

**A plea for larger doses of antitoxin in the treatment of diphtheria / by John McCollom.**

**Contributors**

McCollom, John Hildreth.  
Francis A. Countway Library of Medicine

**Publication/Creation**

Boston : Municipal Printing Office, 1900.

**Persistent URL**

<https://wellcomecollection.org/works/kmu76y6s>

**License and attribution**

This material has been provided by This material has been provided by the Francis A. Countway Library of Medicine, through the Medical Heritage Library. The original may be consulted at the Francis A. Countway Library of Medicine, Harvard Medical School. where the originals may be consulted. This work has been identified as being free of known restrictions under copyright law, including all related and neighbouring rights and is being made available under the Creative Commons, Public Domain Mark.

You can copy, modify, distribute and perform the work, even for commercial purposes, without asking permission.



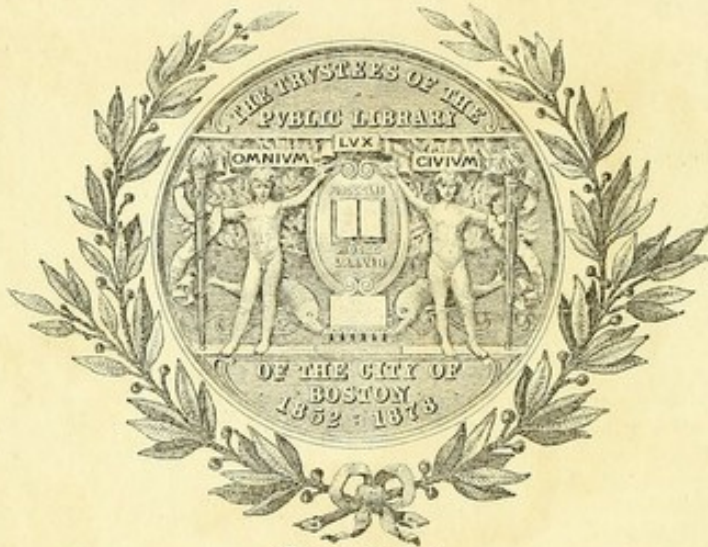
Wellcome Collection  
183 Euston Road  
London NW1 2BE UK  
T +44 (0)20 7611 8722  
E [library@wellcomecollection.org](mailto:library@wellcomecollection.org)  
<https://wellcomecollection.org>



11.20.35

PROPERTY OF THE  
PUBLIC LIBRARY OF THE  
CITY OF BOSTON,  
DEPOSITED IN THE  
BOSTON MEDICAL LIBRARY.

No 3793.33

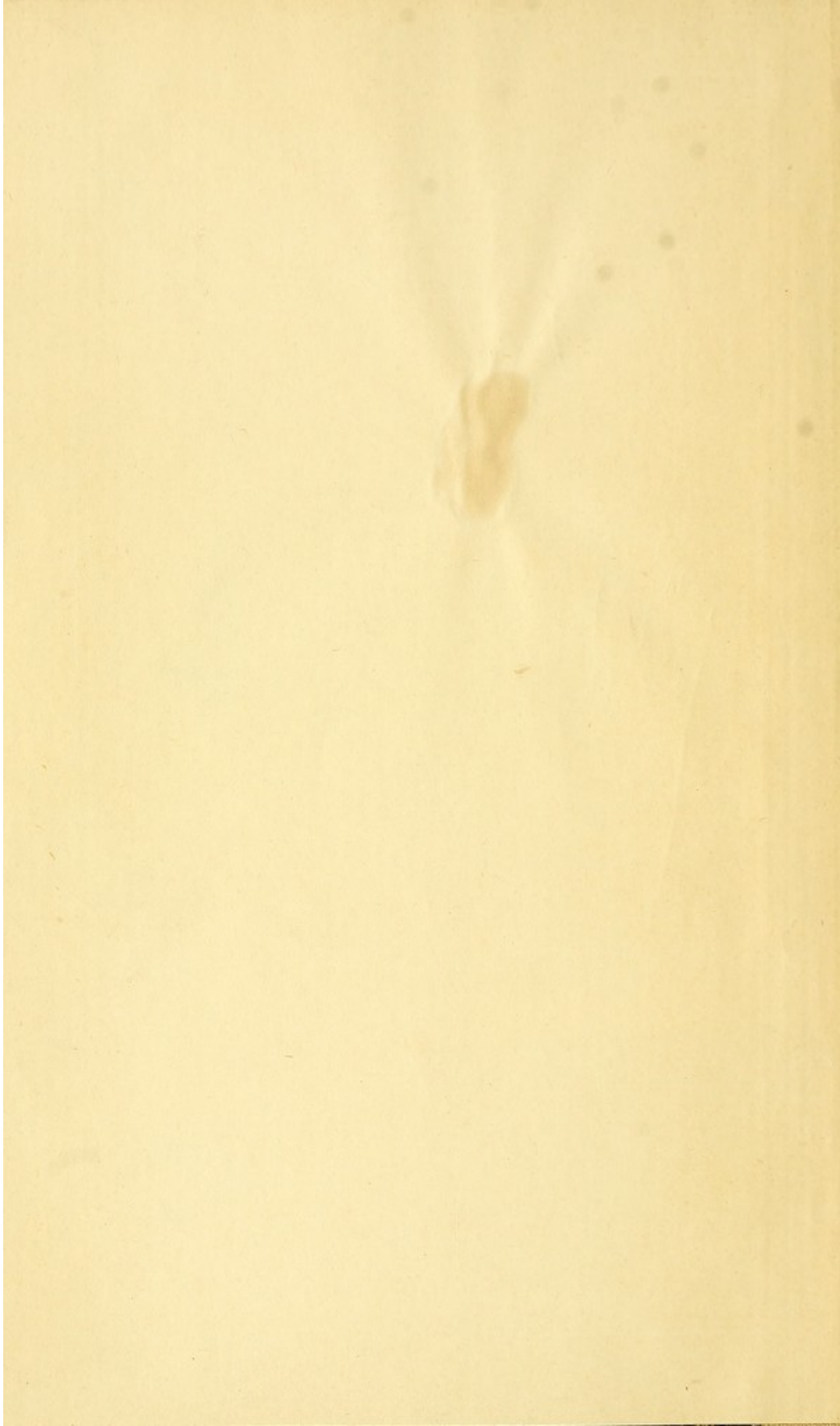


GIVEN BY

Dr. John H. McCallum,

1902

K NOV 18



A PLEA  
FOR  
LARGER DOSES OF ANTITOXIN  
IN THE  
TREATMENT OF DIPHTHERIA

3793.33

BY  
JOHN H. MCCOLLOM, M.D.

