with a strong full pulse and high tension, at other times the pulse was weak and irregular. The respiration was apparently not affected except in the very severe early attacks when there was some dyspnea and the breathing was at times labored, at others shallow. The first attacks were sudden, spontaneous and unassociated with any exertion or effort of any kind, mental or physical, and there was no digestive disturbance. Later there was considerable digestive disturbance, which generally aggravated the attacks.

This patient has never had any physical signs of cardiac or vascular disease. Before the onset of the anginal attacks an oculist found it impossible to fit her with glasses, saying that there was a spasmodic condition of the blood-vessels of the retina, which so affected the eye that glasses satisfactory one day were unsatisfactory and had to be changed the next. This angina was, I believe, functional and of nervous origin, but I cannot explain the connection.

Angina due to tobacco, alcohol, tea, coffee, malaria, influenza and other infectious diseases, the so-called toxic form, is rare, and can be diagnosed usually from the history of the case. Every year several cases due to excessive cigarette smoking are seen in the Emergency Hospital Chest Clinic. The onset in these cases is spontaneous as a rule and the pain not so severe, but distinct. The attacks frequently and usually last several hours and are associated with cardiac dilatation, arrhythmia, tachycardia and palpitation.

The diagnosis of organic angina is plain when, given a history of anginal attacks in an elderly individual, there are present also any physical signs of cardiac or arterial disease, especially aortitis or aortic insufficiency, and when there is also a history of syphilis in earlier life; but when there is no evidence of any change in the heart and arteries, one must rely on the history of the case, the character of the attack, the exciting cause, the onset, the duration, the appearance of the patient, the presence or absence of vasomotor symptoms or associated symptoms. Even then there will sometimes be great difficulty in deciding and autopsy sometimes proves an organic angina when there were no physical signs of cardiac or vascular disease, but observation will accomplish a great deal and time proves much.

The Wyoming.

A STUDY OF THE CONVALESCENT CARRIERS OF TYPHOID *

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The reason for the study of this subject is the well-known menace of typhoid carriers to the community. The following observations were made on patients during convalescence, just before discharge from the hospital, to ascertain what proportion were carriers at that time.

In making the investigation, the feces, urine, saliva, and, in male patients, the prostatic fluid, were examined. The examination of the latter fluid was suggested to us by the report of Marchildon,¹ founded on two cases of typhoid prostatitis and seminal vesiculitis at autopsy.

* From the laboratory of the City Pathologist of St. Louis.

* Read before the Fulton County Medical Society, Atlanta, Ga., Nov. 10, 1911.

1. Marchildon: Am. Jour. Med. Sc., July, 1910; abstr. in THE JOURNAL A. M. A., July 23, 1910, p. 340.

In addition to the routine examination mentioned above, we thought it advisable to study the blood in typhoid convalescents. This study, taking into consideration the opsonic index, Widal reaction, the white blood-cell and differential count, was made in order to determine their relation, if any, to the carrier.

PREVIOUS REPORTS ON CARRIERS

A great deal of attention has been drawn to carriers in recent years from the fact that so many epidemics have been definitely traced to them. They were generally of the food-purveying or food-preparing classes.

Horton Smith, in his Gouldstonian lectures in 1900, was the first to suggest the advisability of studying the excretions of ex-typhoid patients as a possible cause of outbreaks of epidemics. Because of the great suffering of the victims and the many deaths among them, the carrier becomes a terrifying, although an unintentional, enemy of society.

Park,² basing his conclusions on the investigation of fifty-two patients examined eight months after recovery, thinks that 2 per cent. of all typhoid patients become chronic carriers.

Frosch³ gives a tabulation of 6,708 cases, in which 310, or 4.62 per cent., continued to excrete bacilli for over ten weeks after recovery.

Graham Overlander and Dailey⁴ found bacilli in the feces of eleven, or 16.9 per cent. of sixty-five patients, ten days previous to their discharge from the hospital.

Semple and Greig found that 11.6 per cent. of eighty-six typhoid convalescents discharged typhoid bacilli in their feces for over six weeks.

