DIPHTHERIA

With special reference to the treatment with its Antitoxin.

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During the past few years a new impetus has been given to the study of Diphtheria on account of the advances made by Bacteriology. Prior to this period Bacteriology had only been the means of bringing about prophylactic measures. But now it comes forward with a remedy which has been obtained step by step through an immense amount of work in the Laboratory, against a disease which hitherto has been invaded with very defective weapons.

Diphtheria is one of the oldest epidemics of the human race. There is distinct evidence that Diphtheria was known to the ancient physicians, Homer and Hippocrates mentioned the disease Malum Aegyptiacm as a malady greatly to be feared. In the second century (A.D.) Aretaeus gave a minute description of this condition, which corresponds in a wonderful way to our modern Diphtheria. He described the tonsils as being covered with "quodam concreto humore albo" which spreads over the tongue and gums. The ulcers on the tonsils, which are clean, small, superficial, without inflammation, and painless are benignant; while on the other hand those which are extensive, deep, and putrid and covered with a white, livid or blackish clot, usually prove to be malignant. In fatal cases the foetor, which comes from the mouth of those affected with the disease, is so loathsome, that the patients themselves cannot endure it. Fluids are regurgitated through the nose, and there is hoarsness of the voice and often loss altogether. When the disease extends
quickly to the air tubes it produces death in a short time by suffocation. Children, who have not reached the age of puberty are most frequently attacked by this disease. This description is a wonderfully accurate account of the disease, but of course includes other conditions. Aretaeus asserted that this disease arose in Egypt, from whence it derived its name of Malum Aegyptiacum. As a preventive against the malady, a combination of Sulphate of Copper with honey was recommended. This remedy retained its position in the Pharmacopoeia for centuries, under the name of Unguentum Aegyptiscum.

Macrobius described a similar epidemic disease in Rome in the year 380 A.D. In the sixteenth, seventeenth and eighteenth centuries, epidemics of Diphtheria appear to have frequently prevailed in many parts of Europe, particularly in Holland, Spain, Italy, France as well as in England, but it is probable that many other conditions were included under these descriptions, and no accurate account of this disease appeared until Monsieur Bretonneau of Tours in 1821 wrote his celebrated treatise on Diphtheria. He coined the term Diphtherite (Diphthera = leather). This he gave because the essential characteristic of the disease was the exudation, which has the appearance of leather. He asserted that the inflammation without an exudation was never Diphtheritic and no inflammation with exudation is Diphtheritic when it does not spread by
contagion, he believed the membrane exudation was the poison itself, which formed the essential quantity of this disease.

From numerous facts he believed he had proved that contagion occurred only when the Diphtheritic secretion came in immediate contact with soft mucous membrane or with skin deprived of its epithelium. He did not believe the atmosphere did act as a medium for spreading contagion. He also considered Diphtheria and Croup one and the same disease. At first he insisted that diphtheria was wholly a local disease, but later stated that blood poisoning is one of its essential characteristics. He drew a marked distinction between scarlatinal and syphilitic conditions and those of diphtheria.

In the year 1857 there was a marked epidemic throughout England very similar to scarlet fever with the exception of the rash, a similar condition of the fauces, fever and marked depression. Many distinguished observers at this time, asserted, this was a disease they had not seen before, amongst may be mentioned, Addison. From this time the literature on this disease increased rapidly. Many of the points of dispute then mentioned are discussed vigorously at the present day. Various writers began to recognise the importance of the general affections and the sequelae, especially those arising from abnormal action of the throat muscles. Virchow directed attention to the necrotic process which follows the presence of a diphtheritic membrane and distinguished this variety from the croupous
in which the exudation lies upon the surface of the mucous membrane. Then Wagner in opposition to this theory of Virchow's attempted to prove that the croupous and diphtheritic processes were one and the same, one was confined to the throat the other involved the air passages and that the membrane was formed by changed epithelium which he described as a fibrinous degeneration of these cells and did not regard the membrane as a fibrous exudation. Buhl was of opinion that diphtheria was a general infectious disease, entirely independent of any previously existing local disease. He considered that the local manifestations could be compared to the rash in the skin of scarlet fever.

Then a new era opened when Hueter and Oertal demonstrated bacteria in the diphtheritic membrane which they called micrococcii. Tredelenburg and Nassiloff first proved the possibility of infecting animals with diphtheria by inoculation in the trachea or cornea, and by these experiments they came to the conclusion, these bacteria found in the membrane were the primary cause of the condition. Oertel asserted by a series of experiments he had proof that diphtheria begins as a local disease and develops afterwards into a general one and the general infection is kept up by the local one.

The disease finds a spot on which it can exist and there forms a focus of infection and thence radiates poisons throughout the body, setting up a general blood poisoning and death.
He considered croup as a simple form of inflammation in which there was a fibrinous exudation but gave rise to no general blood poisoning.

Dr. Ogden writing from Jamaica in 1769 described diphtheria as it occurred there and recommended the use of senega and calomel. But the American physician that added the most accurate account of diphtheria during this period was Samuel Bard of New York in the year 1771. He asserted that the various forms of diphtheria were identical in nature and all due to the same cause. The etiology is not by any means cleared up, during the past 30 years experiments and extensive microscopic examinations have been made in order to find out the cause of diphtheria. As years go on the evidence becomes stronger that it is due to a microbe, but it is still a matter of doubt which microbe is the actual cause, or whether there are more than one species of bacteria which either singly or by their combination produce diphtheria.

About the year 1868 the cause of diphtheria was believed to be the micrococcus so frequently detected in the membrane.

Eberth in the year 1872 and Klebs in 1871 expressed the opinion that this micrococcus was the same as the septic micrococcus. Also Senator pointed out in the year 1874, that other diseases of the mouth and pharynx were accompanied with the same micrococci as those in diphtheria. Billroth in 1874 made the important statement that "the so called pathogenic
bacteria of diseases are identical with those found in putrefying dead tissues" with a large number of experiments performed at this time it became apparent that "the bacteria or diphtheritic membranes do not differ in their behaviour from those found in putrescent but non-diphtheritic animal material". It therefore became apparent that this micrococcus was not the cause or rather was not peculiar to diphtheria. It was found in the healthy mouth, also occurred in decomposing animal tissues in various diseases.

Diphtheria is decidedly a disease of early life, the number of cases diminishes rapidly as age advances. Sex appears to exert no special influence. The soft condition of the mucous membrane in early life may be one of the factors in the causation of this condition in children also the protuberant condition of the tonsils, the large number of lymphatics, the narrowness of the pharynx are all agencies which cause a predisposition to diphtheria. But there also seems to be a distinct tendency towards diphtheria in certain families which is not very easy to explain.