INSTRUCTOR IN CONTAGIOUS DISEASES HARVARD UNIVERSITY, MEDICAL DEPARTMENT  
RESIDENT PHYSICIAN SOUTH DEPARTMENT, BOSTON CITY HOSPITAL

REPRINTED FROM MEDICAL AND SURGICAL REPORTS, BOSTON CITY HOSPITAL, 1900

---

BOSTON  
MUNICIPAL PRINTING OFFICE  
1900

ACK SENT.  
MAY 3 1901

A PLEA  
FOR  
LARGER DOSES OF ANTITOXIN  
IN THE  
TREATMENT OF DIPHTHERIA

BY

JOHN H. MCCOLLOM, M.D.

INSTRUCTOR IN CONTAGIOUS DISEASES, HARVARD UNIVERSITY, MEDICAL DEPARTMENT  
RESIDENT PHYSICIAN SOUTH DEPARTMENT, BOSTON CITY HOSPITAL

REPRINTED FROM MEDICAL AND SURGICAL REPORTS, BOSTON CITY HOSPITAL, 1900

---

BOSTON  
MUNICIPAL PRINTING OFFICE

1900

C

3793.33



Dr. John B. McCallom,

Jan. 3, 1901.

Digitized by the Internet Archive  
in 2011 with funding from  
Open Knowledge Commons and Harvard Medical School

A PLEA FOR LARGER DOSES OF ANTITOXIN IN THE  
TREATMENT OF DIPHTHERIA.

---

BY JOHN H. MCCOLLOM, M.D.

---

SINCE 1878, when a report of each case of diphtheria was required by the Board of Health, Boston has suffered more than any other of the large American cities from the inroads of this disease. During this time, particularly from 1878 to 1894, a comparison made with some of the foreign cities is not favorable to Boston. The actual number of deaths each year from diphtheria has varied from 817 in 1894 to 170 in 1898. The percentage of mortality to the number of cases in the city at large has ranged from 35.7 in 1881 to 9.76 in 1899. Some of this diminution in the mortality percentage may be explained by the fact that by means of a bacteriological examination many cases are recognized that otherwise would escape detection, but this does not explain the continuous and marked diminution in the death-rate from diphtheria in the past five years in Boston. A study of the ratio of mortality from any given cause per 10,000 of the living is a much more satisfactory manner of arriving at a definite conclusion regarding the benefits to be derived from any particular line of treatment. The ratio of mortality from diphtheria in Boston per 10,000 of the living from 1893 to 1899 has been compared with that of five European and five American cities. Chart A shows the ratio of deaths from diphtheria per 10,000 of the living in Boston, London, Liverpool, Glasgow, Paris, and Berlin from 1893 to 1899, inclusive. It will be seen from this chart that in 1893 and 1894 Boston had the highest death-rate of any of these cities. Chart B

CHART A.—Ratio of Mortality of Diphtheria, per 10,000 of the Living in Boston, London, Liverpool, Glasgow, Paris and Berlin, 1893 to 1899.

