Streptococcus erysipelatis, properly administered, exercises a specific and controlling influence on the course of the disease—preventing its spread, lessening its severity and hastening recovery.

The reason for our faith may be briefly summarized under two main heads:

1. From the standpoint of immunity: The opsonic power of the blood is low during the acute process of the disease and whenever more or less rapid spread is manifest; again, the subsidence of such symptoms as malaise, mental unrest or apathy, pain and tenderness and the localization of the inflammatory area are closely associated with an increased immunity as evidenced by a rise of opsonic power. We are inclined to attach great importance to these considerations of immunity because we have so frequently observed parallel series of events in therapeutic inoculations with bacterial vaccines in many cases of boils, septic hands, tuberculosis of the glands, bladder, etc., and in many other cases of localized bacterial infections.

2. From the standpoint of clinical observation of the course of the disease as apparently influenced by inoculation with our vaccine: Whatever surface becomes involved subsequent to inoculation manifests a less severe form of inflammatory process; mental unrest and physical discomfort are rapidly controlled; pyrexia seems to subside more rapidly and long-continued pyrexia has not been encountered; complications and sequelæ seem to be much less common.

We, therefore, submit that the evidence adduced in this communication is sufficient to justify the use of a vaccine prepared from the *Streptococcus erysipelatis* in the treatment of erysipelas, particularly as there is no recognized remedy for this disease.

TREATMENT

In our series of 50, only the first 16 patients were treated according to the opsonic principles of vaccine therapy, but these revealed such a uniformly satisfactory immunizing response and clinical result that we felt justified in attempting the administration of the erysipelas vaccine without the usual blood examinations; and it seems reasonably certain that in the vast majority of cases of erysipelas it will be unnecessary to be guided by estimations of the opsonic content of the blood to determine either the amount of the vaccine indicated or the appropriate time for reinoculation. We are led to this belief because, having once determined a satisfactory method of administration of the vaccine by the close study of the blood in 16 cases we achieved equally successful results in a series of 34 cases of erysipelas, many of which were severe, without having had recourse to the opsonic index in any case. We are, however, appreciative of the fact that in certain severe cases the usual thorough blood investigation may be required.

If we are right, therefore, in our conclusions that erysipelas vaccine when properly administered is a specific remedy for erysipelas, then the importance of being able to omit the laborious opsonic investigations becomes exceedingly great, for it puts into the hand of every practitioner of medicine a new specific for an exceedingly troublesome affection for which as yet only a multitude of remedies of alleged efficacy is available.

It is entirely unnecessary to prepare a vaccine for each case. It is, however, advisable to have a composite stock vaccine derived from several different strains, from as many different cases. It is probable that the

more virulent the case of erysipelas the more valuable will its streptococcus be as a vaccine.

Our method of treatment has been, in almost every case, to inoculate with 10,000,000 of the devitalized streptococci on the first visit if the case is a severe one, and with 20,000,000 if it is less severe. On the second day in the severe case the patient gets 10,000,000 more if there be signs of improvement. The most important of these signs is a certain clearing of the intellect, and the others are a lessened intensity of the local condition—less tenderness and pain. The temperature is not so satisfactory a guide, although a fall of 2 or 3 degrees on the morning following the injection is a valuable indication for a second inoculation. If, however, no evidence of improvement obtains in the very severe case and it is impossible to determine the opsonic power of the blood, then 5,000,000 only should be administered on the second day. In less severe cases improvement is almost invariably manifest on the day succeeding inoculation and the patient should receive half the first dose: that is, 10,000,000. We then inoculate with 5,000,000, 10,000,000 or 20,000,000 of streptococci on every second day until a week after the temperature has reached normal and the erythema has subsided. We are guided as to the amount of our dose in each case (when opsonic investigations are impossible or unnecessary) by its severity and the satisfactory results as shown by clinical observation. Our rule is: "The more severe the case and the less satisfactory the clinical response the smaller the dose."

The site of inoculation chosen has always been away from the area involved. Our results have been so successful by this method that we have not felt justified in attempting other measures, such as inoculation near the site of infection.