As regards climate, history appears to show that the disease is confined to no special climate, but occurs over the whole surface of the Earth. However there is a marked falling off towards the tropics, so that the temperate and partly the frigid zones are most affected by diphtheria. It is also probable that moisture favours the development of the poison, it is most common during the winter months, this is probably
due to the catarrhal conditions the mucous membranes are al-
ready in and therefore probably in a more receptive condition. 
In short the disease seems to be quite independent of weather 
in the majority of incidents. In England several severe epi-
demics appeared in the early part of the year and lasted through 
out the whole summer quite unaffected with the changes in tem-
perature. This disease attacks all classes of society but 
appears to flourish best in damp dwellings and in rooms on a 
level with the earth's surface and where there is overcrowding, 
poverty and uncleanness, when the air is impregnated with 
animal emanations in cases where men and animals are crowded 
under a common roof. But the healthy and robust are frequent-
ly seized by this disease who enjoy the best of everything in 
the way of care and nourishment.

Mode of propagation. It has now been almost certainly proved 
that this contagion is caused by the introduction of a micro-
organism, the local manifestations are usually the signs of the 
place of entrance and the constitutional disturbances the evi-
dence of the general distribution of the poison. The viru-
ulence of the contagion is in many cases in proportion to the 
severity of the case from which it comes: the more it is al-
lowed to collect in the room where the patient lies, where 
there is defective ventilation, bad nursing, the more active 
does it become. But on the other hand the same infection may 
act in a very different manner on two individuals, sometimes
infection from a very mild case may lead to a fatal result in another: this is probably due to greater susceptibility of the affected mucous membrane, the age of the patient and other causes.

It is proved beyond doubt that diphtheria does not arise de novo. It appears the slightest contact with an infected person is sufficient to transmit this disease, cases are recorded where a moment's exposure to the breath of a patient has been followed by an attack of diphtheria.

The virus of diphtheria adheres to objects on which it happens to alight, the clothing and furniture may retain the poison for a considerable time after the patient is removed. This can easily be demonstrated in the Laboratory, if a portion of membrane is put in a test tube and allowed to dry, weeks afterwards one can obtain cultures of the Diphtheria Bacillus. Sewers and ill-ventilated spaces especially if they are damp and sunshine never reaches them, are very favourable for the development of the virus. Another important mode of propagation is due to the fact that diphtheritic condition is often overlooked, it possesses so few subjective symptoms, so unlike the other contagious diseases of children which are rapidly detected. In this way a child suffering from diphtheria comes in contact with other children and infects them. The diphtheritic poison is so subtle and vitality so great it is a most
difficult disease to stamp out when once it is established.

Another source of infection is from the lower animals, undoubted cases have arisen in this way, fowls appear to be very liable to it. A pseudo membranous condition affects the air passages in a similar manner as in the human subject, in some rare cases followed by paralysis of the legs. Animals in this diseased condition have been introduced into districts free from the disease and have there set up the disease.

Age is a very important factor in Diphtheria, the most frequent period when children are liable to the disease is between the ages of two and six years. Out of a hundred and one cases of true diphtheria that I have seen in the City Hospital, sixty three cases occurred from 6 years downwards, the youngest being 10 months old, from 7 to 12 years 14 cases, from 12 to 18 8 cases, and 16 cases above 18 years of age, the oldest being 47 years. The new born child is said to be not so susceptible, but there are many undoubted cases of diphtheria occurring in newly born children.

The period of incubation is sometimes rather difficult to state exactly, but it usually varies from 2 to 8 days, it is often the case the shorter the incubation the more dangerous the condition.

When the infection is transmitted by direct contact the incubation period is shorter than when it is carried by the atmosphere.
I now pass to the diagnosis of diphtheria, this point is
now being considered throughout the scientific world in a way
that it has never done so before. The clinical descriptions
are so varied and some cases so obscure that a positive sign
is eagerly looked for. This is now practically attained in
the bacteriological examination of the deposit from the throat,
or from any other part of the body which is affected with a
diphtheritic condition.

Klebs described the bacillus as occurring in the diphther-
itic membrane, especially in the deeper portions, intermingled
with numerous other organisms, while the superficial layers of
membrane were invaded with micrococi diplococci and strepto-
cocci. The bacilli may not however be present in the affected
mucous membranes in some cases and Klebs asserted he failed to
detect the bacillus in the internal organs or the blood.

Frosch was amongst the first to definitely state he had ob-
served the diphtheritic bacillus in the organs of the body in
cases of diphtheria.

Babes, Kolesko, Paltauf, Spronck, also Roux and Yersin have
also found the diphtheria bacillus in the organs of the body in
cases of diphtheria. Howards has reported a very interesting
case of acute ulcerative endocarditis due to the Bacillus
Diphtheriae, cultivations made from the mitral valve of the
other organs of the body gave pure cultures of the diphtheria
bacillus, but this bacillus failed to kill animals when in-
inoculated subcutaneously. Abbot and Grisky assert that the bacilli travel through the body by means of the lymphatics in cases where the bacilli have been injected into the tissues. On the other hand there are a large number of observers who state they have failed to find the bacillus in the various organs. I have made several culture preparations from the blood and the internal organs in the post mortem room and in some cases colonies developed which were remarkably like Loeffler's bacillus, and on microscopic examination they resembled the bacillus in a remarkable manner with regard to size, staining properties and involution. I have not had an opportunity of trying the toxic effects of these bacilli on the guinea pig.

Frosch examined ten cases of diphtheria and stated that he found the bacillus in the blood and internal organs in every instance. He however was unable to demonstrate the bacillus in the internal organs in some other cases of diphtheria, but he considered that in some cases the disease may be general with only local manifestation, he also notes that the local manifestation may not in some cases be due to the diphtheria bacillus. This point of course is contradicted by many. The diphtheria bacillus is a rod, usually straight but sometimes slightly curved with rounded ends. (see photograph in appendix). Its length varies from two to three micromillimetres, and from a half to eight-tenths of a micromillimetre in breadth. Involved forms are almost always present in culture preparation, especially if the culture medium used be unfavourable to its
growth. These involuted forms take on various shapes, sometimes the bacillus is swollen in the centre, at other times the swellings are confined to the ends of the rods with a clear space intervening, these clear spaces are very difficult to stain. Multiplication occurs by transverse subdivision. The question of the presence of spores is not yet definitely settled. The swellings formed in the bacillus as a result of involution are probably a form of degeneration, and it is just possible the clear spaces in the body of the bacillus may have something to do with spores if there are any present. I have noticed in some specimens of Loeffler's bacillus spherical bodies which stain badly and extend slightly beyond the apparent outline of the bacillus. By means of drop preparations I have been able to watch the various changes by direct subdivision, the bacillus usually divides into two transversely but sometimes it further divides into three, and some specimens show the three rods in a line. There is an interesting point with regard to the involution forms, if a culture preparation is kept for several days it usually shows involution forms, (although in some undoubted cases of Loeffler's bacillus I have failed to see this involution occur until after several days), if then a fresh tube is inoculated from the tube which contains the inoculated forms, this second tube next day shows bacilli which are not involuted. This of course may be due to the presence of non-involuted forms in the first tube which go on dividing.
in the second preparation.