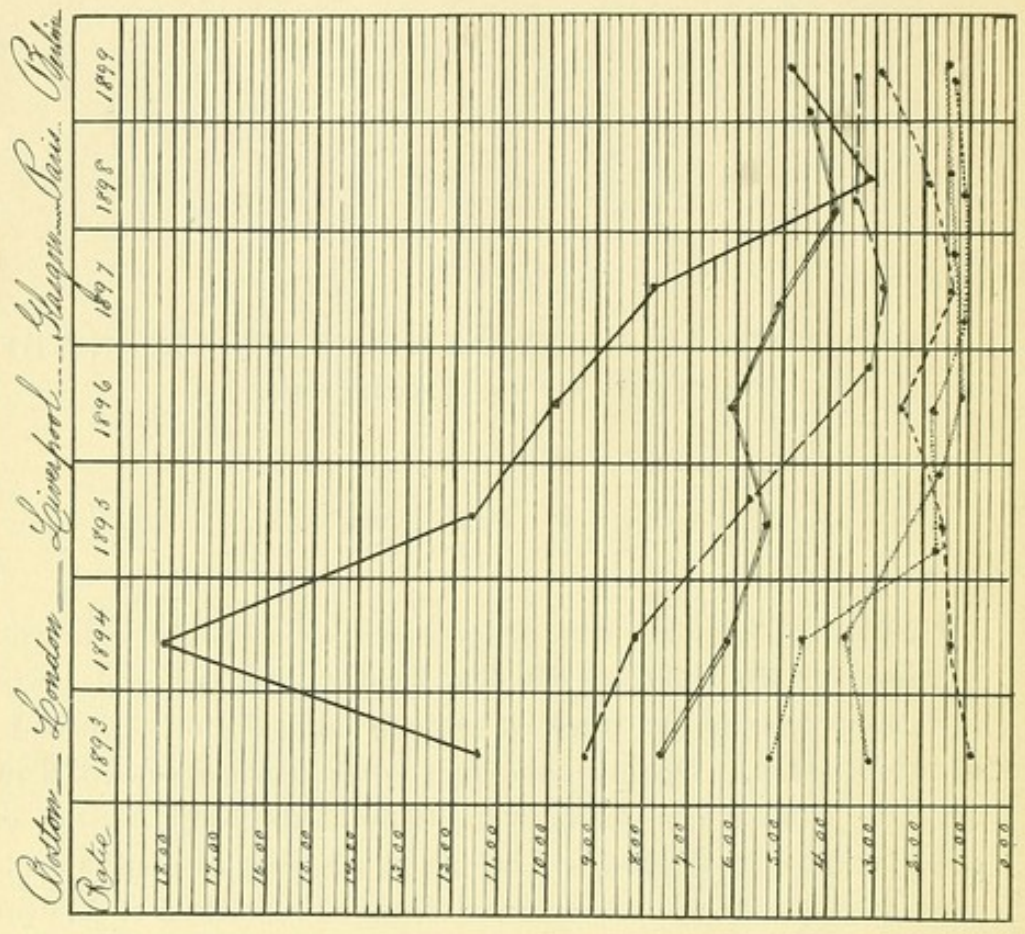
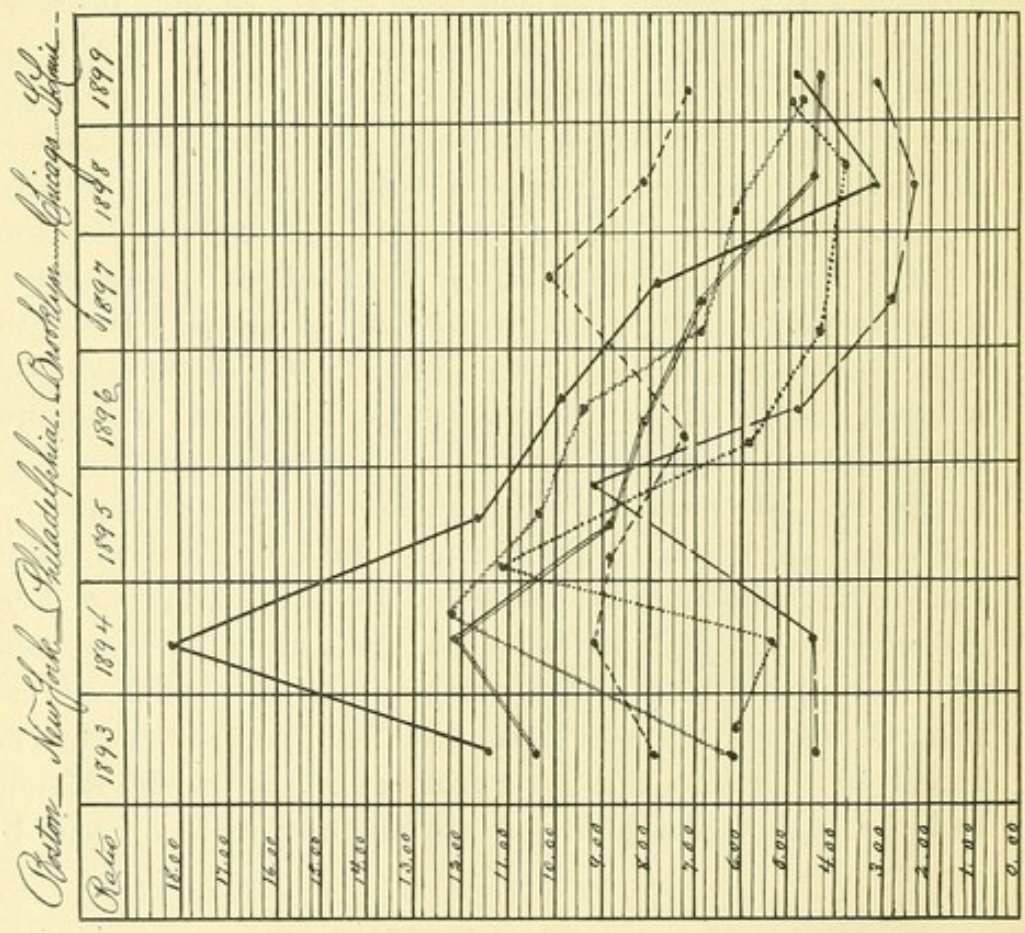


CHART B.—Ratio of Mortality of Diphtheria, per 10,000 of the Living, in Boston, New York, Philadelphia, Brooklyn, Chicago and St. Louis, 1893 to 1899.

