mr MURPHY.—Ulcers in the bowels.

The CHAIRMAN.—Ulceration in the bowels and the sequelæ of typhoid.

Hon. Mr. DANIEL.—It renders the disease milder?

The CHAIRMAN.—I do not find that it lessens temperature much, but in all cases where it has been used we have had very few complications.

Hon. Mr. DANIEL.—Fewer hemorrhage cases?

The CHAIRMAN.—Yes.

Hon. Mr. DANIEL.—How long after the disease has manifested itself have you tried and used vaccine?

The CHAIRMAN.—It has been used by different men in pretty nearly all kinds except the latter stages.

Hon. Mr. MURPHY.—Dr. Starkey has just made the statement that it would be a mistake to give it in a typhoid epidemic.

Prof. STARKEY.—I would not like to go on record just quite in those words. What I said was that it ought to be made quite clear to the public that this is not a form of treatment for the disease, typhoid, but a prophylaxis—that is, a preventive measure—and I would suggest that you keep off the treatment side of the question altogether.

The CHAIRMAN.—That is an undetermined thing. It has been experimented with; I think they have experimented with it in cases of typhoid in the hospital here and elsewhere.

Prof. STARKEY.—Yes.

Hon. Mr. MURPHY.—You claim benefits from the same experimentation?

The CHAIRMAN.—Yes, in the early stages of the disease we have found that it lessens complications, although it does not abort, or does not shorten the duration of the disease at all.

Hon. Mr. MURPHY.—In how many cases have you tried it in that way?

The CHAIRMAN.—I could not tell you. We have tried it in Lethbridge in perhaps three or four cases, but it has been tried generally all over; Green and King up at Cranbrook have tried it that way, and in fact nearly all the surgeons out there have tried it more or less. I have not all their reports; I have their report as to the number they vaccinated, and the number of people that have had typhoid that were vaccinated, and everything of that kind; I have all those reports in, but this is just a thing that we have been doing amongst ourselves to see if we could derive any benefit at all from it.

Prof. STARKEY.—I should like to add one other little remark which relates to the practice of this prophylactic treatment—that I do not think the idea ought to be created that this prophylaxis or preventive measure should take the place, in any sense, of prevention of typhoid by good sanitation; that it ought to be looked upon as a supplement. In those places, or under those circumstances, where the disease, typhoid, is rampant or endemic—that is, it is there, and sanitation measures have not done much good—then I think this prophylactic treatment ought to be made compulsory, because there you have a means of stamping out the disease. Where sanitary measures have failed, for some reason or other, you have a means of stamping the disease out; in other words you render the population immune so that the disease cannot spread and propagate itself so to speak.

Dr. SCHAFFNER, M.P.—Is it very expensive?

Prof. STARKEY.—The prophylactic, oh, dear, no.

Dr. SCHAFFNER, M.P.—The vaccine I mean?

Prof. STARKEY.—Oh, no.

The CHAIRMAN.—Three treatments, 50 cents; three bottles.

Prof. STARKEY.—You want three inoculations?

Hon. Mr. MURPHY.—That is a lot better than diphtheria anti-toxin.

Hon. Mr. DAVID.—The doctor costs more than the vaccine.

Hon. Mr. DANIEL.—Do you make three inoculations?

Prof. STARKEY.—Not all at once; you give an interval of a day or two.

Hon. Mr. MURPHY.—Can you take three treatments out of the one vial?

Prof. STARKEY.—No, that would be dangerous; they put it, as a matter of fact, in small vials, just a dose.

Hon. Mr. MURPHY.—Just the same as the diphtheria anti-toxin?

Prof. STARKEY.—Yes, and if you don't use it all, quite, you throw it away. It is cheap you see what it consists of—just a few dead bacilli floating in some salt solution, there is nothing expensive about it.

Hon. Mr. MURPHY.—That is another advantage it has.

Hon. Mr. DANIEL.—What solution,—glycerine?

Prof. STARKEY.—No, salt solution.

Hon. Mr. MURPHY.—The germ system seems to be more rational.

Prof. STARKEY.—I have always held that in the preparation of these prophylactics, particularly those others—the plague and the cholera—that they ought to have been purified, worked up to a better state than they are; there is no earthly reason why they should not, and you see the German method of doing it is the first rational attempt to clean up the prophylactic.

Hon. Mr. MURPHY.—And have something aseptic.

Prof. STARKEY.—Possibly—I do not know—but it is quite possible that in the future they may improve it still more by being able to treat these bacilli more as a chemical body; however, that does not alter its general use.

Hon. Mr. MURPHY.—They will always have to have some way of growing them.

Prof. STARKEY.—Yes.

Hon. Mr. DANIEL.—I suppose, Dr. De Veber you never made any examination of your men to find whether there were more carriers of typhoid after a case of the disease, or less, by the use of this?

The CHAIRMAN.—No. The trouble is that you cannot very well find out whether a man is a carrier or not until you find a case of typhoid fever in the camp, and then you probably find he is some fellow who has had typhoid in some other gang or camp and has come over and got a job in this camp as cook or some other light job.

Hon. Mr. MURPHY.—Do you always use your tests to find out whether a man has typhoid?

The CHAIRMAN.—No.

Hon. Mr. MURPHY.—You can tell with your naked eye.

The CHAIRMAN.—When a railroad navy breaks down with typhoid you can pretty easily tell without a blood test, because he hangs out as long as he can, and when he comes to hospital the typhoid signs are well in evidence.

Prof. STARKEY.—I was going to say, in answer to the Senator's question that if anyone wanted the vaccine now, I am sure that satisfactory arrangements could be made with the United States service to supply all that was wanted.



Dr. SCHAFFNER.—What I meant by commercialise was this: Is Parke Davis or any other man handling it?

Prof. STARKEY.—I could not tell you.

Hon. Mr. MURPHY.—I think both Stearns and Parke Davis have it.

Hon. Mr. DANIEL.—Does it keep indefinitely?

Prof. STARKEY.—No, it does not keep. The best places will not sell it older than three months.

Hon. Mr. DANIEL.—It is boiled, I suppose, before it is bottled?

Prof. STARKEY.—They do not boil it. The highest temperature that is used in killing the germs is about 54 or 55 Centigrade

Hon. Dr. DANIEL.—What is that Fahrenheit?

Prof. STARKEY.—130 Fahrenheit.

Hon. Mr. DANIEL.—It is under the boiling point?

Prof. STARKEY.—A long way.

Dr. SCHAFFNER, M.P.—Are they not using this vaccine as a curative in cases that really exist?

Prof. STARKEY.—We have been experimenting with it.

Dr. SCHAFFNER, M.P.—What are they doing in Germany?

Prof. STARKEY.—I have not seen any results there obtained.

Dr. SCHAFFNER, M.P.—It seems that physicians through the country are using it.

The CHAIRMAN.—I have only given our experience in the west on the C.P.R. We came to the conclusion that it lessened complications and did not lessen the disease at all. You could not abort the disease by it.

Hon. Mr. MURPHY.—So far as you have gone yet, you have not succeeded sufficiently to tell whether it is a mere coincidence; whether your batch of cases were not of a milder type.