The biological characters of the bacillus are as follows:- it is aerobic, non-mobile and non-liquefying. It grows on various media, the most rapid growth is found when blood serum is used. For practical purposes in the Hospital I have found glycerine agar agar the most useful. The preparation of the blood serum is troublesome and a prolonged process, and for an aid to diagnosis the glycerine agar agar is quite sufficient. In studying the life history of the bacillus, I used blood serum prepared from the blood obtained from an ox. The bacillus grows in a temperature above 20° C and below 40° C, the most suitable height is about 37° C. The bacillus grows pretty rapidly and this point is of great service in everyday routine. If a culture preparation is made from a case which is complicated with mixed infection, the first colonies to appear on the surface of the nutrient medium are usually Loeffler's bacillus. They appear as small whitish dots which have a coarsely granular texture with rather defined edges, some observers state that the colonies have irregular edges. But on the first appearance of the colony the edges are regular and sometimes become rather irregular as growth advances. The shape and appearance of any particular colony depends a great deal on the form of nutrient medium that is used. Some media form greater resistance to the growth of the bacillus than others. When a colony is put
under the low power it appears as a round or somewhat oval disk. The centre is thicker than the periphery which often fades away to a thin edge. When several of these islets run together they form an irregular mass. The colonies of streptococci which are found so frequently in the throat, I find are extremely similar in appearance to those of Loeffler's bacillus. Their growth is nearly as rapid and it is impossible to distinguish the colonies with the naked eye examination.

Loeffler in 1884 published his work on diphtheria and along with Klebs described a bacillus which was found in the membrane of those suffering from diphtheria. This point has now been observed so frequently and one for the present must accept it as the cause of diphtheria. But one feels that more light must be thrown on the subject before this can be definitely accepted. If a pure culture of this Bacillus when placed upon the mucous membrane of an animal set up a condition similar to the condition which occurs in the human subject, the matter would be much clearer. When the bacillus is placed upon a healthy mucous membrane of the lower animals without any abrasion, such as the vaginal mucous membrane of the guinea pig, nothing happens, but if it is rubbed well in and an abrasion formed, a membranous condition develops which however does not spread and a similar condition can be brought about by a non-diphtheritic putrefactive organism or irritants.
The effects of inoculation in the lower animals give rise to an inflammation with general toxaemia and death as a result of the absorption of the toxic products formed by the bacilli at the point of injection. A small quantity of pure culture when injected into a guinea pig gives rise to death from one to five days. The usual changes are extensive local oedema, the lymphatic glands become enlarged and reddened, there is increased serous fluid in the various cavities as the peritoneum, pleura and pericardium, the supra renal capsules are often enlarged and sometimes haemorrhagic. The spleen is often slightly enlarged. Dr. Klein gives some very interesting results of inoculations of milch cows with cultures of the bacillus diphtheriae. He inoculated subcutaneously diphtheria bacillus derived from human diphtheritic membrane. The cow became ill and developed a peculiar acute eruptive affection of the udder, and from the milk of such an animal, the diphtheria bacillus could be obtained. There was also disease of the various internal organs. Loeffler however objected to these results obtained in the case of the cows and stated they should be accepted with caution. Klein also performed experiments on the feeding of cats with recent Agar cultures of diphtheria bacillus. In some cases the cats remained well and showed no abnormal symptoms. In others the cat began to sneeze and cough, they became very emaciated and took very little food.
After a month the cats were killed and showed signs of grey consolidation in the lungs and fatty degeneration in the liver. In some cases he failed to get any disease as a result of feeding the cats owing to the attenuation of the virus and given in too small amounts, Loeffler failed to get any disease in cats as a result of feeding and Klein explained this as being the result of the two above mentioned reasons.

Dr. Roux and Yersin have shown that the diphtheria bacilli in broth cultures form chemical poisons which when injected into the guinea pig produces death of that animal in the same manner as an injection of the living bacilli would have done. They have further stated that by injecting small doses of the chemical poison in question the guinea pig though made ill, survives the experiment and becomes thereby protected against what is customarily a fatal dose. But if these animals are inoculated with a virulent culture they will succumb. But when they used sterilised diphtheria cultures a certain resistance was noticed and the date of death was delayed after an injection with a virulent culture was made. In performing these experiments it is most essential that the virulence of any particular culture is tested on an animal such as the guinea pig. The virulence is rapidly lost in any particular culture as time progresses. A culture is said to be virulent when it is injected into a guinea pig it causes localised oedema and death in 1 - 3 days. But in the case of an attenuated culture, death may be delayed to several weeks.
These animals die as a result of Loeffler's bacillus and these experiments are not conclusive proof that they die of diphtheria. It is an undoubted fact that one of the ways diphtheria may be transmitted is by the membranous deposit coming in contact with a presumably healthy human mucous membrane. This membrane contains Loeffler's bacilli usually associated with other organisms of varying types and numbers.

Sydney Martin has shown that the diphtheritic membrane contains a poison which produces the same results as the albumoses found in the blood and spleen of diphtheritic patients, and he has also proved that the poison found in the membrane is much more virulent than that found in the body. He goes on to say that he considers there is another agent in membrane of the nature of a ferment. This therefore is an important point to explain before excepting the theory that the Bacillus is the actual cause of the condition. Then again there are some cases of undoubted clinical diphtheria which do not show the diphtheria bacillus at all. Strong upholders of the diphtheria Bacillus assert that in these cases the Bacillus was present at the early stage but has died out and left the other organisms to carry on the work. This may be the actual state of affairs but it seems strange when one has to take into account that this same Bacillus may remain in the mouth for weeks and even months after an attack of diphtheria. Whether this Klebs Loeffler is the actual cause or merely a result, it
in no way lessens the value of the bacteriological examination as an aid to diagnosis. In illustrating the value of the bacteriological examination in discriminating those cases which have the Klebs-Loeffler bacillus and those that have not in a series of intimated diphtheria cases, Lennox Brown states that from 4th. May 1893 to 4th. May 1894, 5611 cases of suspected diphtheria were subjected to a bacteriological examination in New York City 60% of these cases contained the Klebs Loeffler bacillus whilst in 40% it was absent. This coincides in a remarkable manner with the return in the City Hospital, Edinburgh. The number of cases intimated to the Diphtheria wards from 1st. Sept 1894 to 5th. April 1895 as being cases of true diphtheria amounted to 109 cases. These were all subjected to a very careful bacteriological examination and 59.5% proved to have the Klebs Loeffler bacillus whereas 40.5% proved to be other conditions where it was absent.