A MILK-BORNE OUTBREAK OF TYPHOID FEVER TRACED TO A BACILLUS-CARRIER

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The city of Washington and the District of Columbia are one. There is but one government, and there are no "city" boundaries except such as prior to 1871 marked the limits of the then existing corporation of Washington. To the westward of the city, across Rock Creek, there was at that time located a smaller, though older, community known as Georgetown. This, like the city of Washington, has long since ceased to exist as a separate corporation and now forms an integral part of the District of Columbia. Officially it is known as West Washington, but in the ordinary speech of either community it is still commonly referred to as Georgetown. For convenience it will be so designated in this paper. The water supply, the sewerage system, the food supply and the laws and sanitary administration of Georgetown are in no way different from those of the rest of the district. The annual police census of 1907, the latest returns available, gave to Georgetown a population of 17,168 and to the remainder of the District of Columbia 312,423, making the population of the whole district 329,591.

EXTENT AND LOCATION OF OUTBREAK

From October 8 to November 1, inclusive, 1908, there were reported in the entire District of Columbia 135 cases of typhoid fever. Of these, 54 occurred among persons residing in Georgetown. The population of Georgetown, about 5 per cent. of the total population, yielded, therefore, about 45 per cent. of all cases, and during this period typhoid fever was over twelve times as prevalent in Georgetown as it was in the remainder of the district. During the twenty-five days preceding October 8 there were reported in the entire district, exclusive of patients brought in from other jurisdictions, 96 cases, only 4 of which were among the residents of Georgetown; and in the twenty-five days immediately following November 1 there were 54 such cases reported in the district, only 2 of which were in Georgetown. The situation is clearly shown by the following table:

STATEMENT SHOWING THE INCIDENCE OF TYPHOID FEVER IN WEST WASHINGTON, COMMONLY KNOWN AS GEORGETOWN, AS COMPARED WITH THE INCIDENCE IN THE REMAINDER OF THE DISTRICT OF COLUMBIA

Period.	No. of Cases. George- town.	Remainder of D. C.	Case Rate per 10,000. George- town.	Remainder of D. C.
Prior to outbreak. Sept. 13, to Oct. 7, 1908....	4	92	2.23	2.94
Period of outbreak. Oct. 8 to Nov. 1, 1908.....	54	81	31.45	2.46
Subsequent to outbreak. Nov. 2, to Nov. 26, 1908....	2	52	1.16	1.66
Population according to the police census of April 10, 1907: Georgetown, 17,168; Remainder of the District, 312,423.				

MILK SUPPLY IN RELATION TO OUTBREAK

A joint investigation of the reported cases by officers of the Public Health and Marine-Hospital Service and of the Health Department of the District of Columbia showed that of the 54 cases occurring in Georgetown during the outbreak 30 were among persons who during the thirty days prior to onset of illness had consumed milk supplied by dairyman A, and 18 among persons who had consumed milk supplied by dairyman B. Of the remaining 6 patients, 2 used milk supplied by dairyman C, 1 used milk rarely and from various sources, 2 used no milk in any way, and 1 used milk supplied by dairyman D and subsequently boiled. No direct connection has ever been found between these 6 cases and the milk sold by either dairyman A or dairyman B. The last-mentioned case occurred, however, in the same household as 2 of the cases which had used milk from dairyman B, and during the two weeks prior to the onset of his illness this patient was in association with the other patients. His infection probably was due to contact.

The milk supply of Georgetown is obtained from certainly more than thirty different dairymen. Dairyman C probably supplies more customers than any other dairyman in Georgetown. He serves 292 households, as against 263 supplied by A and 231 supplied by B, and his delivery route ramifies through the same sections of the city as theirs. Among retail customers A distributes daily about 261 quarts of milk, B about 290 quarts, and C about 525 quarts. As there were during the period of the outbreak but 2 cases reported from households supplied by C, and only 2 cases from households supplied with milk from all sources other than those of A, B and C, it is evident that a disproportionately large number of cases of typhoid fever was occurring among the customers of dairymen A and B in Georgetown. Moreover, during this period there were reported among persons living in sections of the city outside of Georgetown 3 cases among the custom-

ers of A and 2 among the customers of B. (Another case, the onset of which was October 15, was reported among the customers of B on November 16.) The records of the health department showed no cases in households supplied by dairyman A during the entire twelve months preceding this outbreak, and only 7 among the households supplied by dairyman B.