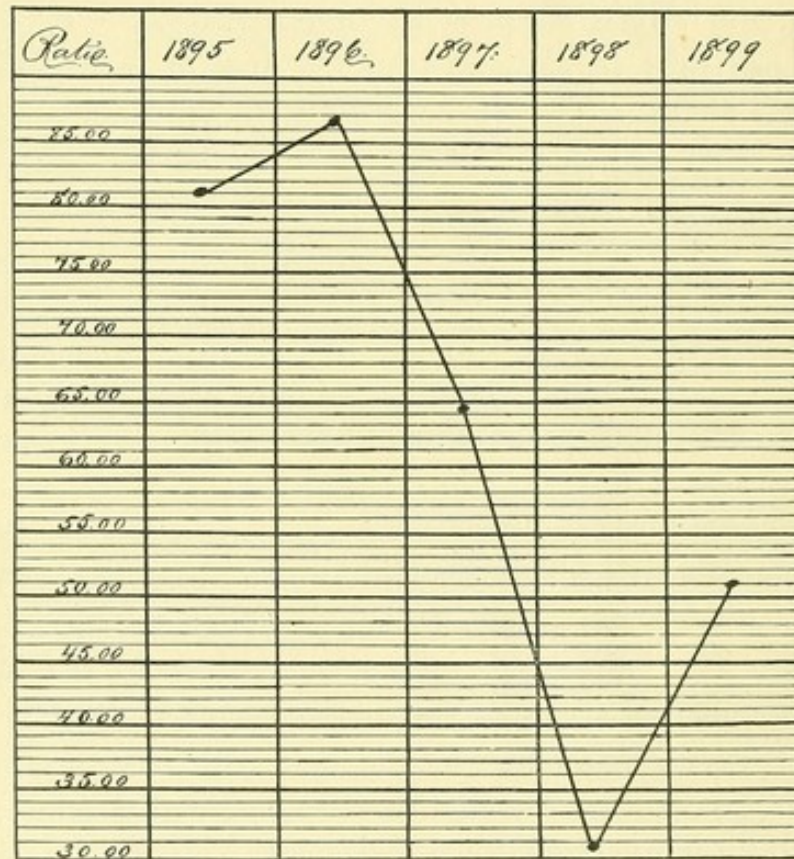


shows the ratio of mortality from diphtheria in five American cities taken for comparison with Boston, namely, New York, Philadelphia, Brooklyn, Chicago, and St. Louis. It will be seen from this chart that in none of the other American cities has there been the marked and continuous diminution that has occurred in Boston. This reduction commenced in 1895, in the latter half of which year the South Department was opened and antitoxin was given to each and every patient at the hospital ill with diphtheria. A diminution from 18 per 10,000 to 4.99 in five years cannot be attributed to good fortune, nor to the mild types of the disease. This diminution can only be explained by the use of antitoxin and treatment in hospital. It must be borne in mind that previous to 1895 only about 10 per cent. of the reported cases were treated in hospital, while in 1896, 1897, 1898, and 1899, about 50 per cent. had hospital treatment. In none of the five American cities taken for comparison has the percentage of reported cases treated in hospital been so large as in Boston. In London, the percentage of cases of diphtheria treated in hospital was, in 1898, 56.88; while in Boston for the same year it was 50. In Glasgow, in 1898, 60 per cent. of the reported cases of diphtheria were treated in hospital.

The fact is evident to the intelligent observer that diphtheria in Boston has been extremely prevalent, and that it has been a very important factor in increasing the death-rate. If the number of cases of the disease occurring in Glasgow during 1898, for example, is compared with that in Boston for 1899, it will be seen that in Glasgow, with a population of 724,349 there were 433 cases reported, giving a ratio of morbidity per 10,000 of 5.9, while in Boston, with a population of 550,057, there were 2,836 cases reported; the ratio of morbidity being 51. The ratio of morbidity per 10,000 for London for 1898 was 25.62. In New York City (Boroughs of Manhattan and Bronx) for 1898 and 1899, it was 37.06 and 38.77, respectively. The morbidity ratio per 10,000 in Boston has fallen from 81.00 in 1895 to 51.00 in 1899. A comparison of the morbidity ratios previous to 1894 with those of the succeeding years cannot be made, as there were no general bacteriological examinations previous to 1894.

Chart C shows the ratio of morbidity in Boston, per 10,000 of the living for five years, 1895 to 1899, inclusive. It will be seen from this chart that there has been a reduction in the morbidity ratio of diphtheria since the opening of a special hospital for the treatment of this disease. For instance, compare 1895, an epidemic year, with a ratio of morbidity of 81, a ratio of mortality per 10,000 of 11.73, and a percentage of

CHART C. — Ratio of Morbidity of Diphtheria, per 10,000 of the Living, in Boston for Five Years, 1895 to 1899, inclusive.



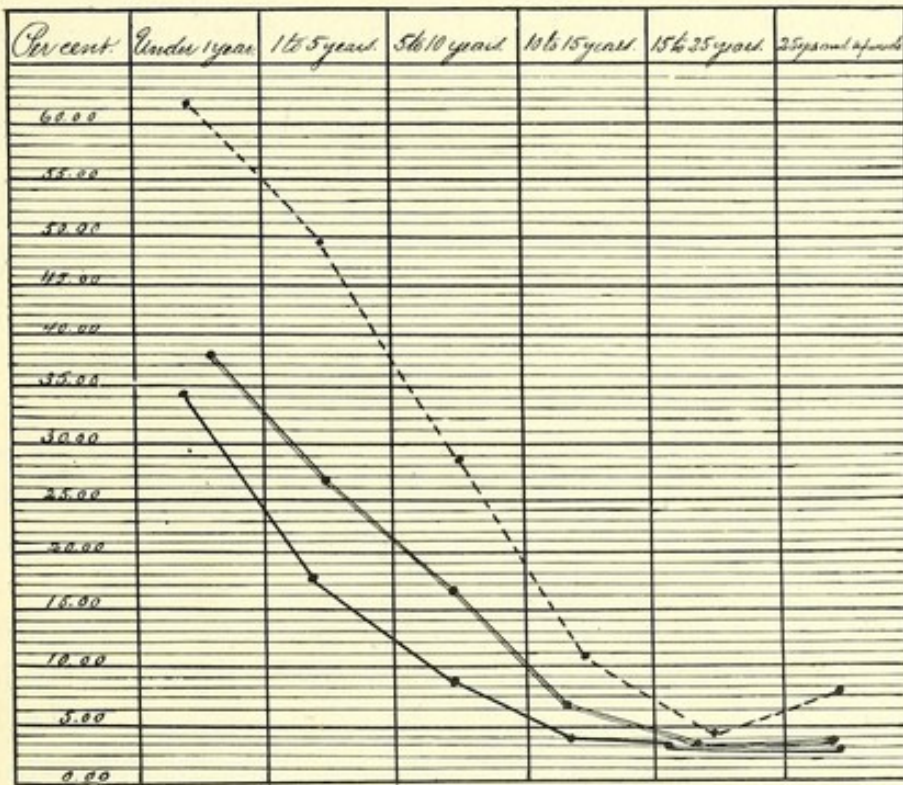
mortality to the number of cases of 14.48, with 1899, also an epidemic year, with a ratio of morbidity of 51, a ratio of mortality per 10,000 of the living of 4.99, and a case percentage of mortality of 9.76.

Before the advent of antitoxin the death-rate of diphtheria varied from 30 to 50 per cent. In the table prepared by Lennox Browne in his work on diphtheria the per cent. in 11,598 cases treated in the Asylums' Board Hospitals, London, from 1888 to 1894, inclusive, was 30.3. In the Boston

City Hospital the rate previous to 1895 was 46. Other hospitals give mortality rates of 40 and 50 per cent. In Bayeux's comprehensive work on diphtheria the death-rate is given as 55 per cent. before antitoxin, and 16 per cent. since the advent of this agent. The rate of 16 per cent. is based upon an analysis of more than 200,000 cases. Bayeux in

CHART D.—Percentage of Mortality of Diphtheria, according to Age, in the Asylums' Board Hospitals, London, 1888-1894, Antitoxin not used; in the Asylums' Board Hospitals, London, 1895-1898, Antitoxin used; in the South Department, Boston City Hospital, 1895-1899, Antitoxin used.