The CHAIRMAN.—No, not any more than I felt sure it would not abort the disease, because out of a large number of diseased persons we have three cases of typhoid, and two of them were taken down a week after the first injection, which shows that they had the typhoid in them before the injection was given, and it did not cut it short.

Hon. Mr. BOYER.—Is vaccination not compulsory in the American Army?

Prof. STARKEY.—Yes, and the navy too.

Hon. Mr. BOYER.—As a preventative?

Prof. STARKEY.—Yes, so that if the men go into any country where typhoid is prevalent they will not get the disease.

The CHAIRMAN.—I have exhaustive reports of the army which I will place before the committee on a future occasion and it will obviate the necessity of going into it now.

Hon. Mr. DANIEL.—Would it make any difference if the patient's blood was not pure? Supposing a syphilitic were injected with this?

Prof. STARKEY.—I think the safe rule is not to advise inoculation unless the person is in perfect health. If he were suffering from any disease I would say certainly defer it until he was well.

Hon. Mr. DANIEL.—If you make it compulsory in the army to inject you must certainly inject a lot of syphilitic men.

Prof. STARKEY.—It does not matter as a matter of fact. When you are asking about disease I do not think the presence of syphilis would militate against it, because syphilis is one of those things where, unless it is a very bad case it does not seem to interfere with the bodily health, so to speak.

Hon. Mr. DANIEL.—No, except the commencement of secondary symptoms.

Prof. STARKEY.—Yes.

Dr. SCHAFFNER, M.P.—Where do you inject, in the arm?

Prof. STARKEY.—Yes.

Dr. SCHAFFNER, M.P.—Hypodermically?

Prof. STARKEY.—Yes.

Dr. SCHAFFNER, M.P.—How large a volume at a time?

Prof. STARKEY.—One c.c., increased up to three.

Hon. Mr. MCKAY.—In dealing with smallpox where there are very few people vaccinated, the first thing we do, we start to vaccinate as many people as we can, and when vaccination is well carried out, and other necessary precautions in connection with the smallpox outbreak attended to, it is only a matter of two or three weeks when you have the disease perfectly under control, virtually stamped out, you have it under the flag. Taking typhoid as you have been describing it, I understand that they have a very serious outbreak of typhoid down in St. Hyacinthe, and down in that section of the country that there is an enormous amount of typhoid at the present time. Has typhoid vaccine been used there along the same lines and to the same extent that we are in the habit of dealing with smallpox?

Prof. STARKEY.—No.

Hon. Mr. MCKAY.—I should say there would be a splendid opportunity there to demonstrate to the people of Canada just what vaccination in typhoid would do, to stamp the thing out. If they could stamp it out in three or four weeks, it would be a great object lesson.

Prof. STARKEY.—As a matter of fact when the first outbreak of typhoid occurred down in St. John, it began somewhere around St. John, Quebec, and travelled down the river; when they found that sanitation measures did not seem to stop the outbreak, they then asked the public to come forward and be vaccinated with this typhoid vaccine, and they expected quite a few volunteers. As a matter of fact there were only three, I do not know whether there were three or one. That was the result of that.

Hon. Mr. MURPHY.—Do they not object very much in Montreal to be vaccinated for smallpox?

Hon. Mr. BOYER.—No. You will find a few cranks, even in your own island, who will object.

Hon. Mr. DANIEL.—There is a great difference between the two. Smallpox being highly contagious, the most contagious disease there is, while the typhoid is one of those things which everybody thinks, 'well, probably I will not get it, and there is no danger of one person catching it from another, as in the case of smallpox.'

Prof. STARKEY.—I can readily understand that where people would acknowledge the necessity of being vaccinated where smallpox is around, they would not feel the same necessity where it was typhoid.

Hon. Mr. MURPHY.—The Ottawa Citizen would run you out of town if it heard you promulgate these views about getting vaccinated.

Prof. STARKEY.—I have had communication with the Citizen before. I think the public ought to be informed as much as possible about the results of this typhoid vaccination, and they ought to be particularly impressed with the fact that the reaction is either absent entirely or is so slight that it does not bother them much. I fancy that when the people do not come forward and offer themselves for vaccination the reason is that they do not understand it and are rather frightened of it. If they can be assured that it will not hurt, then the volunteers will be much greater.

Hon. Mr. DAVID.—Can a man receive vaccination against small pox and typhoid fever at the same time?

Prof. STARKEY.—You can have two or three vaccinations put into you at the same time. You can be vaccinated against typhoid, cholera, and the plague all at once. If you take dead typhoid bacilli and inject them into your body they will set up a reaction in the blood, in the tissues, whereby what we call anti-bodies—a kind of antidote, if I may use a popular term, although it is not strictly scientifically correct—a kind of antidote is manufactured in the blood, and that causes an immunity because when you come along with a fresh dose of living germs, that antidote, or anti-body which has been manufactured in the system prevents them from getting a foothold.

Hon. Mr. MURPHY.—The peculiar effect is that the dead germs will practically cause the same thing.

Prof. STARKEY.—Yes.

Hon. Mr. MURPHY.—The dead germs are just as potent as the living germs themselves; that has been proven.

Prof. STARKEY.—You know the anti-diphtheretic serum, where they manufacture it in a horse, they start with the dead culture—they give the horse first of all a little dead culture, and within a day or two give him a little dose of a living culture, and by that time these anti-bodies are present in the horse's blood, and then they can go on and give larger doses of the living virulent culture, until there are so many of these anti-bodies in the blood, that you cannot give that horse diphtheria under any circumstances. He can stand as many bacteria germs as would kill a regiment.

Hon. Mr. MURPHY.—The idea of that is that if they gave him the living germs at first they would be liable to kill the horse?

Prof. STARKEY.—Yes.

Hon. Mr. MURPHY.—He becomes to a certain extent immunized before he gets the living germ.

Hon. Mr. DANIEL.—There must be some solution of the dead bacilli in order to produce the anti-bodies.

Prof. STARKEY.—Undoubtedly these dead typhoid bacilli, when you inject them under the skin, disappear absolutely.

Hon. Mr. MURPHY.—They dissolve?

Prof. STARKEY.—Yes.

Hon. Mr. MURPHY.—And the toxine which is within the cell itself is liberated?

Prof. STARKEY.—Yes.

Hon. Mr. MURPHY.—And begins to produce irritation which causes the anti-bodies to be formed?

Prof. STARKEY.—Yes.

The CHAIRMAN.—I have here a lecture by Col. Sir Wm. B. Leishman, F.R.S., R.A.M.C, Professor of Pathology, the Royal Army College, London, which will be of interest to the Committee.

After some introductory and historical remarks *re* inoculation for typhoid, Sir William continued: At that time a big epidemic of typhoid fever broke out in the Baring Asylum, and as Sir Almroth Wright was just going off to India as a member of the Plague Commission, and had to leave England in a few days, his assistant, now Sir David Semple, took his place to carry on the inoculation. Sir David Semple was incubating Malta fever and he collapsed. Then Sir Almroth asked me to go down and carry on the work. This first introduction to the subject certainly was a very valuable lesson to me.