The necessary plant and apparatus to carry out these observations were supplied to the Hospital for this express purpose. In carrying out these observations with the object of coming to a diagnosis and testing the presence or absence of the bacillus during convalescence, I have made over 250 culture preparations and over 900 film preparations.

The following is now the daily routine carried on at the City Hospital after a case is intimated to the diphtheria wards. A portion of the membranous deposit is removed by means of a
long pair of sterilized forceps and placed in a small sterile closed dish. This is then removed to the laboratory and divided into two portions, one for an immediate examination the other for cultivation. The first proportion is prepared by making a film preparation on two No. 1 cover glasses, it is then dried and stained for four minutes in Loeffler’s Methylene blue preparation, it is then washed, dried and mounted in Canada balsam in xylol. It is then examined with a Reichert 1/12 oil immersion with No. 4 eye piece. This gives a magnification of 950 diameters. No diaphragm is used in the stage and the condenser is adjusted so as to be close to the specimen. A gas lamp with a blue tinted funnel is used for illuminating purposes. This first examination is most valuable in determining at the outset the actual condition of the case.

The film preparation made directly from the membrane is most valuable. It gives one a comparative idea of the actual proportion of organisms in the membranous deposit in a very rough and ready manner. After a careful examination of several film preparations from a portion of membrane one is able to say whether the Loeffler’s bacilli predominate or whether the micrococcal injection is in greater abundance than the Loeffler’s bacilli. Of course the first examination is only a preliminary to the culture preparation and it is utterly absurd to give a definite statement until the typical colonies have appeared and a cover glass preparation examined and their presence verified.
The point I wish to bring out is the film preparation which gives one a rough idea of the proportions of the organisms existing at the time of examination in the throat. In the majority of cases I have been able to demonstrate the bacillus in the film preparation on the day of admission and then verified the statement next day by means of the culture preparation. This is of course of great value in saving, 12 hours for the administration of the antitoxin.

In a very few cases I have been unable to detect the bacillus in the film preparation and have demonstrated its presence in the culture preparation on the following day. Only on one occasion have I seen a typical appearance of Loeffler's bacillus in a film preparation which was not followed by a verifying culture preparation next day. In this case the bacilli were few in number and probably had not actually come in contact with the surface of the medium or the growth of streptococci which was very extensive may have prevented the colony being picked out when the film preparation was inside.

The second portion is dried slightly with sterile blotting paper and then placed by means of a sterilized platinum wire upon a sterilized nutrient medium, such as blood serum or glycerine agar agar. It is drawn over the surface several times and sometimes I leave a small portion of the membrane on the medium. The cultivations are examined next morning, in the interim they are kept in the incubator at a temperature of
about 37° F. The Klebs Loeffler's Bacillus grows very rapidly
on blood serum and if present is usually the first culture to
appear on the surface of the serum. A cover glass is then
carefully cleaned and a small drop of distilled water placed
upon it, a small portion of the culture is then removed by
means of a sterilized platinum wire and a cover glass pre-
paration made. It is then treated in the manner I have al¬
ready described and at once examined.

For practical purposes Loeffler's bacillus can be divided
into four groups with regard to their shape they are as
follows:-

I. Long Bacilli which are the typical ones.
II. Intermediate form which are shorter.
III. Short form and thicker.
IV. Involute form.

I have found that the above classification has very little to
do with their respective virulence. The long Bacilli which
are supposed to be the most virulent, I have obtained in many
mild cases. The short ones I have found in many fatal cases
but they were always associated with streptococci and micro¬
cocci and it is just possible that if the short Bacilli occurred
in a case alone it would be probably mild. I have found the
short bacillus very common in the latter stages of a severe
case when going on to recovery shows a marked shortening in the
true Bacillus and have been named the pseudo Bacillus.
This so-called pseudo bacillus has been described by Loeffler, Von Hoffman, Roux, Yersin and others. The description of the bacillus is as follows: the colonies are identical with those of true diphtheria bacillus. Its growth however is somewhat slower than the true bacillus. It behaves in the same manner with regard to the various stains used, it stains deeply with methylene blue and also with Grams method. Sometimes it stains throughout its whole length at other times it has a granular appearance. It however is usually shorter when grown on blood serum than the true diphtheria bacillus, the colonies also grow at 20 - 22°C when the true bacillus grows only very slowly, when boullion preparations are made they are firstly acid and then alkaline in both cases but the change occurs much quicker in the case of the pseudo bacillus. The great distinction however between these two bacilli is the fact that death of animals has not occurred as a result of injections of the pseudo bacillus, but only slight oedema at the site of injection and often, even this oedema is absent.

Roux and Yersin examined 45 children in a Paris Hospital who were suffering from non-diphtheritic conditions, the found this variety of bacillus in 15 cases obtained from the pharynx and tonsils. Out of 59 healthy children they found it 26 cases, also 7 cases of measles showed this bacillus in 5.

The question arises are these sufficient facts to decide that there are two distinct forms of bacilli, or merely the
pseudo form is an attenuated state of the true bacillus? The facts which are against this statement are that it is found in the mouths of healthy individuals and in those who have angina which are non-diphtheritic: whilst on the other hand it is found more frequently in cases who have recently had an attack of diphtheria and also in severe cases as they progress towards a favourable termination. Taking these facts into consideration at our present state of information it seems better to consider the pseudo bacillus merely as an attenuated form of the true bacillus.

This form of bacillus of course always comes in the way of the every day routine method of examination and as it is impossible to try the effect on guinea pigs merely for a diagnostic purpose, the matter must therefore be left in this unsatisfactory state until further light is thrown upon the subject.

Having considered the bacteriological aspects of diphtheria I now wish to pass to the clinical phases of this disease.

The cases vary immensely in their virulence from a sore throat to a most rapid and malignant process. In an ordinary mild case there is a feeling of general malaise, sickness and vomiting often present, the child is out of sorts and looks ill. There is usually a rise of temperature, but in many cases this does not exceed 100F. When the temperature exceeds this one looks for other causes such as septic infection complicating the diphtheritic condition in such a case the
temperature may rise to 103 or 104°F. Along with this tempera-
ture there is usually a feeling of chilliness, nausea and some-
times diarrhoea. The child looks pale the eyes are dull
cheeks slightly flushed. The glands at the angle of the jaw
are enlarged and often decidedly painful. This pain is often
increased on pressure, very often this enlargement of glands
extends down to the clavicle.