The period of definite onset of illness of the 33 patients supplied with milk by A extended from September 24 to October 22 and of the 21 patients supplied with milk by dairyman B extended from September 24 to October 24. Two cases secondary to those patients supplied with milk by B had their definite onset on October 22. Early in the investigation it became evident that the spread of the infection had occurred along the routes of the two dealers at about the same time, and a common source of infection for the outputs of these two dairies was suspected.

SOURCES OF SUSPECTED MILK

A's supply of milk was received from two dairy farms, one of which, in the District of Columbia, is owned by him and is the location of his dairy. The other was the farm of Mrs. X in Maryland, from which he received about 40 gallons of milk daily. B's supply came from about twenty-two dairy farms located in various parts of Virginia and Maryland. One of these was the farm of Mrs. X, which also furnished a part of A's supply, and from this farm B received 20 gallons daily. Diagrammatically the situation was as follows:

A most careful investigation was made, but no history of suspicious illness could be discovered among those who were concerned in handling the milk at the dairy of A, at the dairy of B, or at any of the farms supplying either A or B with milk. All the facts, however, seemed to point to the farm of Mrs. X as the source of the infection.

About 64 gallons of milk were produced on the farm of Mrs. X daily. About 40 gallons (in cans) went to dairyman A, about 20 gallons (in cans) to dairyman B, and about 4 gallons (in bottles) were sold to eleven families along the road which the wagon traveled on its way to A's dairy. A house-to-house canvass was made of the homes to which milk was retailed by Mrs. X. The eleven families consisted of about fifty-five persons all told. In only one household was any suspicious illness found. Here a mother and two children were sick. The mother took to her bed on October 3 with a high fever. She remained in bed for about eight or ten days, but was not attended by a physician. Her

blood gave a positive Widal reaction when examined at the Hygienic Laboratory on October 16. One child, about 5 years of age, began to complain about October 8, and on October 15 was sick in bed with a temperature of 103.5. His blood on that date gave a negative Widal reaction. The second child, aged about 3, took to bed about October 17. Both children had fever about ten days; in both stomatitis developed a few days after definite onset of fever, and the diagnosis made by the attending physician was "stomatitis." The facts that the onset of the first case was synchronous with the outbreak in Georgetown, and that the patient's blood gave a positive Widal reaction, suggested strongly that this case was typhoid fever whatever the other two cases may have been.

The sanitary condition of the farm of Mrs. X and the way in which milk was handled there were such as not reasonably to preclude infection from reaching the milk (by hands of persons, by flies, etc.) if infection existed on the farm. The dairy-house was located within a few feet of the stable and was not screened. Flies were abundant. The privy was located about fifty feet from the dairy-house. The privy contents went directly on the ground, being partially retained as a heap by a few boards fixed at the back of the privy. Chickens had access to the privy contents and to the yard around the dairy-house, in which milk cans were set. They had access also to the ground around and to the platform over the well from which the farm's water supply was obtained. The well was down hill and about 450 feet from the privy. A few feet from the well was a housed-in spring, and in the spring box the cans of milk were placed to be kept cool. Sand was used for scouring the milk cans and was obtained for this purpose, it was said, from the bed of the stream having its origin in the spring on the place.

Those engaged in milking the cows and handling the milk consisted of Mrs. X, a son, and three hired colored men. In addition to the above there lived on the farm in a house about 1,000 feet from that of Mrs. X and the dairy-house the family of one of the hired men, consisting of a wife and seven children, making on the farm thirteen persons all told. No history of any recent illness among the persons on the farm could be ascertained. The last case of typhoid fever that was known to have occurred on the place was that of a school teacher, who about seven years previously had boarded there. About two or three months after he went to the farm he was taken down with typhoid fever and died. At the time of the investigation the only persons living on the farm who gave a history of ever having had typhoid fever were Mrs. X, who had had it eighteen years before, and one of the employes, who had had it eight years before; but during the attack neither Mrs. X nor the hired man had lived on this farm.