You must all be familiar with the strong arguments against inoculation in the shape of the negative phase. This phase explains itself very fully. They say that

There is a moment following inoculation in which the resistance to infection is not only not increased, but actually lower. So that if during that moment a person came in contact with infection he would be more likely to contract the disease than an uninoculated person. If ever one should encounter that phase anywhere it would have been in this asylum. Here vaccine was employed in large doses and the result was that in the inoculation of nearly one hundred attendants in the asylum, among others going down every day with the disease and a good many dying, not a single inoculated person contracted enteric. This made on me a strong impression, confirmed since, that there is no practical danger of the negative phase with typhoid inoculation with dead typhoid cultures. That argument against inoculation is brought forward even now. Many colleagues in England inoculated when there is no typhoid about, but never dream of inoculating in the presence of an epidemic. Many are of this opinion. This has been the hardest argument to fight down. Of course, if this had really been the case it would have limited the use of typhoid vaccination largely in India, as enteric is found in every State of the country and we could not have dared to inoculate there if this statement had been true.

We believe that there is no such thing as the negative phase. We advised inoculation in India, with the results I will show you.

On Sir Almroth retiring, his mantle fell on my shoulders. We had a larger opportunity of testing typhoid vaccination in the Boer War, where we tried to get good statistical information. In war it is very difficult to get that information, from the fact that in active service statistical information is impossible to get. Documents get lost, the men responsible for them die, and your figures are in chaos, and such figures as do come to light are contradictory. Some of the figures we got were good, some were not very good, and some were actually bad. That being so, the Army Council decided that typhoid inoculation must be discontinued in the army until we knew more about it.

For the purpose of learning more about it, there was appointed a commission of experts, so called, for I happened to be one of them. Their function was to get information in regard to all that was known of the subject, and to conduct further research with a view to the improvement of the vaccine. This committee is now dissolved, having presented their final report. Their report recommended the universal adoption of typhoid vaccination in the army. This was gratifying to me because it was an extraordinary uphill fight, as vaccination had fallen into bad repute. The war officials, however, did not make it compulsory. I hope the day will come when our army, following the example of the American army, will make it compulsory for the soldier to be inoculated either in peace or in war. It is a many sided question. The nature of the vaccine we employ is a sterilized broth culture of the typhoid bacillus, sterilized, that is, killed, and we employ as a sterilizing agent heat. You must not parboil the bacteria as we used to do in the olden days of the Boer war, that is, you must not overheat. We have learned that this overheating destroys the effectiveness of the vaccine as an immunizing agent. We employ the lowest temperature at which we are certain of killing the bacteria in one hour, and that is 53 degrees Centigrade. The organism we have selected for that purpose is the strain alluded to by Dr. Hamilton. We selected this haphazard at first. I remember the post-mortem at Netley from which I isolated that bacillus. It was from the spleen of an undistinguished soldier called Rollins, who died there many years ago. I was on sufficiently intimate terms with a clergyman as to suggest to him a subject for a text of his sermon, and thought he could have no better one than the case of that soldier, Rollins. He died of a preventable fever, but his death has been the means of saving hundreds and perhaps thousands of lives. This strain from Rollins, though selected haphazard, happened to be a good one. Strains differ in their property of giving life to anti-bodies. This one is excellent for that purpose. It is more suitable than a great many others we have tested against it. We always added a certain amount of antiseptic to our vaccine,

and again I should like to emphasize the necessity for this in regard to typhoid or any vaccine, for the purpose of insuring subsequent sterility. One would be a criminal if one did not send out sterilized vaccine; but you cannot make it remain sterilized in other hands unless antiseptics are added. There are only too many instances where this has been neglected. A plague vaccine in India became infected with tetanus germs with terrible results.

Scarcely less important is the question of standardization. We standardize our vaccine by counting the bacteria. With our present knowledge that is the most effective way in which we can proceed. An ideal method of standardization is not yet discovered. We carry out our method the best we can in regard to technique and by observing every possible similarity and detail. We use the same strain and count the germs so that we shall get the same results with regard to reaction and with regard to protection in the successive batches of vaccine prepared for us. Beyond that, however, one cannot go, for though we standardize the vaccine we cannot standardize the person we are going to vaccinate. Different individuals differ very much in individual susceptibility. We cannot, I think, advise especially further precautions, such as analyzing the blood of the individual to see if he is especially susceptible to virus or not. From my own experience, I am led to the conclusion that when an individual shows exceptionally severe reaction to vaccine, that individual is not so likely to be effectively protected as one who shows ordinary reaction. Indeed, he is more likely, if exposed, to contract the disease. I have seen cases in which this has been well shown, as in the case of a British officer who had a very severe reaction, and subsequently, within a year or eighteen months, had a very severe attack of typhoid in Africa. He nearly died, and two years afterwards he had another attack of enteric. In the other case this vaccination would probably have done good. He was very susceptible to typhoid bacillus, whether they were dead or alive.

We employ in our dosage two successive inoculations; first a dose of five hundred million bacteria; second, double that, or one thousand million. We separate these doses by an interval of ten days. This interval is not fixed haphazard, but is the result of careful experiment, which has shown this to be the most suitable length of time between two doses. A third dose would be better, possibly four would be better than three, but in the army there are reasons which make it impossible to go beyond two doses. In the American army, where they have had the good sense to adopt the compulsory system, they tell their men they have to have three doses.

Following the question of dose is the question of reaction. The vaccine is given by a hypodermic injection, and results in an area of tenderness and redness about three inches in diameter, about the site of introduction of the needle. This is sometimes painful and generally tender on pressure. This local reaction reaches its maximum in eighteen to twenty-four hours after inoculation, and then subsides. There is nothing like the disturbance which follows an ordinary vaccination against smallpox. In exceptional cases the glands of the axilla become slightly enlarged and the lymphatics injected, but this generally subsides rapidly.

The symptoms of the constitutional reaction are fever, and sometimes a certain amount of nausea and general feeling of malaise. The fever rarely exceeds 101 degrees, the average is a fraction over a hundred, and a large percentage of inoculated individuals show no temperature at all. There are, however, cases which show a much more severe reaction than that and where the temperature may rise to 102 or over and the individual feel out of sorts for perhaps three or four days.

In several hundred thousand inoculations, which have been done with our vaccine, I am glad to say no dangerous results have been reported and no deaths. It is a perfectly safe procedure, even if reaction is sometimes severe.

In connection with this question of reaction, there are a great many other typhoid vaccines than the one devised by Sir Almroth Wright and improved by myself and my colleagues. This is only one, but it is the pioneer, the one which in early days was employed most largely, and is the parent of the one now used by our colleagues of the

Army Medical Service of the United States. Many other vaccines are in use, but very few of them have been used on so large a scale.

To decide whether a vaccine is good or bad the only clinical test is whether it will protect from typhoid fever. Arguments in favour of these vaccines are mostly confined to laboratory experiment, and though convinced from that point of view I will not give up our own till I see another vaccine giving better statistical results. The living vaccine of a fredka is perhaps the best. I just mentioned this particular one because it is much advocated by those who bear the greatest name in bacteriology. There is a grave disadvantage to its use, even if it is one which gives a higher degree of immunity than our dead vaccine, and that is because it is a living vaccine. A living typhoid bacteria, under the skin, even if attenuated and even if we know that such a procedure is perfectly safe and will not produce an attack of typhoid fever from the point of view of widespread use, is not advisable. We can never safely proceed to issue a living vaccine widecast over the country. It may get into water, etc., and do harm; we, therefore, adhere to the dead vaccine instead of the living one, if the latter should be slightly better in results.