Klinger⁵ was able to trace to their source 1,397 cases, or 36 per cent. of the entire number of cases investigated. In 1,272 cases the typhoid convalescent carrier was found to be the cause, and in 125 cases, the healthy carrier. Considering all patients as chronic carriers in whom the bacillus had been demonstrated for at least three months, it is found that out of 431 carriers, 211 were temporary and 220 chronic carriers. In thirty of the chronic carriers, cholecystitis was present. The ages of the carriers in the two classes were also markedly different; the temporary carriers were mostly young; the chronic, old or middle-aged. This class also contained many weakly individuals and twenty-five lunatics. Of 222 chronic carriers, thirty continued to pass bacilli for six months, fifty-five for a year, sixty-four for two years and eighty-one for four and one half years. Post-mortem examinations were made on three of ten chronic carriers; the supposition that the gall-bladder was the breeding-place of the bacilli was confirmed.

In 1902, Conradi and Von Drigalski found typhoid bacilli in the stools of persons who had not had the fever, but had been in contact with people who had the disease. Roscoe⁷ reports an outbreak of twelve cases in an insane hospital, due to contact with a carrier who had never had typhoid.

Davies⁸ found that in five of seven examinations of the feces of a carrier, no bacilli were found, and of these, four were successive from January 20 to March 14,

2. Park: THE JOURNAL A. M. A., Sept. 19, 1908, p. 981.

3. Frosch: Klin. Jahrb., Jena, 1908, xix, 537.

4. Overlander, G., and Dailey: Boston Med. and Surg. Jour., Jan. 14, 1909, p. 38.

5. Klinger: An Epidemic in South Germany, Translation and Review by Captain Black, Jour. Roy. Army Med. Corps, January, 1910.

7. Roscoe: Lancet, London, 1909, xvii, 1137.

8. Davies: Proc. Royal Soc. Med., 1908, epidemiologic section, p. 224.

1911, indicating the intermittency of the excretion of typhoid bacilli by carriers.

Kayser⁹ reports that in Strasburg, during the years of 1901 to 1905, 13.5 per cent. of all cases of typhoid were traced to six typhoid carriers, all of whom were women and gave histories of having had typhoid from one to twenty-seven years before.

OPSONINS

Gachtgens¹⁰ has found that the opsonic index returns to normal in a few months after typhoid, unless the person becomes a chronic carrier, in which case it remains high. Hamilton,¹¹ following the suggestion of Gachtgens, tested the opsonic indices of seven carriers having gall-bladder disease, and found high opsonic indices. Stone¹² says: "During convalescence and afterward the opsonic index is relatively high. During the first few weeks of the fever the index is increased to 1.5 to 3.5. There is generally a slight decline during convalescence, but high indices may be obtained during this time. A high index, from 2 to 3, is as a rule persistent for months after an attack."

AGGLUTININS

It is generally understood that during the second or third week of typhoid fever the agglutinins are increased so that, on an average, the serum will agglutinate typhoid bacilli in dilutions of 1 to 50, 1 to 100 or 1 to 200, sometimes as high as 1 to 400. Stone¹² states that after the decline of the disease a rapid decrease of agglutinins ensues, the average being 1 to 60 or 1 to 80, and that for a few months to one year or longer this value remains low at about 1 to 40 or 1 to 60. Leishman and Harrison,¹³ quoted by Stone, however, refer to one patient whose serum, six months after recovery, agglutinated the typhoid bacillus in dilutions of 1 to 1,000.

LEUKOCYTES

The leukocytes in typhoid, as a rule, are decreased after the first few days. The leukocytes have been thoroughly studied by O. Nageli. His conclusions, as quoted by Sahli,¹⁴ are as follows:

First stage or ascending fever curve: Usually a neutrophilic leukocytosis which soon diminishes, eosinophils entirely or almost absent. Moderate diminution of lymphocytes.

Second stage: Neutrophils and lymphocytes diminished still farther; lymphocytes may be somewhat increased toward the end of fastigium.