*South Dept. 1895-1899 — Asyl Board 1888-1894 — Asyl Board 1895-1898*

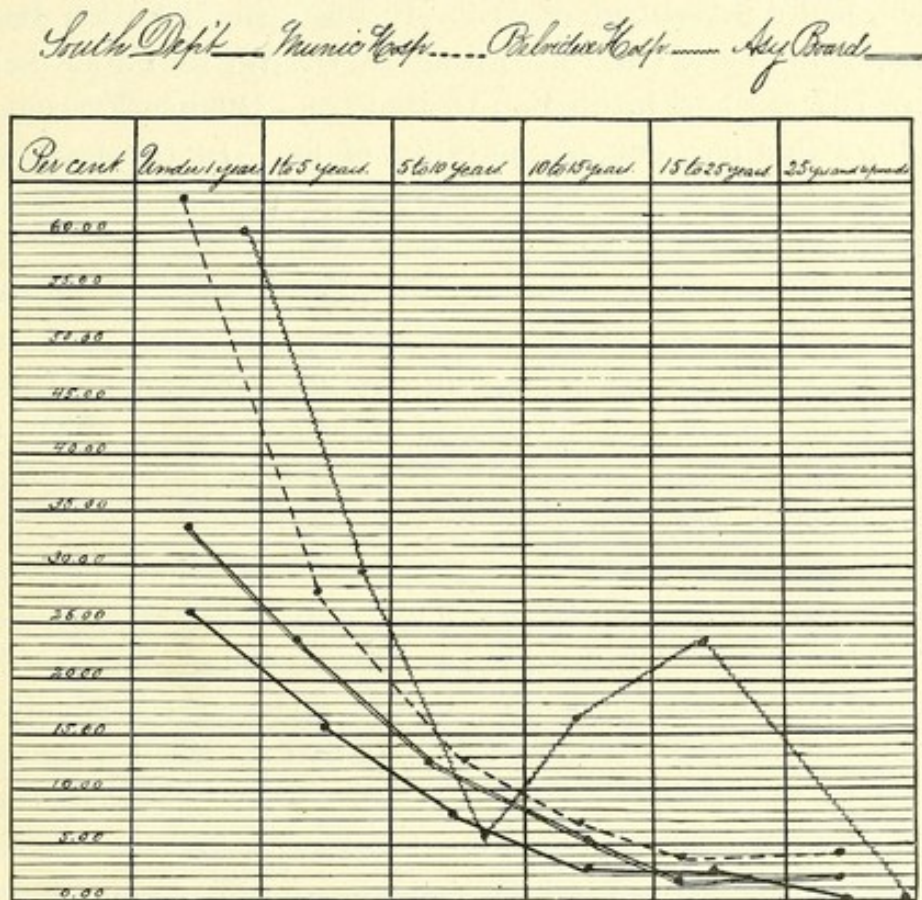


his work also makes the statement that not a single death has been scientifically demonstrated to be due to the use of the serum. In the five years that the South Department has been in operation, August 31, 1895, to August 31, 1900, during which time 7,657 patients were treated, the percentage of mortality was 12.9. It must be borne in mind that these were all cases of diphtheria, both from a clinical and from a bacteriological point of view. The death-rate of diphtheria in young children has always been very high, as high as 76

per cent.; elderly people generally succumb to the disease. A comparison of mortality rates in the Asylums' Board Hospitals in the years 1888 to 1894, during which time 11,598 patients were treated without antitoxin; the same hospitals from 1895 to 1898, when 20,382 patients were treated with antitoxin, with that of the South Department from August 31, 1895, to August 31, 1900, when 7,657 patients were treated with antitoxin in large doses, may be of interest. The death-rate in the London hospitals before antitoxin was used was 30.3; in the same hospitals with antitoxin, 18.4; while that of the South Department was 12.9. Chart D shows the per cent. of mortality by age, of diphtheria in the Asylums' Board Hospitals, London, before antitoxin was generally used; the percentage of mortality in the same hospitals from 1895 to 1898, when antitoxin was generally used, and the mortality percentage from diphtheria in the South Department for five years, when antitoxin was given to each patient ill with diphtheria. A study of this chart shows that in the London hospitals, before antitoxin was used, the mortality percentage in children under one year of age was 61.8; that in the London hospitals, when antitoxin was used, the rate was 38.0 per cent.; that in the South Department the rate was 34.6. In children from 1 to 5 years the percentage in the London hospitals before antitoxin was 49.33; that in the London hospitals, when antitoxin was used, it was 26.83; at the South Department the rate was 17.8 per cent. From 5 to 10 years the percentage was 28.1 before antitoxin, 16.3 with antitoxin; 8.1 at the South Department. It is of interest to note that the rate in patients from 5 to 10 years of age at the South Department is lower by one-half than in the London hospitals. In the other ages the difference is not so marked, but in each instance the rate of the South Department is lower than that of the London hospitals. Lest it should be said that a large number of cases is compared with a smaller number of cases to the manifest advantage of the latter, Chart E has been prepared, which gives the percentage of mortality by age for one year in the following hospitals; namely, South Department, Boston City Hospital; Municipal Hospital, Philadelphia; Belvidere Hospital, Glasgow;

and Asylums' Board Hospitals, London. By following the full black line it will be seen that the rate at the South Department is generally lower than that of the other hospitals taken for comparison. For instance, compare the hospital in Philadelphia with a percentage of mortality of 63 in children under one year of age with that of the South Department with a percentage of 26. There is also a marked diminution

CHART E. — Percentage of Mortality of Diphtheria, according to Age, at the South Department, Boston City Hospital, 1899; Municipal Hospital, Philadelphia, 1899; Belvidere Hospital, Glasgow, 1898, and Asylums' Board Hospitals, London, 1898.



in children from 1 to 5 years of age in favor of the South Department. In the epoch of life from 15 to 25 years the difference between the percentage of mortality in the Glasgow hospital as compared with the Boston hospitals is very marked. It is a very significant fact that in 1899 the cases of diphtheria were of an extremely virulent type, and therefore that much larger doses of antitoxin were required than in some of the previous years, and yet the death-rate was



lower generally than in any of the hospitals taken for comparison.