In regard to the duration of immunity conveyed by our vaccine, we have not as precise information as we would like. It is difficult with a large floating population as an army, where men are going on the road and batches are coming to take their places, to follow the histories accurately. From the knowledge we have our vaccine conveys immunity for about two years. After two years, or better eighteen months, we should revaccinate. Our soldiers in India are inoculated after that lapse of time. Here I would like to state my personal view. The usual criterion which is adopted of testing blood for the presence of immune substances is not necessarily accurate. I have good reason to know that the individual may lose all trace of demonstrable bactericidal substances and agglutinins within six months after inoculation and may still be protected against infection. Our tests for these substances are at best somewhat crude. At present, even if these substances are not found when we test the individual some eight months after inoculation, we are not entitled to say he is not protected.

What have vaccines done? It may be of interest to you to learn our results in the case of our army in India. In the case of inoculation in the army, we have to deal with it from two points of view, protection in peace and protection in war; these are very different problems. In peace, in the foreign service of the army, typhoid fever has been the most serious trouble against which we have to fight. As an example of this, the incidence of enteric of our army in India, where there are 73,000 troops on an average, from the year 1890 and up to the year 1905, there was an average of from 1,500 to 1,600 cases of enteric every year in this garrison, and as regards death, you are fortunate if you can keep the typhoid rate under 25 per cent; 400, 383, 443, 536, 637, 348, etc., are yearly numbers of deaths. That means we were losing in these years practically half a battalion by death from enteric in India every year.

I need hardly quote to you the results of typhoid fever in war. One need only turn to our Bcr war, where out of 380,603 troops we had 57,684 cases and 8,022 deaths from enteric fever in three years. That incidence is appalling especially if one contrasts the 8,022 deaths with the total number of deaths from those either killed in action or who have died in other ways. Here the total number of deaths from other causes than typhoid was 7,702, a less number than for typhoid alone.

The Spanish war of 1898, a recent campaign between two civilized powers, shows precisely similar results. The same thing will happen if any two powers will engage in a war. They will take typhoid fever with them, either in incubation cases or still more deadly in typhoid carriers, or will contract the disease in the country they invade. Given a few sources of foci of infection, and it will under the conditions of field service spread like wildfire. It has always done so and will always do so unless we take precautions against it.

In these recent campaigns every advantage we could think of for improved sanitary appliances, everything we could think of in peace, was brought into service. Good

water was provided, and we sterilized the excreta, and yet we had this lamentable result.

What has typhoid inoculation done to better this condition?

With a view to getting the results exhibited statistically we divided what was called the test unit of experiment, that means that we selected with approval, of the war office as soon as we could, such a vaccine as could do no harm and one we believe would do good. We took the responsibility of recommending it. They accepted this and allowed us to appoint a medical officer to every unit that left England for foreign service. This officer had a special course of training at the Army Medical College in modern methods of diagnosing fevers, methods of blood analysis, etc. These officers after this course, were attached to these units. They had to take on them the part of lecturing these men and to convince the soldiers that they should accept this offer of protection. Their chief task when accompanying these units abroad was that they should keep accurate record of the soldiers inoculated, and see that every case of continued fever in each battalion should be investigated by blood culture, etc., with view to deciding if it were enteric fever, or, if not, to find out what fever it really was.

During a period of experiment lasting five years, twenty-four units were dealt with, and the report of twenty-six medical officers collected into tables, and summarized as follows: Of these twenty-four regiments the average period of exposure to infection was dated from the time of their arrival in tropical station till the time we ceased to keep records, the average period was one year and eight months. The number of men who were in the experiment concerned, was 19,514. Of the men who were vaccinated among this 19,514 the number was 10,378, and among these 10,378 in this average period of one year and eight months were 56 cases of enteric, five of whom died.

Contrast that with uninoculated group. The smaller group, 8,936 practically 9,000, against the 10,000. In this smaller number there were 272 cases and 46 deaths. That is, nearly as many cases died of enteric in the non-inoculated group as contracted infection in the inoculated. Figures are not true indicators of what typhoid inoculation can do, for we figure among these every case that was inoculated whether properly inoculated or not. A very considerable proportion of these cases were inoculated with ineffective vaccine, superheated vaccine. In other cases soldiers who contracted enteric had been inoculated with vaccine kept too long, which must have lost all potency. These are all lumped together there, and if I excluded these and those soldiers who got one dose instead of two doses, if I put these all outside, the table would have worked out ten to one instead of five to one in favour of inoculation, as it has worked out in our experiment. It is, however, the best experiment on record, although better figures are shown in the American army and in the French army. In this experiment the external conditions were more accurately kept than in any other similar experiment. In each of these units soldiers were living under the same conditions as regards food and water and as regards exposure to infection. The two groups of inoculated and non-inoculated were strictly comparable. We found it a better test than in the case of groups of men altogether inoculated. I know this from our French colleagues, and they quite agree that these figures are the best evidence we have in support of inoculation. We have had very much better figures than those in individual units exposed to infection within comparatively short time of inoculation, that is within six or eight months afterwards. There the results are more instructive. One is not exaggerating to say those results are comparable to the results given by small-pox vaccination. Immunity tends to die away, and as the time approaches two years the individual should be re-inoculated.

The effect of this in India, only recently extended to the whole garrison, shows from the year 1907 a continual growth in the yearly number of those inoculated. This growth has been most gratifying and now has reached close on 95 per cent of our

whole garrison in India, and that when on a voluntary basis says a great deal for the British soldier.

Leading down from the year 1907 we find that in 1907 there were 1,910 cases and 192 deaths. In 1909 there were 616, with 112 deaths. In 1910, 196 cases and 45 deaths. In 1911, 170 cases and 22 deaths, and in 1912, 118 cases in the whole of India, as contrasted with the figures of some 2,000 of a few years before. I am talking of typhoid as regards the en masse of India. Now that 93 per cent of the soldiers are inoculated, it is much more difficult to draw comparison between results for those inoculated and those not inoculated, because of the great disparity between the two groups, and the incidence is now confined to small groups of non-inoculated cases.

I do not wish to minimize the value resulting from increased study and increased application of the study of hygiene and sanitation. I may remind you that in India now when a soldier contracts enteric he is not allowed to return to barracks until he has been thoroughly tested bacteriologically. He is sent for convalescence at once to the typhoid convalescent depot, of which there are two in India. There he is tested from day to day till we are certain he is not a typhoid carrier. No carrier who develops as carrier during service in India can be missed by this system, and that is an enormous gain, guarding against the spreading of infection. Now the carrier group is ordinarily not over three per cent, and last year only two or three carriers were found in the whole of India.

There are two more general questions I should like touch on; first, the use of typhoid vaccine and the treatment of cases of enteric; second, the application of typhoid vaccine to the civil population as a protective measure.