Third stage or remission: The lymphocytes are frequently increased and sometimes decidedly so; the neutrophils are diminished; the eosinophils are beginning to reappear. In adults the lymphocytes may remain few in number.

Fourth stage or descending fever curve: The neutrophils are more diminished. Lymphocytes considerably increased; eosinophils are increased.

After the fever disappears, neutrophils increase, the lymphocytes are very abundant, and the eosinophils increase.

In convalescence after typhoid a high percentage of lymphocytes is thought to exist; the opsonic index and the agglutinating power of the serum vary considerably. This, then, is the question: Do a very large number of

lymphocytes in the differential count, a leukopenia or high opsonic index and agglutination on the part of the serum have any relation to the carrier at the time of his discharge from the hospital, or do these depend on the length or severity of the disease or some other factors? This we are trying to determine.

GENERAL SURVEY AND TECHNIC EMPLOYED

In this series of cases we endeavored to examine every excretion and secretion which could be expected to contain typhoid organisms and which, in any way, could be excreted and thus get into the outside world and be a source of infection.

Each patient was examined at least twice, some more frequently, and, although examinations were made in more cases than we present here, we record only the cases that were proved to be typhoid by laboratory methods.

Different mediums were tried out. We were accustomed to the malachite green, Conradt's, von Drigalski's and that of Endo, but were more or less disappointed and dissatisfied with the use of these mediums, as they depend entirely on the color reaction. So finally, our preliminary plating was done on the semisolid Hesse medium as modified by Stokes and Hachtel,¹⁵ which gives good color reaction and the evidence of motility. This worked beautifully, a colony of typhoid bacilli giving a pale pinkish large colony, while the colon was usually small and always a deeper red.

This medium also has its disadvantages. The motile colon bacillus is hard to differentiate by this medium, so further tests have to be carried out. Other confusing organisms are the *Bacillus pyocyaneus*, *Bacillus alkaligenes* and *Bacillus proteus vulgaris*. Of course, all cocci and non-motile bacilli give very small colonies, and the above bacilli, except the *proteus*, give large, rather bluish colonies, instead of the large pinkish ones which the typhoid bacillus exhibits and are consequently largely eliminated by the plating with the semisolid, colored, sugar medium. After studying our tables and results, however, we have concluded that although for urine and prostatic fluids we prefer the semisolid medium, for the examination of feces which contain large numbers of various motile bacilli, we could use a solid medium, such as the Endo, to better advantage. Although, personally, we found that this medium was best adapted for our purposes in the urine, saliva and prostatic fluids, we are free to admit that to make any of the differential mediums useful, one must gain experience in interpreting that particular reaction of the organism studied on the medium employed.

To test out the organism further it was stained by Gram's method and grown in glucose-agar stab, litmus milk, milk, bouillon, potato and for the indol reaction; getting typical characteristics in all of these tests, we finally determined the agglutinability of it by an immune serum typhoid. This, of course, necessitated a large amount of work, taking into consideration the number of examinations made. Occasionally, feces or urine of typhoid patients obtained during the course of the disease, were examined as a control for our methods.

We examined the prostatic secretions of nineteen convalescents; four of the male patients were not examined because bacilli were found in the urine at the time of their release from the hospital. One left the hospital before notifying us and two were under 6 years of age. In one case, we isolated the paratyphoid A from the

9. Kayser, quoted by Park: THE JOURNAL A. M. A., Sept. 19, 1908, p. 981.

10. Gachtgens: Deutsch. med. Wchnschr., 1900, xxxv, 1337.

11. Hamilton: THE JOURNAL A. M. A., Feb. 20, 1910, p. 704.

12. Stone: THE JOURNAL A. M. A., Oct. 10, 1909, p. 1253.

13. Leishman and Harrison, quoted by Stone: THE JOURNAL A. M. A., Oct. 10, 1909, p. 1253.

14. Sahli: Treatise on Diagnostic Methods of Examination, 1906, p. 46.

15. Stokes and Hachtel: Arch. Int. Med., 1910, vi, 121.

prostatic secretion. It is noteworthy also that we had previously isolated the bacillus from the blood (Case 3, Table 1). This patient gave a negative Widal for typhoid bacillus up to the time of his vaccination by the killed typhoid organisms, which his clinician deemed wise to give him because of a prolonged convalescence. After the vaccination the Widal test was positive.