It is generally conceded that laryngeal diphtheria is a very serious disease, and that in operative cases, intubation and tracheotomy, the death-rate is very high, being in pre-antitoxin days from 75 to 87 per cent. Since antitoxin has been in use the death-rate has fallen very materially. In 313 cases of tracheotomy in the Asylums' Board Hospitals of London, the per cent. was 38.0. In the Belvidere Fever Hospital, Glasgow, the operative cases for the year ending May 31, 1899, had a percentage of 41.9. In the Willard Parker Hospital, New York City, according to Dr. W. H. Park, there were 737 cases of intubation treated from 1895 to February, 1900, with a per cent. of mortality of 63. In the last two years the rate was 52 per cent. In the Municipal Hospital of Philadelphia the rate in 165 cases was 58.78 per cent. At the South Department, during 1899, there were 192 intubation cases treated, the per cent. of mortality being 34, as compared with a percentage of mortality of 46 in 1898. This reduction must be attributed to the large doses of serum given in the severer cases when there was an indication that the membrane was extending into the bronchi.

It has been shown by the foregoing figures that the ratio of mortality of diphtheria per 10,000 of the living has been diminished in a marked degree in Boston since the introduction of antitoxin; that there has also been a marked reduction in the mortality per cent. in the operative cases since larger doses of the healing serum have been given. No hard and firm rule can be made regarding the use of the serum; the agent must be given until the characteristic effect is produced on the diphtheritic membrane; in some cases 4,000 units will accomplish this, in other instances 60,000 or 70,000 units may be required. When a guinea-pig is inoculated at the laboratory with a certain definite amount of the toxin of diphtheria it is a very easy matter to antagonize this with a certain amount of antitoxin. In the case of a patient ill with diphtheria there is no way of estimating the quantity of toxin generated by the membrane and therefore one must administer the agent until the characteristic effect is produced,

viz.: the shrivelling of the membrane; the diminution of the nasal discharge; the correction of the fœtid odor and a general improvement in the condition of the patient. In the operative cases the beneficial effect of large doses of antitoxin has been marked, preventing, in many instances, the extension of membrane to the smaller ramifications of the bronchi; a most important factor in raising the death-rate in this class of cases. In the operative cases it is safe to say that nearly twenty per cent. of the deaths was caused by blocking of the bronchi with diphtheritic membrane. At the South Department the autopsies proved this fact. It was observed in pre-antitoxin days that patients in operative cases would do well for from twenty-four to forty-eight hours after the operation, and then would commence to have a limited amount of dyspnœa; the temperature would rise; the tube would become clogged with a thick, tough tenacious mucus; the physical sign in the lungs would be that of a bronchopneumonia; and the patient would succumb in a short time. This clogging of the tube with hard muco-purulent discharge is an indication of extension of membrane; a symptom of very serious import, and demands the heroic administration of antitoxin. No case of diphtheria in the acute stage should be considered hopeless. Antitoxin should be administered in each and every instance. It has been my experience during the past few years to see so many patients apparently hopelessly ill, recover, that my convictions are very firm on this subject. When one sees a patient with membrane covering the tonsils and uvula; profuse sanious discharge from the nose, spots of ecchymosis on the body and extremities; cold clammy hands and feet; a feeble pulse; and the nauseous odor of diphtheria, and finds that after the administration of 10,000 units of antitoxin in two doses the condition of the patient improves slightly; that after 10,000 units more have been given there is a marked abatement in the severity of the symptoms; that when an additional 10,000 units have been given the patient is apparently out of danger, and eventually recovers, one must believe in the curative power of antitoxin. When one sees a patient in whom the intubation tube has been repeatedly clogged; when the hopeless condition of the

patient changes for the better after the administration of 50,000 units, one cannot help but be convinced of the importance of giving large doses of antitoxin in the very severe and apparently hopeless cases. In the majority of instances these large doses are not required, particularly if the patients are seen early in the attack; 4,000 to 6,000 units being enough to produce the characteristic effect on the membrane. As illustrating the advantage of the early administration of antitoxin, an allusion to the cases of diphtheria occurring in the staff of the South Department may be of interest. There have been since September, 1895, 104 instances of diphtheria contracted in the line of duty, and not a single death. Each patient received a full dose of antitoxin, 4,000 units at the outset, or as soon as there were any symptoms of the disease. In some instances it was not necessary to repeat the dose; in others the doses were repeated two or three times. It is of interest to note that in this series of cases there were no marked symptoms of paralysis; that heart complications did not occur, and that the duration of the illness was comparatively short. It must be borne in mind that these were genuine cases of diphtheria, contracted under unfavorable conditions. The results obtained with cases of diphtheria injected with antitoxin by the Health Department of New York City also prove the advantage of the early administration of the serum. Dr. Park gives the following figures: Of 319 patients injected on the first day of the illness, 13 died, a mortality of 4 per cent.; 850 were injected on the second day, 57 died, a mortality of 6.7 per cent.; 573 were injected on the third day, with a mortality of 12 per cent.

In the study of any particular line of treatment for a special disease the clinical picture presented by patients ill with that disease is always of interest, and is frequently more conclusive than a simple array of figures. A short history of a few of the extremely severe cases of diphtheria in which antitoxin was administered in large doses will be given.

*Case 1.* — A boy, six years of age. When admitted he had been ill three days; there was a large patch of membrane on each tonsil; the uvula was œdematous; there was a profuse nasal discharge. Dyspnoea was very great, and there was marked cyanosis. The cul-

tures were positive. Pulse feeble and rapid. Temperature, 99.5. There was a slight trace of albumin in the urine. He was intubed at once, and given 4,000 units of antitoxin. The intubation tube not giving relief, it was removed in ten minutes, when the patient expectorated a quantity of thick tough tenacious mucus, and the breathing immediately became easier. On the second day after admission the dyspnoea was urgent, and the boy was re-intubed with marked relief. In four days this patient had 56,000 units of antitoxin without any injurious effect and with positive relief. He was discharged well. He had none of the usual sequelæ of diphtheria. He did have a troublesome urticaria. The heart did not at any time have an irregular action; there was no indication of paralysis.