The treatment of typhoid fever by inoculation is beyond the stage of mere protection and interesting experiment. Treatment of cases of enteric by typhoid vaccine is thoroughly scientific, and it is the only scientific method to treat these cases.

This is not a new thing, I do not claim any credit for it, but I have strongly advocated its use among my brother officers. Given a proper vaccine and given proper doses of vaccine, you will approach a case of typhoid fever with very much more confidence than you have in the past. I have seen grave toxic cases treated in this way, change their character completely in a period of 24 to 48 hours, not in the way of temperature coming down straight to normal, and the attack of fever becoming abortive, but the temperature running along at a much more moderate level and, above all, in a change for the better condition of the patient, who loses the typical typhoid face, the anxious expression we all know so well. He becomes a more cheerful individual, he no longer looks like a man dangerously ill. I have known soldiers to ask for the inoculation to be repeated. This is a good testimony of its value in treatment. The temperature following inoculation usually arises in twelve hours to a slightly higher level than one would expect to be present in an uninterrupted case. The local reaction is very slightly in evidence. Following this rise within twelve hours or so the temperature drops to a lower level than one would expect in an ordinary case. The temperature at first goes a little higher, then goes down lower than you expected, and only by degrees comes up to the old level. Another inoculation brings it down a little lower, and when two or three doses have been administered it comes down to normal and remains normal.

The duration of the attack is not greatly shortened, but there are fewer complications, and relapses are very much more rare. Monsieur Natelle's published account of his collections of the writings of those who have been working on this subject some forty papers published in different countries show what this method of treatment is doing. These cases of Natelle's thirteen hundred and ten in all had a mortality of only five per cent, and here there were cases treated by doses of vaccine that were useless. Some were too small, others one could have no confidence in. I am convinced that with an effective vaccine the mortality would be one or two per cent. If you have opportunity of trying this treatment, try it and you will be rewarded. One should start with an initial dose of two hundred million of the ordinary prophylactic vaccine and repeat the dose on the third day allowing one clear day as an interval.



Repeat again on the fifth day, using on the third occasion say five hundred million. I do not think that a smaller dose than that will have any effect at all. There is still much information required on this subject and we must have far larger figures to make this information accurate. The treatment is harmless and is scientific, the most promising treatment in typhoid we possess.

As to the application of typhoid vaccine in civil life, it seems to me that if we control typhoid in the army in peace, and we hope to do so in war, in the future, that you in civil life, should not hold your hands from the benefit of such typhoid vaccination, especially if you are threatened or exposed to typhoid in your immediate surroundings.

Measures of protection against typhoid, such as improved water supply, an improved sanitation generally, instruction of the people as to the care necessary to prevent this disease is an excellent aid, but does not take the place of typhoid inoculation. This vaccine is a very simple thing to prepare. I have had brought to my notice in several ways during the few days spent in Canada, that you suffer largely from typhoid in this country. For example, Ottawa has had a severe epidemic, and typhoid is at large in various parts of your country districts. If you could organize a campaign against typhoid to persuade people likely to be exposed to infection to be inoculated, you would be doing a great good to this country and to science in general, and in that way accumulate information that would convince everyone.

I was bold enough at Montreal the other day to suggest that they should vaccinate the whole population. That seemed a tall order, but I do not see why it should not be done.

We do not know when we may catch typhoid ourselves. Why throw away the chance of preventing such a happening? Thinking over the thing from that point of view you will have three sets of people to convince. First and most important is yourself and it is up to you to convince the second set, the authorities, and thirdly, the people you are going to inoculate. The authorities are the hardest nuts to crack. You may have trouble with them, but not with the people. The latter are extraordinarily amenable to the influence of the medical man whom they trust. If you are convinced and believe typhoid inoculation is a good thing, it will do you no harm if you inoculate yourself, except to cause a sore spot or sore head for a day or so. If you inoculate yourself, very few people will refuse inoculation when it comes to their turn. Of course, there is a prejudice against this form of treatment like there is against vaccination for smallpox, but these prejudices vanish in the presence of danger. When the relatives and children are contracting enteric, their friends will fly to you and you will have no difficulty to get them to accept treatment.

I believe, personally, most strongly, in the benefits to be derived from this method of treatment, and if I may give you advice, should urge you to use it to the utmost in adding to the weapons which you use fighting this disease.

HON. MR. MCKAY: Summing up the whole matter, with a view to bringing about a general use of this vaccine in typhoid, what would be your suggestion in regard to the best method to employ? We have a country where this thing is an unknown quantity. It is an established scientific fact, and we want to put the people in possession of this fact, and impress them also with the fact that this thing will be an immense benefit to them in various ways, not only so far as saving time, which is money, but also in saving life. Which would be the best method to pursue in order to bring into general use this matter before the public? Would it be better to do it through the local Boards of Health, instructing them, and educating them up to its use, and through them, getting people to use it? It would be possible under certain conditions such as you have down there at St. Hyacinthe, where I should say they have a good live Board of Health, and a few energetic men with some great force behind them, who could bring this matter more permanently before the people, and they would have an excellent opportunity of demonstrating the use of it. You understand what I mean?

PROF. STARKEY: Yes, quite. I think one of the best things that could happen would be an actual demonstration of the benefits. For instance take St. John. The

people were invited to come forward, and they did not. You could demonstrate to the people of St. John the benefit of it.

HON. MR. DAVID: You must first convince the doctors.

PROF. STARKEY: Another thing that occurs to me; on all construction works it should be compulsory, and after a year or so you would have so much evidence in favour of it, that you could bring it before the people by publicity; they could not contradict it, they could not even doubt it, and that is a sort of thing that would encourage the people to come forward of their own free will and have it done.

HON. MR. DANIELS: I think it must be done by education.

PROF. STAREY: And that is very slow.

HON. MR. DANIEL: You cannot get vaccination against smallpox made compulsory, and that is a thing which is patent to everybody. I doubt if you would be more likely to get vaccination against typhoid made compulsory.

THE CHAIRMAN: Here is a little resume of a report made from the army in India by the authorities, which reads as follows:

"With the army in India in 1890 there were 1,253 cases of typhoid, and 332 deaths. Anti-typhoid inoculation was re-introduced in India as a voluntary measure in 1905, but it was not until the year 1909 that the number of men inoculated became sufficiently large to influence the general statistics. From that year there had been a steady and very remarkable decline, the figures for each successive year constituting a fresh low record, until in 1912 they found that there had been only 118 cases of typhoid fever in the whole of the British Army in India—a gratifying contrast to the large figures recorded in the past."

I have the report of the vaccination of the C.P.R. in Alberta which I will place before the Committee. I may say here, in order to show why we C.P.R. surgeons take such an interest in this, that each man has a certain amount of his pay deducted, which is paid to the doctor, and the doctor has to provide medicine, and if it is a hospital case, he has to provide the hospital for the men. In consequence we do not want any more cases than necessary, because we have to pay for all the hospital cases. I may say the C.P.R. issued vaccine all along their lines to C.P.R. doctors, and we are supposed to induce as many men as possible to come forward and be vaccinated, though they cannot make it compulsory. This report reads as follows:

#### TYPOID VACCINATION IN THE INDUSTRIAL WORLD.

With the large increase of population in the western country during the last few years, it has been a hard matter to keep pace in a Sanitary way with the growth. This is true, not only of this country, but of all new districts which open up, and as a result we suffer from those diseases which follow unsanitary conditions. Our worst enemy in this field is typhoid fever.