As a harboring place for bacilli, we think the prostate gland deserves consideration. It is in such position and so constituted anatomically, as to be a feeder of bacilli to the urine. Some cases of chronic prostatitis might be traced to such organisms of hematogenous origin.

The fact that 20.5 per cent. of the patients examined were carriers does not prove that these people are chronic carriers by any means; but it does prove that a large number of people left this hospital as carriers.

In summing up our results, we feel quite certain that some of the patients were excreting bacilli in their feces, although bacilli were not discovered. We judge this

was used in this opsonic determination with unheated serum.

The average length of the disease in the seven carrier cases was seventy days; that in the twenty-seven non-carrier cases was seventy-two days.

The average leukocyte count in the carrier cases was 7,742; in the non-carrier cases, 7,844. The large lymphocytes in the carrier cases averaged 20.2, while those of the non-carrier cases averaged 12.6, or a difference of 7.6 per cent.; while the small lymphocytes in the carrier cases averaged 22.18, and those of the non-carrier cases, 35.1. In the carrier cases three serums would not agglutinate stock culture of typhoid in dilutions of 1 to 50; one was positive in 1 to 400, both to typhoid and to paratyphoid A. Another was positive in 1 to 100 dilution and two in 1 to 50. Six of the twenty-seven non-carrier cases were negative in dilutions of 1 to 50; two were positive in dilutions as high as 1 to 400; eighteen were positive in lower dilutions and one was not tested.

TABLE 1.—CARRIER CASES

Case No.	Sex	Age	Color	Duration of Disease (Days)	Leukocyte Count.	Differential Count						O. I.	Feces	Urine	Saliva	Prostate	Gall-Bladder	Widal of Convalescence	Laboratory Diagnosis Confirmed	Remarks
						P.	S. L.	L. L.	E.	M. C.	T.									
1	M.	22	W.	56	8,600	65.5	12.5	21.5	0*	0	0	8.3	—	+	—	0	..	— 1/50	Widal.	Paratyphoid A blood culture. Paratyphoid A prostate.
2	M.	17	W.	51	9,000	45.5	25.5	27.5	0.7	0	0	3.6	—	+	—	0	..	— 1/50	Widal.	
3	M.	17	W.	91	6,000	58.5	22.5	18.5	0	0	0	2.5	—	+	—	+	..	+ 1/400	Blood culture.	
4	M.	35	W.	45	8,000	53.6	35.0	9.3	2.0	0	0	7.0	—	+	—	0	..	+ 1/100	Blood culture.	Organism found in saliva with mixed bronchial mucus.
5	M.	33	W.	120	8,000	49.7	31.5	18.5	0	0	0	7.5	—	—	+	—	..	+ 1/50	Blood culture.	
6	F.	20	W.	71	6,000	56.8	16.8	25.0	0	0	0	4.3	—	+	—	..	..	— 1/50	Blood culture.	
7	M.	28	W.	60	8,000	61.5	11.5	20.5	3.0	2.5	0	4.3	—	+	—	0	..	+ 1/50	Blood culture.	
				70+	7,742	55.8	22.18	20.2	0.8	0.3	0	5.3	—	—	—	—	—			Averages.

because the bacilli were isolated but once from the feces (Case 1, Table 3), while we isolated the bacilli from five urines, the prostatic fluid of one patient and the saliva mixed with bronchial mucus of another; also because the blood-findings in several of the negative cases were very similar to those in the cases of patients proved to be carriers.

Therefore we have arrived at the conclusion that the feces contain too many motile organisms to permit the use of the semisolid medium successfully for the detection of typhoid bacilli. When such material is examined, even though diluted, there are always innumerable motile bacilli which tend to fill up the plate with large colonies and the detection of the typhoid bacillus is made much more difficult.