I have however seen several well marked cases with very
slight glandular implication, but with careful manipulation one
can usually detect enlargement and tenderness on pressure.
The next point is the examination of the throat, now in some
children this is no easy matter, but if the head is held firmly
by an assistant and the child wrapped up in a blanket and held
in a fixed position, it simplifies matters very much. A small
spatula is then introduced into the mouth and passed far back,
in this way the patient involuntarily opens the mouth to its
full extent and at once exposes the parts. The further examina-
tion is very much assisted by means of a small incandescent
lamp on the forehead of the operator or on the blade of the
spatula. I have found this procedure of great service; it
is easily kept in working order, the light is very pure, and
cannot be blown out by the patient. One now examines the tons-
sils, uvula and posterior pharyngeal wall. The diphtheritic
membrane very often commences on the tonsils and extends up
the pillars of the fauces on the uvula thence along the roof
of the mouth and on the posterior pharyngeal wall. Many obser-
vers lay great stress on the implication of the uvula, it is an
undoubted fact that the majority of cases of true diphtheria have the uvula implicated, but I have certainly seen cases where the uvula was covered with a slight membranous exudation, which only proved to be a septic condition and quite distinct from a diphtheritic condition. Then a considerable variety in shades of colour are present in different membranous deposits from almost pure white to a dirty grey and sometimes almost black. I have noticed in those cases where the membrane is light in colour the diphtheria Bacillus is plentiful and the other organisms which are often present somewhat fewer in number. The exudation at first lies on the surface of the mucous membrane and then a necrotic process occurs below and erodes the substance of the mucous membrane. In this way the surface of the exudation is nearly on the same plane as the surrounding mucous membrane. The adjacent mucous membrane is usually in a catarrhal condition and markedly congested. The position and amount are of importance, the position denoting in the majority of cases if there is extension occurring in the direction of the air passages lower down, this however fails in some cases as the air passages become affected first. The amount of exudation is not regarded by some observers as being of very great importance, but if the bacteria in the exudation are to be regarded as the primary cause of the condition and by their action the toxalbumins are developed and permeated throughout the system generally, it therefore follows the amount of the
exudation will influence the amount of toxalbumin to a certain extent. Of course there are cases where the local manifestations are not in proportion to the constitutional sequelae in these cases the quantity of toxalbumin had gained a thorough entrance into the system.

The true diphtheritic membrane is fibrous and usually well organised, that is to say that if a portion of the membrane be grasped by a pair of forceps usually a considerable portion is removed. After the removal there is a bleeding surface left, this does not occur at the very early stage before the necrotic process has begun to destroy the mucous membrane, then when the case is advanced no bleeding occurs. The membrane is made up of connective tissue cells, fibrin and debris from the epithelial cells. The arrangement of the organisms varies in different cases. In some cases they are deep seated in others on the surface of the membrane and intermingled in its meshes. I have prepared sections of the membrane in situ and stained with Gramm's method, the micro-photographs are in the appendix.

The odour of the breath is usually offensive due to the decomposition going on. This odour is very much modified by treatment and one seldom sees the extremely offensive cases that are described as occurring before antiseptic measures came into use.

Swallowing is performed with difficulty and sometimes painful. The pulse is weak and easily compressible and is either
very rapid or very slow. The first sound of the heart is often weak in character. The urine is frequently scanty and high coloured, albuminuria is commonly present sometimes associated with various forms of casts in the deposit. This is a description of a typical form of diphtheria. The attack may however be much milder and only give rise to a catarrhal sore throat with a slight rise of temperature and the pulse unaffected. The patient complains of a feeling of dryness in the throat and slight difficulty in swallowing. The patient recovers from these slight symptoms, but there remains a persistent weakness which may not disappear for a lengthened period.

The typical throat variety may pass into a very serious condition when infection takes place into the trachea, this occurs about the third or fourth day after the invasion. One diagnoses this serious complication by hoarseness or even loss of the voice, increased cyanosis, stridulous breathing, swelling of the face and indrawing of the intercostal spaces and supraclavicular regions. The amount and position of the exudation in the pharynx helps in determining if this condition is about to take place. But I have seen cases where the tonsils have been affected and the trachea become implicated whilst the intervening parts were free from membrane. And in one case I saw, the trachea was affected before the pharynx:— When the membrane has reached the trachea the respiration is quickened, and embarrassed, the inspiration is prolonged and laboured and
accompanied by a whistling hissing sound. This steadily pro-
gresses until the patient becomes a painful sight the agonising
attempts to gain oxygen, whereby all the extraordinary muscles
of respiration are called into action and every effort is exer-
ted in attempting to make a negative pressure in the thorax.
The result of this excessive muscular movement not being
satisfied with a supply of air, is the indrawing of all the re-
sisting parts which in some cases becomes excessive, in young
subjects and in those whose osseous deposits have not been
strongly developed, show great indrawing of the sternum which
is allowed a large amount of play by the soft attachments to
the ends of the ribs. The patient tosses about in the bed,
first on one side then on the other often turns the face towards
the wall and gives its whole attention to the respiratory act,
if the nurse or doctor wish to move its position it shows con-
siderable annoyance. The patient often turns over and supports
itself in hands and feet and tries all manner of means to com-
pensate for the obstruction to the inflow of air. However the
strength begins to fail and the patient becomes drowsy and not
at all sensible to those around. The respirations become very
short and laboured and very often with a fit of coughing death
relieves the agonies of the sufferer. I think there is hardly
a more distressing sight than the one I have described, the sub-
ject may be a healthy well-nourished child perfectly conscious
of its critical condition. I shall deal with the operative
procedures which attempt to relieve this condition later on.

There is however a malignant form of diphtheria which commences with rigors headache and vomiting. The temperature is not very high, throat symptoms not always severe. Very often the odour of the breath is very offensive, due to the decomposition of the secretion. The pulse is small and often rapid, patient becomes drowsy, bleeding occurs from the mucous surfaces and goes on to a fatal termination rapidly.

Diphtheria may be confounded with Scarlet fever, acute tonsillitis, acute laryngitis and herpes of the throat.

With Scarlet fever, the throat in scarlet fever is more uniformly reddened and the membranous deposit is somewhat rare. When it does occur it is easily detached and does not leave a bleeding surface. The trachea is almost never implicated. The constitutional disturbances are not so severe in scarlet as in diphtheria, however haematuria is common in scarlet and rare in diphtheria. The rash is an important point, in diphtheria it is rare and when it does occur it is a uniform rash scattered here and there and suddenly appears and disappears and also does not possess the punctate appearance which is the characteristic point about the scarlet rash. There are some very difficult cases however and I have found the bacteriological examination of the greatest value in clearing a case up. And I am sure a large number of so called diphtheritic conditions complicating scarlet are much rarer than is
really thought to be the case, and by means of the bacteriological examination this is easily settled. There is another condition which simulates diphtheria in the early stages, that in follicular tonsillitis. Again the bacteriological examination is the sheet anchor. Acute laryngitis and confluent herpes of the throat are other conditions which are cleared up in the same manner.