*Case 2.* — A girl, six years old. She had been ill three days when admitted. The tonsils and uvula were covered with a thick membrane. Pulse rapid and weak. The membrane commenced to disappear in three days, but on the fourth it commenced to re-form and therefore large doses of antitoxin were given. In all, this patient received 80,000 units of antitoxin. The cervical glands supplicated. At one time during the course of the attack the action of the heart was irregular. There was a slight palatal paralysis. At one time there was a slight trace of albumin in the urine. She made a good recovery.

*Case 3.* — A man, eighteen years old. He had been ill one week at the time of admission. There was great prostration; a profuse nasal discharge with a foul odor; there was a very extensive membrane covering the tonsils, uvula and palate. The action of the heart was feeble; the sounds indistinct. Pulse, feeble. The general condition indicated speedy death. He had on entrance an initial dose of 6,000 units of antitoxin, repeated in five hours. The next day he had four doses of 6,000 units each, and on the third and fourth days a like quantity. On the fifth day after entrance the throat was clear, and the mucous membrane normal in appearance. For the first four days delirium was a marked symptom. The patient was unable to swallow, and food and stimulants were given by the rectum. At one time there was a slightly nasal voice, but there was no marked paralysis. The action of the heart was regular at the time of discharge. A slight trace of albumin was found in the urine. Urticaria was an annoying complication, but not a grave one. There was no arthralgia. Brandy and strychnia were given in large doses. It is cases of this class that swell the mortality ratio of hospitals. The patient was moribund when admitted; he left the hospital well, and has been well up to the present time. It is possible that the man might have recovered with a slightly diminished dose; it is certain that the usual doses of antitoxin would not have saved his life, and it is also certain that no injurious effect followed the large dose.

*Case 4.* — A colored boy, seven years old. On admission this patient had a very weak pulse; the heart sounds were feeble; the tonsils, uvula and hard palate were covered with a dirty necrotic membrane; there was a profuse nasal discharge; the cervical glands on the right side had sloughed; there was an intolerable odor. His condition was as unfavorable as it could well be. The boy had 84,000 units of antitoxin in five days. He was discharged well in sixty-six days. At the end of the sixth day after entrance the condition of the patient had improved so much that no one who had not seen him on entrance would have believed that he had been so critically ill. He made a good recovery, which was somewhat delayed by post-diphtheritic paralysis. He was nourished during part of the time by the rectum. At one time during convalescence he had one-eighth of one per cent. of albumin in the urine. This albuminuria could not, however, be attributed to the antitoxin, as it is one of the most frequent symptoms in severe attacks of diphtheria, and was recognized and described long before the days of antitoxin.

*Case 5.* — A boy, age eight years. On entrance there was profound prostration; very extensive membrane in the throat, a marked dyspnoea; feeble and irregular action of the heart. This certainly could not be called a mild attack of the disease. This patient had 56,000 units of antitoxin. He made a good recovery. He did not have paralysis. There was an eruption of urticaria of moderate severity. A slight trace of albumin was found in the urine.

*Case 6.* — A woman, aged twenty-four years. When seen, the patient had been ill five days. There was a profuse foetid nasal discharge; extensive diphtheritic membrane in the fauces; marked prostration; a weak and irregular pulse; a dilated heart, feeble in action; the sallow hue of the skin seen in toxæmia. This patient had 76,000 units of antitoxin in four days. On the fifth day after entrance the membrane had disappeared from the throat, and her general condition had very much improved. In the case of this patient the irregular action of the heart continued for some little time. She, however, was discharged well at the end of fifty-four days. The somewhat prolonged stay in the hospital was due to the condition of the heart, and a slight paralysis of the muscles of deglutition. Urticaria was not a distressing symptom in this case. Arthralgia was not present. A slight trace of albumin was found in the urine for three or four days during the period of convalescence.

*Case 7.* — A girl, eleven years of age. This patient had been ill two days when admitted. Her condition was as follows: Marked prostration; profuse nasal discharge; extensive membrane on the tonsils and uvula; a strong foetid odor; the action of the heart was irregular, and the sounds indistinct. In four days she received 52,000 units of antitoxin. Urticaria and arthralgia caused some

considerable discomfort. No paralysis developed. The patient was discharged well in thirty-nine days. From the rapid spread of the membrane in the two days before admission to the hospital it is evident that this was an extremely virulent attack of diphtheria. The conclusion that the girl would have died if antitoxin had not been given in large doses is justifiable.

*Case 8.* — A man, eighteen years of age. He had been ill three days before admission, with sore throat, headache and vomiting. When seen there was considerable prostration, a profuse nasal discharge, marked enlargement of the cervical glands; hypertrophied tonsils covered with a thick membrane; an extremely foetid odor to the breath. The action of the heart was regular, but somewhat weak. This patient had 50,000 units of antitoxin in four days. The throat cleared in three days, but as the nasal discharge continued, two additional doses of antitoxin were given. The man made a good recovery, and was discharged in thirty-five days. Urticaria and arthralgia did not cause much discomfort in this case. The patient did not have paralysis. Albuminuria was a transient symptom. In this case, if the toxin of diphtheria had not been antagonized by large doses of antitoxin, judging by experience, paralysis would have been a very prominent symptom. Six months after leaving the hospital this man was well.

*Case 9.* — A man, nineteen years of age. He had been ill three days when admitted. On examination, the following condition was found; enlarged cervical glands with great tenderness; a profuse nasal discharge; tonsils greatly enlarged, meeting in the median line, and covered with thick diphtheritic membrane; uvula covered with membrane; profound prostration. Prognosis unfavorable. This patient had 90,000 units of antitoxin in five days. The throat cleared in three days; the nasal discharge diminished; the offensive odor of the breath was not so marked. The patient was discharged well in thirty days. Albuminuria was not pronounced. There were no complications of serious import due to the use of antitoxin. Urticaria and arthralgia, although present, did not cause a great amount of discomfort.