We think our results justify us in suspecting that the opsonic index is high in persons who are carriers when they leave the hospital. The average index of our carriers is 5.5, while of twenty-one others who are not carriers, the average was 1.97. The highest index of the carriers was 8.3, and the lowest 2.5. The highest index of the non-carriers was 8, and the lowest was 0.1. There was only one other up to 5. The other non-carriers were quite low; one laboratory stock culture

GALL-BLADDER AND POST-MORTEM CASES

Post-mortem examinations of four typhoid patients who died in the various stages of the disease were made. All had typhoid bacilli in their gall-bladders (see Cases 2, 3, 4 and 5, Table 3). One cholecystitis patient gave a pure culture of typhoid bacilli, and was found to be a carrier at operation. The bile contained a pure culture of typhoid bacilli. Bacilli had been isolated from the feces previous to the operation. He had had typhoid fever seven years previously. His opsonic index was low, 0.9, but he was suffering, at the time, from peritonitis following the operation. The large mononuclear leukocytes were increased in this case to 23 per cent.; polynuclears were 60, small lymphocytes 16, and transitionals, 1. The leukocyte count varied from 13,000 to 17,000. The Widal reaction was negative in dilutions of 1 to 50 for his own bacilli and for stock cultures. Two blood-cultures were negative for typhoid (see Case 1, Table 3).

It seems to us that all typhoid convalescents should be examined before leaving the hospital, and if found to be carriers, should be asked to return from time to time for reexamination. They should also, in our opinion, be carefully instructed as to how dangerous they are to

The armies of the world, especially those of England and the United States, have proved beyond question the efficacy of vaccination against typhoid and the harmless-

ness to the individual of the operation. If we profit by the success of our experience of vaccination against small-pox and make typhoid vaccination compulsory also, for the good of the whole people, typhoid fever will be a thing of the past and the typhoid carrier will cease to be a menace in civil life, as he has about ceased to be in army life. Until that time comes, as we firmly believe it will come, we wish here to urge that the carrier question be one that is carefully considered and that examination of out-going patients be a routine procedure, as well as the subject of reëxamination; only

Case No.	Sex	Age	Color	Duration of Disease (Days)	Leukocyte Count.	Differential Count						O. I.	Feces	Urine	Saliva	Prostate	Gall-Bladder	Widal of Convalescence	Laboratory Diagnosis Confirmed	Remarks
						P.	S. L.	L. L.	E.	M. C.	T.									
1	M.	23	W.	58	9,000	50.8	32.0	4.7	0.5	0	0	2.2	—	—	—	0	—	+ 1/50	Blood culture.	Typhoid vaccine during convalescence. Typhoid vaccine during convalescence.
2	M.	40	W.	59	8,800	47.2	47.2	1.5	4.0	0	0	0.1	—	—	—	—	—	+ 1/100	Widal.	
3	M.	22	W.	40	9,000	37.6	57.0	4.0	1.3	0	0	0.37	—	—	—	—	—	+ 1/100	Widal.	
4	M.	34	W.	75	8,800	48.5	45.0	0.75	5.6	0	0	0.65	—	—	—	—	—	+ 1/50	Widal.	
5	M.	18	W.	48	5,200	36.0	25.3	35.5	0.0	2.3	0	2.3	—	—	—	—	—	+ 1/50	Blood culture.	
6	F.	18	W.	05	10,000	59.8	10.9	18.0	4.0	0	0	3.0	—	—	—	0	—	+ 1/50	Blood culture.	
7	M.	13	W.	58	0,500	56.0	35.6	7.0	0.0	0	0	2.8	—	—	—	—	—	+ 1/50	Widal.	
8	M.	22	W.	07	3,200	61.4	21.6	10.0	0.0	0	0	0	—	—	—	—	—	+ 1/50	Widal.	
9	M.	5	W.	127	9,000	61.8	12.9	24.7	0	0	0	2.4	—	—	—	0	—	+ 1/200	Widal.	
10	F.	21	W.	78	8,800	41.5	20.5	31.0	1.0	0	0	5.0	—	—	—	0	—	+ 1/50	Widal.	
11	M.	35	W.	55	0,800	39.5	40.5	10.5	2.0	0	0	0	—	—	—	0	—	+ 1/200	Widal.	
12	M.	25	W.	59	14,000	58.0	10.0	31.0	1.0	0	0	1.1	—	—	—	—	—	+ 1/100	Widal.	
13	F.	12	W.	49	0,000	32.5	30.3	27.0	1.0	0	0	1.6	—	—	—	0	—	+ 1/50	Widal.	
14	F.	21	W.	49	0,400	54.5	38.9	5.4	0	0	1.2	0.46	—	—	—	0	—	+ 1/200	Widal.	
15	M.	10	W.	81	10,000	54.7	21.0	23.0	1.0	0	0	0.39	—	—	—	—	—	+ 1/50	Widal.	
16	M.	28	W.	35	8,600	67.0	26.0	1.7	5.3	0	0	1.1	—	—	—	—	—	+ 1/400	Blood culture.	
17	M.	13	C.	150	7,000	45.5	38.5	10.0	4.0	1.5	0	1.6	—	—	—	—	—	+ 1/400	Widal.	
18	M.	20	C.	76	4,000	47.5	30.8	10.8	3.5	0	1	2.0	—	—	—	—	—	+ 1/100	Blood culture.	
19	M.	15	C.	84	8,000	67.0	21.0	7.0	5.0	0	0	2.6	—	—	—	—	—	+ 1/100	Blood culture.	
20	M.	21	W.	66	8,000	57.0	32.0	10.0	1.0	0	0	0	—	—	—	—	—	+ 1/50	Blood culture.	
21	M.	18	W.	150	8,000	62.8	28.5	8.5	0	0	0	2.0	—	—	—	—				