Diphtheria is one of the many diseases where it is important to make an early diagnosis both for the sake of the patients and for those who happen to come in contact with him. In the early stage this is almost impossible without a bacteriological examination.

The relationship between croup and diphtheria is a point upon which many observers differ. Since the bacteriological examinations have been carried out in these cases a new line of division has been made, namely those conditions which have the Klebs Loeffler Bacillus present and those in which it is absent. For the present the first of these groups are called diphtheria and the latter are subdivided up into their respective subdivisions depending upon the organism or different forms of organism that may be present. Some so called cases of croup have undoubtedly proved to be laryngeal diphtheria, the only way to differentiate these two conditions is by means of the bacteriological examination.

Falling under the first of these groups one may get the
trachea affected with a membranous deposit, with the parts in
the pharynx and mouth perfectly free, with Loeffler's Bacillus
either alone or associated with other organisms.

In the second group it is possible to have a membranous
deposit in the trachea with streptococci either alone or assoc¬
iated with micrococci and no Loeffler's Bacilli.

My own experience with regard to this point is limited, I
have found in the so called croup cases where there is no mem¬
branous deposit visible in the throat, but with evident signs
of extension in the air passages lower down, that it is very
difficult to decide what form of organism is present, because I
consider that a swab preparation from the posterior pharyngeal
wall is not sufficient in giving one data as to the condition
of the parts lower down. In one case under observation the
swab preparation gave cultures of micrococci and diplococci
with no Loeffler's bacillus but required operative interference
on account of the excessive obstruction, during the operation
portions of membrane were removed which on a most careful bact¬
eriological examination failed to show Loeffler's Bacillus, this
case went on to a favourable termination.

Then again I have seen cases commence in the trachea and
extend upwards and implicate the parts above, the bacteriologi¬
cal examination showing the presence of Loeffler's Bacillus.
At the early stage of this case it had every appearance of a so
called croup, the bacteriological examination of the swab obtained from the posterior pharyngeal wall was negative with regard to the presence of Loeffler's bacillus. In summing up this question I think that the great majority of membranous conditions of the trachea are diphtheritic, but there are certainly cases which have no Loeffler's bacillus present.

Out of the 155 cases that I have examined I have found two cases of membrane in the trachea in which I was unable to detect Loeffler's bacillus either by many film preparations or by culture. Also another case which showed no membrane on the tonsils or pharynx, expectorated a cast of the trachea which was most carefully examined, it proved to be about one inch and a half long, when opened up have a transverse measurement of \( \frac{3}{4} \) of an inch, on careful bacteriological examination being made I failed to get Loeffler's bacillus.

I now pass to the prognosis, it should be very guarded. And it is far the wiser plan to take a grave view of all true cases of diphtheria. It is a most treacherous disease and often causes a fatal result when it is least expected. I have now seen three cases which went through the acute stages and apparently making a speedy recovery when they suddenly died of paralysis of the heart.

As an everyday rule one is influenced by the amount and position of the membrane, of course if the membrane appears to be encroaching on the trachea the prognosis becomes very grave
indeed. Epistaxis is another very grave symptom and in those cases where it occurs usually prove fatal. If the pulse indicates any heart failure that is another fatal omen.

**Treatment of Diphtheria.** The remedies which are advocated for this disease are so numerous that I will confine my remarks entirely to the measures that I have personally tried in this disease. Of course the treatment naturally divides itself into two parts, first that devoted to the general conditions, and secondly to the local manifestations. The first of these two divisions is of utmost importance, it is most essential to attend to the general condition of the patient. The diet should be very nutritious, given in small quantities and at repeated intervals. Any appearance of heart failure should be anticipated by cardiac tonics such as strophanthus or digitalis and whisky. Any vomiting or diarrhoea should be attended to. This general treatment should be carried out in all cases, it is most important to insist upon the patient taking a large quantity of nourishment. The ward should be at a temperature of about 65°F well aired and easily ventilated. There should be a large supply of sunlight and everything kept scrupulously clean. All discharges should be removed on muslin and at once burned. The utensils for food should be placed in boiling water after use. All motions should be treated with carbolic lotion before they are passed into the drains. Those in attendance should be in perfect health and have plenty of outdoor daily exercise. It is well to have an antiseptic aromatic
substance such as eucalyptus or benzoic acid in a vessel, kept at the boiling point in the centre of the ward. Various suggestions have been made in preventing those attending diphtheria from getting the disease, cotton wool introduced into the nostrils and even respirators have been used, but these are quite unnecessary if ordinary care is taken. Having considered the general treatment I now pass to the local treatment.

External applications to the neck are of service in relieving the pain and swelling they include cold applications in the form of water or ice. I have used for some time a remedy advocated by Loeffler which consists of a mixture of lead acetate and carbolic acid (1 in 40). It is very pleasant and the acetate assists in allowing the phenol to be absorbed, and thus help the local applications from the outside. The list of internal applications is very large, they are often assisted with steam inhalations. This is usually carried out by means of inhalors or bronchitic kettles. But in a Hospital where there may be several cases requiring steam at the same time I found the bronchitic kettles were a great drawback, not only in not being very effectual, but also causing the nurses in attendance a great deal of labour in filling etc., and the danger of fire was very considerable, the methylated spirit which is required is also an expensive item. Another objection to the bronchitic kettle is owing to its position, it usually stands in the
way of the medical man who may require to assist the patient hurriedly and sometimes during a fit of hurried coughing the patient springs up in bed and comes in contact with the tube from the kettle and gets injured. To do away with these objections I constructed a steam boiler in the corner of the ward with a main steam pipe running along the wall, with a tap to each bed. The steam on escaping fell into a tin vessel with an outflow conducted to a vessel on the floor in this way the water of condensation is caught and spray or drops of hot water are thus prevented from escaping on to the patient. If the steam is to be medicated in any way the drug is merely introduced into the boiler or hung in a small vessel below the tap in the tent over the cot. By this mechanism it is very easy to get a very effectual supply of steam and requires little or no attention. The local applications which I have found of greatest service are Corrosive Sublimate, Lactic Acid, Carbo- lolic Acid, Hydrogen Peroxide and Iron.