A careful inquiry as to recent sickness on other places in the neighborhood of the farm was made, but no history of any illness could be obtained. As it seemed that there had been no actual case of typhoid fever to account for the infection, and that all the evidence still suggested strongly that there had been infection on this farm, the possibility of some one on the place being a typhoid bacillus carrier suggested itself to us and an investigation with this possibility in view was begun.

DISCOVERY OF BACILLUS-CARRIER

On October 13 specimens of stools and urine from all the persons on the farm were obtained and examined for the presence of the typhoid bacillus. The examinations were made by Passed Assistant Surgeon L. J. Lumsden, assisted by Dr. Walter Cannon, at the Hygienic Laboratory of the Public Health and Marine-Hospital Service. All the specimens were negative for *B. typhosus* except the specimen of feces from Mrs. X. This specimen showed on the Endo plates a large number of colonies typical for growth of *B. typhosus* on this medium. Eleven of these colonies were "fished" and planted in broth tubes. Every one of the eleven colonies proved by subsequent and extensive studies to be of a bacillus which morphologically, culturally and in serum reactions responded typically to all of the tests required to identify it as the typhoid bacillus.

EFFECT OF SHUTTING OFF MILK SUPPLIED FROM FARM OF BACILLUS-CARRIER

The positive finding of the bacillus in the feces was determined on October 16 and on that date the sale in the District of Columbia of milk from Mrs. X's farm was discontinued by order of the health officer. Eight days later, October 24, the last case occurring in the outbreak of typhoid fever among the customers of dairymen A and B had its onset of definite symptoms of typhoid fever.

During the thirty days subsequent to October 24 not a single case of typhoid fever developed among the customers of either of these dairymen, although they continued without interruption to sell milk from all the farms which had been supplying them except that of Mrs. X.

INFECTIVENESS OF BACILLUS-CARRIERS

Unfortunately, Mrs. X so far has declined to submit further specimens for examination, so we can not report now on the persistence of the bacilli in her feces. Her subsequent history in this regard would, of course, throw some light on the question as to whether she is a chronic typhoid bacillus-carrier (and perhaps has been since her attack of typhoid fever eighteen years ago), or whether she was what we may term an acute bacillus-carrier—that is, a person who becoming infected harbors bacilli and discharges them in the excreta for a few days or weeks, and who yet, due to some immunity rendered by previous attack or otherwise, does not have the symptoms of the disease.

If this woman has been a bacillus-carrier since her attack of typhoid fever eighteen years ago it appears somewhat remarkable, since she has been in the dairy-farm business for five years or more, that infection has not sooner reached the milk and caused a pronounced outbreak. Furthermore, the infection, judging by the dates of onset of the cases, seemed to be more or less constantly in the milk for a period of about a month.

One exercising ordinary care as to cleanliness of person, however, as Mrs. X apparently did, would not frequently contaminate directly with fecal matter the milk handled. Then, too, considering the number and duration of the intervals in which the fecal matter of pronounced chronic bacillus-carriers is apparently free of typhoid bacilli, a number of contaminations with fecal matter might be necessary before infection would occur in which organisms alive and virulent, and sufficiently hardy to survive, would be introduced into the milk. If the view is taken that the infection was conveyed to

the milk indirectly through the privy contents, which by means of flies or the feet of the chickens or in any other way reached the milk cans or the water supply, it is still readily conceivable that a number of contaminations of the milk with the excreta might have occurred during the several years previous without causing infection. The contamination of the milk with typhoid bacilli once having occurred, it is readily conceivable that the infection could survive on the dairy utensils, and so more or less constantly infect the milk for some days or even weeks.