*Case 10.* — A man, aged thirty-four years. He had been ill four days when admitted. There was very extensive diphtheritic membrane on each tonsil; the uvula was covered; there was a profuse nasal discharge; the cervical glands were much enlarged; there was marked prostration; the pulse was feeble and irregular; there was some dyspnoea; the voice was husky. The clinical picture he presented was that of a patient moribund from an attack of diphtheria. The condition of the man seemed absolutely hopeless, but acting on the principle that no person ill with diphtheria should be considered beyond help, 8,000 units of antitoxin were given; a second dose of 4,000 units was given in three hours and repeated every four or six

hours until 92,000 units had been administered. In four days there was a marked improvement in the condition of the man. In five days the throat was clear of membrane. He made a good recovery, was discharged well in twenty-six days. He, however, had post-diphtheritic paralysis about three weeks after his discharge. Recovery from this, however, has been complete, and at the present time, 130 days after the commencement of the attack of diphtheria, this patient is well; therefore, the statement cannot be made with truth that he has suffered any ill effects from the large dose of antitoxin.

*Case 11.* — A woman, whose age was forty-eight years. She had been ill five days. On entrance, the tonsils, posterior pharyngeal wall, uvula and soft palate were covered with a thick diphtheritic membrane. There was also a patch of membrane on the lower lip. The cervical glands were enlarged. The patient was aphonic; there were frequent attacks of dyspnoea, so that at one time operative interference was imminent. She was unable to swallow, and was therefore nourished by the rectum. The prostration was profound. In five days 48,000 units of antitoxin were given; 12,000 units being administered the first day. At the end of the fifth day the throat was practically clear, the general condition of the patient much improved. The cervical glands suppurated. For two or three days the slightest possible trace of albumin was found in the urine. Urticaria and arthralgia caused a certain amount of annoyance. There was no special heart complication, although at one time the action of the organ was irregular, as is always the case in severe attacks of diphtheria. Post-diphtheritic paralysis ensued, but was not sufficient at any time to cause great anxiety. This certainly cannot be considered a mild attack of the disease. If a less amount of antitoxin had been given the patient would have died, without doubt. It is of interest to note that four other members of this family had diphtheria, but as antitoxin was given early in the course of the disease, only small doses were required. This woman had a tedious convalescence, but was discharged well. Seven months from the date of the attack she was in good health.

Many more cases might be cited in which large doses of antitoxin were given with satisfactory results, but enough has been said to prove that small doses of antitoxin are of little avail in the treatment of grave types of the disease; that in order to obtain the best results the serum must be heroically administered. It is true that all of the patients to whom large doses of antitoxin have been given have not recovered, but so many of them have that one must be convinced that

large doses are imperatively demanded in very severe cases. When death has occurred, it has been from nerve degeneration or from sepsis. In no instance was there any injurious effect produced by either the large or small doses of antitoxin. Albuminuria, although present in many cases, cannot be attributed to the serum, as albuminuria is one of the most frequent symptoms in diphtheria. Heart complications of a serious nature have not been so frequent in the 7,657 patients treated at the South Department, as would have been the case in a like number treated without antitoxin. Paralysis, although occurring in the severer cases, has not been so prominent as it would have been in an equal number of cases treated without antitoxin. Urticaria and arthralgia are certainly very annoying complications, but they do not imperil the life of the patient, and are therefore not worthy of being considered an argument against the use of the serum. It has been observed that the serum from certain horses caused a larger per cent. of urticaria than that from others. There is no explanation of this fact. It is to be hoped that in the future there may be some way of eliminating this troublesome symptom. The time in which an urticaria may appear varies from ten minutes after the injection of antitoxin to three weeks. Abscesses after the injection should be of rare occurrence, and when they do appear are an indication of some error of technique in the sterilization of the syringe or in the quality of the serum. In the last 1,500 injections given at the South Department an abscess occurred twice.

It must be conceded that diphtheria at the outset is a local disease caused by the bacillus of diphtheria. The constitutional symptoms are the result of the extension of membrane and the formation of toxin. If the local process can be stopped, if the membrane can be prevented from extending, the life of the patient will be saved. Although different remedies were used to prevent the extension of membrane before the advent of antitoxin the death-rate from diphtheria remained about the same until the introduction of antitoxin. Before the days of antitoxin there was no method of limiting



the extension of the membrane. It is true that the membrane could be torn off, leaving a raw surface, but the organism of diphtheria would not be destroyed, and therefore the membrane would re-form. The number of different applications to the diphtheritic membrane was so great as to prove that no one of them was satisfactory. No germicide can be of sufficient strength to effectually destroy the bacilli of diphtheria without causing destruction of the mucous membrane, and thus opening a fresh field for the growth of the organism. In the light of our present knowledge regarding the etiology of diphtheria, there can be no more unscientific method of treating the disease than by the application of caustics to the membrane, with the hope of destroying it. The experiments of Roux and Yersin proved conclusively that the bacilli of diphtheria would not grow on intact mucous membrane, and, therefore, the less the throat of a patient ill with diphtheria is abraded the better.

Of the 7,657 cases of diphtheria treated in the five years that the South Department has been open, 772, or 10.08 per cent., required operative interference. In about one hundred instances there were marked laryngeal symptoms, but operative interference was not required, the stenosis being relieved by antitoxin. The use of steam for the relief of the stenosis has been discarded, except in cases of tracheotomy, because it was found that the relief was not sufficient to offset the debilitating effects of the steam on the patients. The sublimation of calomel was tried in many cases, but without satisfactory results, as the patients almost invariably required operation. To discuss the relative advantages of intubation as compared with tracheotomy, would prolong this paper to an unseemly length, but a death-rate of 34 per cent. in intubation cases as compared with the death-rate reported in tracheotomy cases shows conclusively the advantage of intubation over tracheotomy.

From a comparison of the health reports of Boston, before and after the introduction of the anti-diphtheritic serum, from a comparison of the health reports of other cities, from a study of hospital reports, from a clinical observation of

nearly 8,000 cases of diphtheria, the following conclusions are justifiable :

1st. That the ratio of mortality of diphtheria, per 10,000 of the living, was very high in Boston previous to 1895.

2d. That the ratio of mortality per 10,000 has been very materially reduced since the introduction of antitoxin.

3d. That the percentage of mortality in the South Department is lower than that of any of the hospitals taken for comparison.

4th. That since larger doses of antitoxin have been given the death-rate has been materially reduced, this reduction having occurred in the apparently moribund cases.

5th. That no injurious effect has followed the use of the serum.

6th. That to arrive at the most satisfactory results in the treatment of diphtheria, antitoxin should be given at the earliest possible moment in the course of the disease.