Corrosive Sublimate is used as a spray, the strength used is 1 in 1000. The Corrosive Sublimate mixed with Peroxide of Hydrogen is advocated by some, but I have found that the mercury becomes slightly precipitated and therefore do not use the two solutions in the same spray but alternate them. Hydrogen Peroxide should be frequently tested with the permanganate of potash to ascertain if it still retains its standard strength.
An excellent preparation is the one advocated by Loeffler namely Spt. Vini. Rect. Toluol and Tnt. Ferri Perchlor. This is used along with the other sprays by means of cotton wool swabs applied thrice daily.

Mercury is of great service both given internally in the form of calomel and also given by fumigation.

Mechanical removal of the membrane is a point upon which many observers differ. Some state that the removal causes abrasions of the surrounding parts and in that way gives the bacillus new foci for extension. I certainly agree with this statement but I consider that with care one can remove a large amount of the membrane without causing injury to the surrounding parts.

When there is a nasal discharge the nostrils should be well irrigated every hour by means of a douche can or syringe. When extension occurs to the larynx, emetics are sometimes of service. When however this procedure fails and the extension becomes so marked that suffocation is impending some mechanical intervention is required.

The two commonly used methods are intubation and tracheotomy.

I. Intubation is a method which has been very strongly advocated by medical men across the Atlantic especially Dr. O'Dwyer of New York. The tube is introduced by means of a holder. The operation has not gained much favour in Britain, it has been
tried in many cases in London but tracheotomy is again taking its place. In cases which are treated with Antitoxin where at a certain time the membranous deposit becomes detached and expelled, the tube of course being inside the lumen of the membrane must be expelled along with the deposit before the patient can expel the membrane. However some observers state that they consider this procedure the one which will be most extensively used along with the Antitoxin treatment. The actual introduction of the tube is an easy matter after a little practice on the cadaver. But when it has to be done on a patient who is obtaining very little oxygen at the time, on account of the stenosis it is a very difficult matter, because during the introduction, the respiratory act is interfered with and therefore the operation has to be performed very rapidly. Having repeatedly tried intubation on the dead body, I find it very easy to rapidly introduce the tube, but a most difficult matter to remove it rapidly. After the tube is in situ it is impossible to leave a piece of thread attached to the tube unless the patient's arms are tied down and in this way prevent the patient drawing up the tube. In a case where there is extensive membranous deposit, the tube of course lies in the lumen of the membrane; if antitoxin is also given after a certain time the membrane may become separated and it is just possible that the lower portion will act as a valve to the lower end of the intubation tube when this occurs of course the
tube has to be removed and if the child has been struggling for some time as a result of this valve action at the lower end of the tube, probably the necessary struggling which would be brought about in the difficult performance of removing the tube would be sufficient to cause death. A case of this kind was reported in the Edinburgh Medical Journal in 1892. But in cases where there is stenosis of the upper part of the trachea and larynx as a result of membrane which has not extended far down I think intubation is a suitable measure that should be adopted. It certainly for the time relieves the dyspnoea, there is no objection raised by the parents, there is very little shock if it is rapidly and properly performed, no anaesthetic is required and the inspired air enters the lungs moist and warm in this way preventing the common complications of tracheotomy.

On examination of the photographs of casts in the appendix one will at once see how extremely difficult it would be to have them expelled through the glottis. I have performed intubation of one case of stenosis of the larynx due to diphtheria with a successful result.

II. Tracheotomy appears to me to be the better plan when there is extensive membranous deposit. It gives instant relief if there is not very general toxic effects and the membrane has not occluded the bronchi.
By this means the patient is carried over the critical period and gives the antitoxin time to act. Undoubtedly the mortality is very high in this country as compared with that which we get from abroad. But I think the reason for this is, it is only done in this country as a last resource when the patient has lost all the little strength that was remaining. I shall give statistics on this point under the antitoxin treatment. During the six months prior to the antitoxin we had eleven tracheotomies at the City Hospital all terminating fatally. Since the antitoxin treatment we have had ten tracheotomies with two recoveries.

It is most important to make a large tracheal wound and at the time of operation remove as much of the membrane as possible both above the wound and below it. Fluids may be removed by an aspirator with a German metal tube than can be introduced into the trachea. The choice of a tube is an important point and I have found that Parker's angular tube with a moveable collar is a very servicable one, an india-rubber tube may be used after the fourth day after operation. I now wish to pass to the special reference of the treatment of Diphtheria with Antitoxin.

The infectious diseases are undoubtedly one of the most dreaded enemies to the human race. Happily however one attack very often causes immunity against future invasions. This however does not hold good in diphtheria as it very often
happens that one attack tends to make the victim more susceptible to the subsequent attacks of the specific bacillus.

This power of immunity appears to have been long recognised for centuries self inoculation has been practised in India and China by means of virus obtained from mild cases in this way prevented the onset of a more virulent type of the disease. This method however got into disfavour as many cases unfortunately took the virulent type instead of the mild one. It was not until Jenner in 1798 cleared the way for practical application. This point in relation to small-pox is now so practically proved that it is only natural that observers have been long looking for a similar method in other infectious diseases. At present a great part of the research in this direction is mainly devoted to the bacteriological aspects of the various conditions and it is of extreme interest to remember that the discovery of the value of vaccination was accidentally found out and that the bacteriological relationship of its causation has not been definitely cleared up even at the present date. Pasteur was probably the first who used bacteriological methods in obtaining immunisation against Anthrax and fowl cholera. He obtained this by the inoculation of weakened or attenuated bacilli. Following on these two diseases with more or less encouraging results in cholera, hydrophobia and diphtheria. These results have been attained by means of the attenuation of any particular bacillus. This is accompanied
by a considerable amount of danger especially when one is dealing with a bacillus which when in the virulent state would cause a fatal termination if injected into the system. It was this source of danger which has led many observers in other directions to gain immunity from any particular disease. When an animal is rendered immune the blood of that animal has properties so that when the blood is injected into a susceptible animal it destroys the same immunity possessed by the animal from which the blood was obtained. The reason for this immunisation is not yet definitely settled. The antitoxins are nitrogenous substances, derivatives of the proteid compounds found in the system.

In nearly all the diseases that are specific in origin, due to bacteria that produce toxins, nature makes a cure by the development in the system of an antitoxin. The serum of a patient who has recovered from diphtheria contains the same antitoxin that is obtained from the horse. In the case of diphtheria where nearly all the cases are complicated with mixed infection the antitoxin has not a curative effect on the products of these other organisms, it may neutralise the toxin of the Klebs Loeffler's bacillus but for the other organisms and their products it exerts no antitoxic power.