Case No.	Sex	Age	Color	Duration of Disease (Days)	Leukocyte Count.	Differential Count						O. I.	Feces	Urine	Saliva	Prostate	Gall-Bladder	Widal	Laboratory Diagnosis Confirmed	Remarks
						P.	S. L.	L. L.	E.	M. C.	T.									
1	M.	40	W.	12	13,000 to 17,000	60	14	23	—	—	1	0.9	+	0	0	0	+	Widal negative.	Blood culture negative.	Typhoid seven years previous; cholecystitis on entering hospital; died 36 hours after operation.
2	M.	40	W.	26	—	—	—	—	—	—	—	—	0	0	0	0	+	0	0	
3	M.	17	W.	38	—	—	—	—	—	—	—	—	0	0	0	0	+	Widal positive.	Blood culture negative.	Died on thirty-eighth day, with complication of pneumonia.
4	M.	30	W.	15	—	—	—	—	—	—	—	—	0	0	0	0	+	0	0	Died on fifteenth day, of hemorrhage.
5	F.	18	W.	43	—	—	—	—	—	—	—	—	0	0	0	0	+	0	0	Died on forty-third day, apparently of exhaustion.

in this way shall we be doing our duty in the prophylaxis of typhoid epidemics.

That this may be done thoroughly, we believe that the saliva, urine and feces and, of all male patients, the prostatic secretion should be examined.

CONCLUSIONS

- 1. A large percentage of typhoid convalescents leave the hospital as carriers.
- 2. The gall-bladder is the harboring place of the bacilli which are excreted in the feces.
- 3. The prostate gland is a factor to be considered in the male, as it excretes bacilli into the urine.
- 4. People may expectorate typhoid bacilli.
- 5. Hesse's semisolid medium, as modified by Stokes and Hachtel, may be used to advantage for the examination of urine and prostatic secretions.
- 6. The solid color-reaction mediums are better adapted for stool examinations, because of the large variety of motile organisms contained in the stools.
- 7. The leukocyte count of carriers is normal, averaging 8,000.
- 8. The opsonic index and percentage of large mononuclear leukocytes were increased in our series of cases.
- 9. The agglutination of typhoid bacilli on the part of the serum in convalescents from typhoid or in the chronic carrier bore no relation to the carrier.