To a large company like the Canadian Pacific Railway the presence of typhoid means a very great loss, much more than one would imagine without going into it thoroughly. We have already done our utmost to fight the condition by sanitation, and have been greatly rewarded for our efforts. We followed pretty closely the rules as laid down by the military authorities covering the sanitation of camps. With the introduction of typhoid vaccine into the armies of the world, and the marvelous results that have been recorded, we decided to introduce it into the railroad world.

To give an idea of what typhoid means to a big company I will give you a few figures. When a man goes down with typhoid he is incapacitated for a period of at least four months or in terms of days, about 120 days. In the year 1911 there were about 320 cases of typhoid fever on the Alberta Division which means a loss of time to the company of 38,400 days.

Again this disease comes just at the time of year when these men are most needed, that is in the fall of the year when the work is being finished before the oncoming

winter and when the company is getting the harvest away and placing coal and other winter supplies all over the country.

Now if it means all this to the company, what does it mean to the man himself? It means that he is incapacitated just at the time when there is plenty of work for him to do.

It means a heavy raid on his financial condition for medical, hospital, and convalescent expenses at the time of the year when he can least afford it.

Having all this in our minds we decided to approach the Company and get their co-operation and were met more than half way in the scheme. This however was only the starting point as we still have to get the consent of as many as possible and placed the proposition before them as clearly as we could and were more than satisfied to find that a great number entered into the work sufficient at least to warrant our going ahead with the vaccination. All the district surgeons were also eager to start ahead with the work as soon as possible. We soon found out that our troubles were only commencing. The men all had a very painful recollections of having been vaccinated for smallpox and immediately put typhoid vaccination in the same category. We were also dealing with a non-disciplined lot of men whom we could not force to be vaccinated as might have been done in the army, so it had to be optional and in several places it required a great deal of patience and some hard talking to convince them that it was being done for their own good.

For the complete treatment we use three inoculations at intervals of 10 days. The first inoculation consisted of 8 minims containing 500,000,000 killed bacteria. Ten days later a second inoculation of 15 minims containing 1,000,000,000 bacteria and again ten days later a repeat of 15 minims of 1,000,000,000 bacteria.

The site for the inoculation was chiefly the upper arm either at the insertion of the deltoid muscle or the back of the arm into the triceps.

These injections were done as nearly as possible in the afternoon so that the reaction would be all over by morning.

A few hours after the injection the reaction commenced like an oncoming attack of LaGrippe, slight headache, general soreness, lassitude, slight elevation of temperature and in some cases some slight nausea. This lasted for about ten hours and was then completely gone. The local reaction was redness, pain, swelling and heat, this lasted longer than the general symptom but was pretty well over in 48 hours.

We use the ordinary hypodermic syringe with several needles which were sterilized by boiling. A separate needle being used for each inoculation. The site of inoculation was simply prepared by painting with Iodine and after the injection was done no dressing was applied.

Some of those inoculated showed more severe symptoms than the rest such as syncope which lasted for a short while and recovered without any treatment. Examination of these men afterwards showed no reason why it should have happened. We found no condition that we could classify as a contra-indication to vaccination. As to the time lost as the result of the vaccination about 95 per cent of the men kept right at their work. The other 5 per cent were laid off for not longer than 48 hours.

Last year there were about 5,500 inoculations done with two cases of typhoid developing amongst them and one of these two had only received one injection, and came down with the fever a few days later so that it is possible that he was coming down at the time of the inoculation.

Among the other men living under exactly the same conditions as the men who were vaccinated there were 220 cases of typhoid.

One of the most striking results of the vaccine was in a gang of about 35 men who were camped within the city limits and who absolutely refused to be vaccinated at first. There were 11 cases developed in this camp and then the men began to ask to be vaccinated which was done and following that we had only one more case.

Last year Dr. Maclaren and Drs. King and Green used the vaccine in the treatment of cases using at each injection small doses of about 1,000,000 bacteria every fourth or fifth day and found that in those cases which they treated from the beginning

of the disease that the complications were almost nil, although it did not lessen the course of the disease at all. Those cases that were well advanced before they came in under treatment showed no effect at all.

This year we have not as yet received all the reports so can only give an incomplete report to you. So far the total number vaccinated is 2,771 with one case developing fever and against this there are reported 70 cases amongst the non-vaccinated. When all the reports are in these figures will probably be between eight and ten thousand.

The conclusions that we draw from this work are:

We have a very valuable aid for the prevention of typhoid fever in the use of vaccine.

That the name of vaccination should be abolished and inoculation should be used in its place.

When cases of typhoid come under observation early enough that most of the complications can be lessened.

That its use should be advocated in all places where men are to be in camp and under doubtful sanitary conditions for any period of time.

That the period of immunity is apparently indefinite, probably equal to that produced by a single attack of typhoid.

Since this report was read the various lists have come in to complete the work for 1913. The total number vaccinated being 8,400, with only the one case developing.

There is an article in the National Geographic Magazine, entitled "Our Army versus a Bacillus," by Alton G. Grinnell which has an important bearing on the subject which reads as follows:—

In all the history of human endeavour nothing compels greater admiration than the devotion of a lifetime to the conquest of a world-wide disease. It is seldom, if ever given to one individual to search out single-handed the cause of the disease, demonstrate to humanity how it is communicated, and show how it may be prevented. In such a monumental achievement the ultimate success is usually due to the researches and experiments of many men, all of whom have been actuated by an ambition to relieve human beings of unnecessary suffering.

The details of the first act of such a drama are usually obscure, and even if known to the public are uninteresting at the time because of their technical character and apparent lack of connection with human ills.

But when the years of experimentation have passed and the marvelous thing is demonstrated, with all the world, the stage, men wonder at the transformation.

Typhoid fever, which before 1908 had been fought with every weapon known to modern science and still lurked in every community, is now put to rout in open combat by the aid of its own dead bacteria. The illuminating light of discovery makes possible the immunization of an army of 85,000 men against a disease which is more prevalent in this country than in most civilized countries and causes a yearly loss of something like \$350,000,000 and untold suffering—a disease which has been the scourge of our army and has killed and maimed more than powder and shot. This same disease was directly responsible for an outlay of \$20,000,000 in the British South African War, and has been the cause of great suffering and financial loss for many years among all peoples in every climate, in peace and in war.

#### A SERIES OF DISCOVERIES.

Scientists of many nations have contributed to the campaign for the eradication of typhoid, but to the United States Army belongs the credit for the first practical demonstration on a large scale. From the discovery of the germ to this remarkable demonstration was a span of 31 years, wherein the following important contributions were made:

(1) Eberth, a German bacteriologist and anatomist, discovered the typhoid germ in the year 1880. It belongs to that group of bacteria which live on live animal and

vegetable matter and is known as a parasite. Twelve thousand of them placed end to end would measure only one inch. They multiply very rapidly under favourable conditions, dividing into two about every 40 minutes, which in the course of 24 hours would result in the production of millions but for the lack of sufficient food.