SUMMING UP OF EVIDENCE THAT THE OUTBREAK WAS CAUSED BY INFECTION IN MILK

1. There was a sudden onset of a disproportionately large number of cases among the customers of the two dairymen supplying the suspected milk.
2. A typhoid bacillus-carrier was discovered among the persons handling the milk on the only dairy farm supplying both dairymen with milk.
3. There was no occurrence of any unusual number of cases among persons living in the same sections of the city as those affected but receiving milk from other sources.
4. There was no occurrence of an unusual number of cases in sections of the city other than those supplied with the suspected milk.
5. Most of the cases occurred among well-to-do persons, and among those who used milk freely, women and children principally being affected. Thus of the 54 patients there were, among those who used milk as a beverage, 30 cases; among those who used it on fruits and cereals freely 20, among those who used it in coffee only 2, and of those who used it as ice cream only 2. There were 15 instances in which the members of the household who used milk freely were affected, while those who used none or used it more sparingly, escaped.
6. Many of the cases had a sudden onset of definite symptoms without recognizable prodromes, and many ran a mild course.
7. All other known possible factors were eliminated as cause common to any considerable number of the cases.
8. The outbreak suddenly ceased ten days after the suspected milk supply was shut off, although all the other suggested possible factors continued, so far as could be learned, about as they were before and during the outbreak.

LESSONS TAUGHT BY OUTBREAK

Had dairymen A and B pasteurized their supply of milk before delivering it to their customers, the infection in the milk received from the dairy farm would have been destroyed and this outbreak of typhoid fever would not have occurred.

Had the sanitary arrangements been perfect on the farm of Mrs. X, and had much greater care been exercised there in handling the milk, the infection might not have reached the milk.

The possibility that there may be typhoid bacillus-carriers among persons handling milk, and the liability that these carriers may get infected excreta on their hands from time to time, should be considered in determining if any degree of cleanliness less than absolute surgical cleanliness would be sufficient to safeguard milk from infection.

To enforce officially such extreme care in the handling of the milk supply of a large city would be a difficult, if

not an impracticable task, while official supervision of the pasteurization of the milk supply of a large city, if done at distributing depots, would be entirely practicable, much less expensive, and a more nearly certain safeguard against infection.

THE RATE OF COOLING OF SEVERAL POULTICE MASSES *

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The value of poultices for most purposes being proportional to their retention of heat, it appeared desirable to compare the rate of cooling of several poultice masses. A comparison of the easily prepared linseed poultice and the official clay poultice, cataplasma kaolini, seemed particularly desirable and these were controlled most carefully.

Experiments with small quantities in large test-tubes proved unsatisfactory, and the following disposition, suggested by Dr. Söhlmann, was finally adopted:

The poultice masses were placed in bottles measuring 6 by 14 cm. to a depth of 9.5 cm. A thermometer was supported in each bottle by a cork. The bulb of the thermometer was adjusted 2.5 cm. from the bottom and 2.75 cm. from the sides. The bottle of cataplasma kaolin was heated in a boiling water bath and when a temperature of 70 to 80 degrees C. was reached the bottle of freshly-prepared hot linseed poultice mass (one part of ground linseed added to two and one-half parts of boiling water) was placed in the same bath. When the mixtures attained a fairly constant temperature, 94 to 98 degrees, they were transferred to a second large but shallow water bath, 2 to 2.5 cm. in depth, kept at 37 to 40 degrees C. The parts of the bottles above the level of the water were wrapped in cotton. This arrangement was thought to approach as nearly as possible the conditions of the poultices when applied to the body. The temperatures were recorded at ten-minute intervals until the temperature of the bath was reached. Three sets of experiments were made, two bottles of each specimen being used in each experiment. Between 85 and 95 degrees the linseed mixture swelled considerably, forcing a small quantity from the bottle, which had to be removed in order that the thermometer might be accurately placed. When the mass cooled a depression was left in the center, which brought the thermometer bulb nearer the surface than in the other mixtures and might have caused an apparent increase of the rate of cooling of the linseed mass.

In another set of experiments the difference in the rate of cooling at the surface and at the center was observed by placing two thermometers in jars measuring 18 by 17 cm. A central thermometer, as in the previous experiment, was placed with the bulb 2.5 cm. from the bottom and equidistant (2.75 cm.) from the sides, and a second, or "outer" thermometer 1.25 cm. from the sides of the jar. The mixtures in the bottles were 8 cm. in depth.

As the two thermometers ran practically parallel with a difference of but 1 or 2 degrees, these experiments, five in all, are classed with the previous experiments.

The results were plotted in curves in which the

* From the Pharmacological Laboratory of Western Reserve University.

* Read in the Section on Pharmacology and Therapeutics of the American Medical Association, at the Fifty-ninth Annual Session held at Chicago, June, 1908.