We are much indebted to Dr. D. L. Harris, under whose direction and through whose courtesy this work was done. Dr. Harris also suggested the carrying out of the differential leukocyte count during convalescence.

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STREPTOCOCCUS VACCINES IN SCARLET
FEVER PROPHYLAXIS *

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Much has been written concerning the cause of scarlet fever during the past two decades and a vast amount of research has been pursued in order to ascertain a possible etiologic agency for the disease.

In spite of the writings and the necessarily preceding researches our knowledge is essentially the same as when the studies were first undertaken. In practically all of the work one organism has sooner or later been encountered by all workers, the streptococcus. A few seem to consider this to be a sufficient cause, but the majority look on it as a secondary infecting organism. More are probably inclined to consider the peculiar bodies described by Mallory and named by him *Cyclaster scarlatinalis* to be an adequate explanation of the various phenomena. However this may be, we must decide that at present the cause of the disease is not definitely known.

Recognizing the almost constant association of the streptococcus with scarlet fever, a Russian, Gabritschewsky,¹ conceived the idea of treating the disease as though it were in truth a streptococcus infection. This method as described consists in the administration of broth cultures of streptococci in doses of about 0.5 c.c. previously killed by heat and phenol (carbolic acid). These doses are repeated in about a week. After using

* After this communication was written, at about Christmas time, one nurse, who had received three inoculations of a stock streptococcus vaccine, made from several strains not coming from scarlet fever cases, contracted a mild case of the disease.

1. Centralbl. f. Bakteriol., 1906, xii, 719.

the vaccine in about 700 cases he concluded that it has a decided value from a prophylactic standpoint and that the method deserves further study. A number of his fellow countrymen did pursue the matter further and with similar conclusions, but outside of Russia the subject seems to have received scant attention as far as practical investigation is concerned.

Influenced by this article I decided to give to the theory a practical test in actual work. About four years ago the Haynes Memorial Hospital for Contagious Diseases was opened as a department of the Massachusetts Homeopathic Hospital, with accommodation for about 150 beds. Among others, wards were reserved for the exclusive use of scarlet fever patients. These wards have been continuously occupied to a varying degree since, sometimes containing from fifty to seventy-five patients and at others falling as low as ten or fifteen, dependent on the prevalence of the disease in the community.

The addition of the contagious department brought new problems for the training-school, as in this were 110 nurses who had enrolled themselves as pupils without planning for contagious work and often not desiring it. In connection with scarlet fever the problem was only

TABLE SHOWING EFFECT OF STREPTOCOCCUS
IMMUNIZATION OF NURSES

Year	No. Non-Immune Nurses	Receiving Vaccine	Not Receiving Vaccine	Contracted Disease				
				Receiving Vaccine		Not Receiving Vaccine		In Favor of Vaccine
				No.	Per Cent.	No.	Per Cent.	
1910....	21	10	11	1	10.0	2	18.0	8
1911....	15	11	3*	0	0.0	3	100.0	100
	36	21	14*	1	2.7	5	35.7	31

* Incomplete immunization in one case.

with the smaller number, those who had never previously contracted the disease, as the others were, of course, practically immune. Very little difficulty was encountered in spite of the fact that many of these non-immunes contracted the disease. At the end of two years more than 35 per cent. of such non-immunes had been thus afflicted.

It was then suggested that this Russian idea of immunization be tested and with the hearty cooperation of Dr. Mann, the superintendent, it has been carefully followed for two years. The object of this paper is to give the results. Each year's results will first be given separately and then both will be combined.

In the first place cultures were made from a number of throats of scarlet fever patients and many strains of streptococci were isolated. These were combined in the manufacture of a polyvalent vaccine standardized at five hundred million per cubic centimeter. The project was then explained to all the nurses interested and they were allowed to choose the vaccine treatment or to reject it as they preferred.

In 1910 twenty-one non-immune nurses, those who had never contracted the disease, went on duty in the scarlet fever wards. Of these, ten took the treatment, eleven did not. In 1911, fifteen performed similar duties. Of these, eleven received vaccines and three did not. One received a single dose the day she went on