They cannot develop in intermediary hosts, such as fleas, mosquitoes, etc., like certain other micro-organisms; but they can exist for several months in various substances, and thus be transmitted from one person to another. Fortunately, the sunlight destroys them in from four to eight hours.

After being taken into the mouth in food or drink, or on the fingers, the germ finds its way into the intestines, whence it is carried by the blood to all parts of the body and produces a poison known as the typhoid toxin, which affects the tissues and organs in such a manner as to cause the symptoms of the disease.

(2) Dr. Ehrlich, a German scientist advanced the theory that besides the poisonous toxin another substance is formed in the body, as the result of the invasion by the typhoid bacilli or other germ, which is antagonistic to it and is known as its anti-toxin.

(3) In 1884, the great Russian scientist Metchnikoff advanced the theory that the function of the microscopic cells, the white blood-corpuscles, which are found in great numbers in all parts of the body, is to act as policemen of the blood, and that it is due to their eternal vigilance that disease germs in the blood, such as the typhoid bacilli are destroyed. He calls these microbeaters "phagocytes." Certain diseases, such as typhoid fever, smallpox, plague, etc., practically never attack the same individual twice, because these defenders have become so actively energized in their efforts to overcome the germs during the first attack that they remain in this active state indefinitely.

#### WRIGHT INTRODUCES PREVENTATIVE VACCINE.

(4) As the result of the work of Sir Almroth Wright, an Irishman, the two theories above were united to explain the resistance of the body to disease. He showed that the substance mentioned by Ehrlich first attacks and sensitizes the foreign organisms in the body, and that the white corpuscles then absorb and carry them away.

The most remarkable exhibition of this functioning is now given to the public by means of moving pictures, a film having been prepared by a French scientist and exhibited by MM. Pathe Freres which "shows the white corpuscles of the blood gradually altering their shape and position and fulfilling one of their best-known functions as scavengers and absorbing such abnormal substances as microbes, disease-cells, and granules of inert matter."

These facts being known to science, experiments were made to produce anti-typhoid vaccines, which when injected into the blood would have in a mild degree the same effect upon the body tissues as the disease germs.

(5) The French scientist Pasteur made the first successful experiments, in the immunization of chickens against cholera, which led up to the immunization of man against typhoid. His experiments were conducted solely upon animals. Others continued his researches.

(6) Later Sir Almroth Wright demonstrated that the dead bacteria of typhoid could be made into a preventive vaccine, and in 1897 he published a report of the first 20 anti-typhoid inoculations on human beings.

#### HOW THE WORK IN AMERICA BEGAN.

(7) The scene now shifted to the United States. One autumn afternoon in the year 1908 there assembled in the office of the Surgeon General of the Army a group of distinguished physicians and surgeons:

Brig. Gen. R. M. O'Rielly, Surgeon General: Drs. Victor C. Vaughan, Wm. T. Councilman, John H. Musser, Alexander Lambert, Simon Flexner, William S. Thayer, and Capt. Frederick F. Russel, Medical Corps, U. S. A.

With the exception of the Surgeon General and Capt. F. F. Russell, this army board was made up of members of the "Reserve Corps."

The Surgeon General addressed the scientists present, stating why they had been brought together, and set forth briefly the history of typhoid in the United States Army up to that time. Had we been present we would have learned that typhoid fever exacted a toll in the northern army during the Civil War of 80,000 cases, and was the cause of not less than 86 per cent of the total mortality of the American Army in the Spanish War of 1898, there having been 20,738 cases, with 1,580 deaths, among a total of 107,973 men.

The lessons of the latter war and subsequent investigations had made possible many advances in sanitation, and the medical department of the army was bending every effort toward the eradication of the disease. The number of cases per year had finally been forced down to about 300 in the army in the United States, but the ever-present "carrier" (an individual who is apparently not sick of the disease but still harbors the germs in his system and is capable of imparting them in virulent form to others) was elusive; also typhoid was flourishing quite generally in the civil population of the United States. In this country the *Bacillus Typhosus* was attacking a half million people every year, and 35,000 to 40,000 died of the disease. The utmost endeavors of the health department were inadequate to eradicate it.

The Surgeon General now called for the report of Captain Russell, who had spent three months in Europe, by order of the Secretary of War, studying the method of immunization used by Sir Almroth Wright. It set forth with scientific accuracy the details of typhoid vaccination as practiced abroad, and stated that although the measure had not met with universal favor it had been reasonably successful, and recommended its adoption experimentally in our army among those who would volunteer.

#### TYPHOID VACCINATION INTRODUCED IN THE UNITED STATES ARMY.

After some discussion, the board unanimously recommended the adoption of anti-typhoid vaccination in the army as a voluntary measure. Backed by the recommendation of these distinguished gentlemen and the authority of the Secretary of War, the Surgeon General took immediate steps to start experimental vaccination and placed Captain (now Major) Russell in charge of the work.

Within a couple of months he had developed an improved technique, so that the reactions which had been somewhat severe before were now quite mild. All the medical officers, their families, many commanding officers, and the Hospital Corps immediately submitted to this procedure in order to set a good example, and the volunteers came forward from the regular army in such goodly numbers as to reflect credit upon the service.

During 1909 and 1910 about 18,000 men were vaccinated. The results were so good that upon the mobilization of the troops on the Texas border in 1911 the Secretary of War ordered the compulsory vaccination of all the troops in the field—the first time in the history of anti-typhoid vaccination that it had been made compulsory; the first test on a large scale of this method of individual protection against the disease which had been the terror of our army camps. The details of this crucial test are imperative to a proper comprehension of the immense value of anti-typhoid vaccination as a prevention against the disease. In an article entitled "The Sanitary Record of the Manœuver Division" Col. J. R. Kean, in charge of the Sanitary and Statistical Division of the Surgeon General's office, states as follows:

"The immense advance in camp sanitation, and particularly the value of this protective measure, can be estimated by comparing the typhoid incidence of this camp with that of the 2nd Division, 7th Army Corps, which was organized at Jacksonville, Florida, about June 1, 1898, and remained there in camp until October, some of the regiments leaving in September. This division was not conspicuously unfortunate in its typhoid record for that time and is selected because of the close

similarity of its conditions of service to those of the Manœuvre Division. The two divisions were encamped in nearly the same latitude and for about the same time; each had a good camp site and an artesian water supply of unimpeachable purity. While the period in camp of the 2nd Division, 7th Army Corps, was later in the year, the number of men involved is larger for the Manœuvre Division.

#### SOME VERY REMARKABLE FIGURES.

The following table shows the typhoid incidence in the two camps:

Mortality and morbidity from typhoid fever in the 2nd Division, 7th Army Corps, at Jacksonville, Florida (June-October, 1898):

Mean strength. . . . .	10,759
Cases of typhoid, certain and probable. . . . .	2,693
Deaths from typhoid. . . . .	258
Deaths from all diseases. . . . .	281

Compare these figures with those for the Manœuvre Division, San Antonio, Texas, March 10 to July 11, 1911:

Mean strength. . . . .	12,801
Cases of typhoid, certain and probable. . . . .	1
Deaths from typhoid. . . . .	0
Deaths from all diseases. . . . .	11

"This is the more remarkable when it is stated that the average typhoid rate at the army posts in the United States during the same period was 34 per 1,000; in other words, the health of those soldiers in camp, sometimes living deep in mud and at other times in clouds of dust and under a semi-tropical sun, was better than in barracks surrounded by the comforts and sanitary appliances of post life."

Further proof of the many opportunities which the soldiers had to contract typhoid is given in Major Russell's report:

"There is no doubt but that the hygiene and health of the men received almost ideal care; the difficulty was, however, that the men were not confined to camp, but had liberty and opportunity to visit the neighboring cities of San Antonio and Galveston. Thousands spent more or less time in these cities, where they dined and lunched, and drank and slept; in fact, became, for the time being, a part of the community.

"In Galveston, especially where a ten minutes' ride carried one from the camp to the heart of the city, the number of men visiting town was large. The soldier always has a good appetite, and he drank and ate everywhere—in good restaurants and bad, in the numerous lunch-wagons, and at streetcorner stands. Fruits and pies and sweets in enormous quantities were purchased from hucksters lined up along the camp boundaries; they even invaded the company streets, carrying their various sorts of indigestible and infectious products from tent to tent. The best kind of camp sanitation could not keep down typhoid in the presence of all these possible chances of infection, if typhoid existed to any extent among the local population.

"During this period of four months there were reported to the health office 49 cases of typhoid, with 19 deaths, among the civil population of the city of San Antonio, and in Galveston 192 cases were recorded during the same period. These two cities can therefore serve as controls and indicate what might have happened to our troops in the absence of vaccination.

#### AN IMMUNIZED ARMY.

"Aside from the sources of infection in the adjoining cities, we must believe that the men were also exposed to the influence of an unknown number of chronic bacillus-carriers among our own men. There is every reason to believe that among 18,000 men there were one or more carriers in each regiment, yet they spread no disease, and

one of the most important conclusions to be drawn from our recent experience is that in vaccination we have the only effective protection against the elusive carrier."

Complete confidence in vaccination was established by this epoch-making achievement, and, upon the recommendation of the Surgeon General, the Secretary of War ordered, on September 30, 1911, the compulsory vaccination of every person in the army under 45 years of age, and of all recruits. This was carried out as promptly as possible, and, as the result the United States has today an "immunized" army, not a single case of typhoid having thus far been reported among the troops in this country during 1913. This record, compared with that of any year previous to the beginning of vaccination, seems little short of miraculous.

In no other army is anti-typhoid vaccination mandatory, and no other is entirely immunized against the disease. Our navy soon followed the precedent established by the army, and it is today immunized with vaccine prepared in the laboratory of the Army Medical School.

### SOME FIGURES THAT PROVE

In a paper recently read before the Congress of American Physicians and Surgeons in Washington, Major Russell included a table showing the incidence of typhoid in the army in the United States during the period 1903-1913. These statistics were gathered with the utmost accuracy and tell the story in a nutshell:

#### TYPHOID FEVER, U. S. ARMY, IN THE UNITED STATES

	<i>Cases.</i>
Five years prior to 1908 (Average per year) . . . . .	160
Two years after vaccination had begun (year 1911) . . . . .	44
Three years after vaccination had begun (year 1912) . . . . .	18
First nine months of 1913 (latest figures available) . . . . .	0

Since 1908 a prodigious amount of work has been accomplished. The various steps in the production of each dose of vaccine have been as carefully regulated and supervised as though it was to be used upon the President of the United States. Before leaving the laboratory, it is tested upon guinea pigs, and the statistics above quoted show the results of this painstaking care. Large quantities have been furnished to the various government departments, to the militia, and to a number of civil institutions.

As soon as its success was assured the larger drug firms of the country sent representatives to Washington to learn the formula and to study the process of manufacture. The same vaccine is now prepared by these firms and sold to the medical profession of the country at a reasonable rate.

Regarding the act of vaccination itself, an authority states:

"It is quite simple, consisting merely in the subcutaneous administration, with a hypodermic syringe, of a small quantity of the opalescent prophylactic fluid. The syringe is sterilized by boiling, the skin is prepared by painting a place on the arm the size of a quarter, and the immunization is completed by the administering of three doses—the first containing  $7\frac{1}{2}$  drops and the second and third, which are given 10 and 20 days later, 15 drops each. The site of inoculation becomes somewhat red and tender for a day or two, but there is no sore and no scar as in vaccination against smallpox.

"In a small percentage of cases, less than five, there is some headache and prostration, but it soon disappears, rarely lasting more than 24 or at the most 48 hours. In this connection it is necessary to remember that we vaccinate none but the healthy."

The progressive health department of New York city decided to use the typhoid prophylactic as soon as its success was assured by the War Department, and it is



every day being more generally used throughout the country among those who come in contact with the disease or are travelling in areas known to be infected. Miners, campers, contractors, and all who are removed from the safeguards of sanitation in a modern community find it the surest and most convenient means of protection.

### WHAT HAPPENED IN THE RECLAMATION SERVICE.

The United States Reclamation Service decided to use the typhoid prophylactic early in the year among its field force, which is scattered over a large area in the west. It was made compulsory, but circulars were sent to the various camps describing the treatment and the results obtained in the army. One of the circulars contained the following ingenious pronouncement:

Typhoid fever can be prevented.  
You can aid by being vaccinated.  
Prevention beats the physician and the undertaker.  
Healthy persons may have typhoid tomorrow.  
Only those vaccinated or who have had typhoid are immune.  
Immunity lasts three years.  
Don't hesitate. Volunteer today.

Over 500 persons volunteered for the treatment. Shortly after this an epidemic of typhoid fever broke out in the town of Malta, Montana, most of the cases developing in a hotel, where four of the Reclamation Service men were taking their meals. Of these four one had refused to be vaccinated, one had had typhoid fever, and two were immunized by vaccination. The unvaccinated man contracted a severe case of the disease, the other three escaping. The sequence was that the townpeople made arrangements to secure a supply of the vaccine.

The recent illness from typhoid of the third baseman of the Washington baseball team (which resulted, some assert, in the loss of a penant) calls attention to the importance of immunizing all professional baseball players. The vaccination of all school children is especially recommended, as they bear the treatment better than adults.

### SOME PROPER PRECAUTIONS.

As the typhoid bacillus can live but a limited time in water, soil, and other substances, it is obvious that if new pollution is not added from time to time epidemics will be prevented. The general use of the prophylactic will, probably, extinguish the disease, since the vaccination of an entire community absolutely prevents the "carriers" and all others from giving off the typhoid bacilli, and the focus from which new infection would ordinarily radiate is eliminated.

HON. MR. MURPHY: I move a vote of thanks to Dr. Starkey, for his interesting lecture. I am sure we have all profited by it and we hope the public will profit by it as well.

HON. MR. DAVID: I second the motion.

PROF. STARKEY: Thank you very much. I am only too happy to think that I am the slightest use in the matter.

The Committee then adjourned.