In 1890 Behring published his results on the action of the serum of immune animals on the diphtheria poison. He found that the serum derived from an animal such as a guinea pig
which has been previously protected from diphtheria by artificial means, had the power of saving an animal which had been subjected to a fatal dose of the diphtheritic poison. In order to apply this method to the human subject it was necessary to use much larger animals for the production of this serum with antitoxic qualities, hence sheep, goats and oxen were tried but it was however found that the horse was the most suitable as it could resist large doses of the diphtheria poison without showing much discomfort and also of course it could give large quantities of serum at periodic intervals.

Nuttall, V. Fodon, Buchien and other have demonstrated the powerful germicidal properties of extra vascular blood serum and there is every reason the believe that the serum in the animal has the same power. But this does not explain natural immunity. If natural immunity were explained by this, the blood of immune animals would possess germicidal properties and the blood serum of susceptible animals would not possess these properties. This however is not the case, but sometimes the very opposite. With regard to artificial immunity however many more definite facts are known. It is now known that the blood serum acquires the property of neutralizing the disease producing qualities of certain micro-organisms.

Brieger, Kitasato and Wassermann draw a marked distinction between infection and intoxication which was first made by Koch. They say that in infection the micro-organisms of a disease gain entrance into the body of a susceptible animal, it
may be in very small numbers and spread and multiply throughout the body. In intoxication on the other hand the microorganisms when inoculated in small doses often produce no disease, they tend to remain at a certain focus and there produce poisons which are disseminated throughout the whole body. These poisons are of two kinds namely ptomaines and toxalbumin.

The majority of observers state that the diphtheria bacilli do not enter the system but produce toxic substance that are absorbed and acting on the blood, and tissues produce substances which have been shown by Sidney Martin to be of at least two kinds, acids and toxalbumins. The method of procedure in obtaining these bodies is as follows: the tissues of patients dead of diphtheria were, in the first instance, chemically investigated before an attempt was made to isolate the products of the diphtheria bacillus. All facts point to the membrane as the seat of origin of the disease, so that it was examined in the same way as the blood spleen and kidneys. The tissues to be examined are minced and placed in rectified spirit which coagulates all the proteids. It is then filtered and the residue is extracted with cold distilled water until nothing more dissolves. All the extracts are mixed together evaporated at 35°C to a small bulk and then placed into absolute alcohol. It is then passed through various stages at a low temperature and ultimately is allowed to precipitate and stand under alcohol for six weeks. The alcohol is then poured off and the
precipitate dried in vacuo.

His results are briefly as follows:

1. The albumoses are always associated with the presence of the organic acid and that the amount of the albumoses is much greater than that of the acid.

2. The spleen contains more albumoses than any other organ and he concludes that the spleen is the chief repository of the diphtheritic poison in the body.

In summing up the chemistry of the tissues in diphtheria he states that there are two distinct substances which are present that are abnormal to the body, one belonging to the digested proteids namely albumoses, the other an organic acid.

When these poisons are injected into an animal they set up a local oedema which rapidly passes off and leaves no necrosis. A rather important point is that it does not cause a marked rise of temperature but only a slight irregularity when injected into guinea pigs. In rabbits however the injection is followed by fever sometimes great, in others small. there is however a constant symptom namely paresis of the muscles. This paresis does not go on to complete paralysis but the animals become sluggish and are unable to move rapidly and have evident weakness in the limbs. The muscles show however no special wasting although there is a general loss of body weight, which is often in proportion to the dose injected.
The action of these albumoses is distinctly of a prolonged character, lasting in some cases for three weeks.

There is usually marked watery diarrhoea. The blood of the animals which were injected coagulated very slowly and this condition may be present weeks after the injection which may help to throw light on the question of diphtheritic paralysis occurring in the human subject some time after the acute attack.

The paresis which is brought about by the injection of these albumoses is due to a degeneration of the nerves themselves either medullated or non-medullated nerve fibres may be affected. The spinal ganglia, spinal cord, medulla and brain were in all cases found normal. He has therefore proved that this diphtheritic poison although a fever producer is a nerve poison selecting the peripheral nerves for its action.

The degeneration first affects the white substance of Schwann, which breaks up and finally disappears and the axis cylinder becomes attenuated and splits up into strands. When this occurs the part of the nerve below this point undergoes descending degeneration and the muscle fibres undergo fatty degeneration. When the axis cylinder is not ruptured of course the paralysis will only be partial which is generally the case in diphtheria and therefore not complete.

When on the other hand the organic acid is injected it
causes fever but no paralysis. The blood does not coagulate slowly. However fatty degeneration was found in the heart and degenerative changes in some of the nerves. It is therefore a nerve poison similar to the albumoses. The chemical examination of the membrane shows that it consists of the following proteids, one almost insoluble in saline solutions at the ordinary temperature which is the fibrin of the membrane, also three forms of albumoses, namely hetero-proto and deutero-albumoses. The acid body which is found in the tissues is present but only in minute quantities. The extract of the membrane from which all bacilli had been removed when injected into a rabbit caused fever followed by paresis of the limbs and loss of body weight. The animal died and the blood was found to coagulate slowly, fatty degeneration of the skeletal and heart muscles, also degeneration in the peripheral nerves similar to that which has been already described.

These points illustrate that there exists in the diphtheritic membrane a poison which produces the same results as the albumoses found in the blood and spleen of diphtheritic patients.

When Loeffler in 1884 described the bacillus which has retained his name he did not state at that time it was the cause of diphtheria for the following reasons:

1. The bacilli are absent in a number of cases of typical diphtheria.
2. The bacilli are not found in the pseudo membrane of inoculated dogs and hens in the typical arrangement observed in man.

3. No effect is produced on animals sensitive to inoculation when the bacilli are applied to the uninjured mucous membrane of the pharynx, larynx, vagina or conjunctiva.

4. The animals which recover after inoculation show no symptoms of paralysis.

5. Bacilli, identical in form and in character and found in the mucous membrane of healthy children.

At the present date the status of this question is as follows:

1. Loeffler's bacillus is not found in all the cases of Bretonneau's diphtheria although practically all of these cases must be regarded as typical diphtheria.

2. The Loeffler's bacillus is never found alone but in conjunction with other bacteria as micrococci, diplococci, streptococci etc.

3. Then again the Loeffler's bacillus is found in diseases not identical with Bretonneau's diphtheria as phlegmon of the skin, mild conjuncticitis, light pharyngitis etc.

Then again guinea pigs though very sensitive to Loeffler's bacillus have never spontaneously contracted diphtheria, whereas on the other hand cats have contracted the disease.

Dr. Hansemann states that Loeffler's bacillus therefore may
not be the actual cause of the disease although it plays a most important part in the disease.

The basis of the antitoxin treatment is

1. A cure is produced by an immunity due to the action of the disease itself.

2. This immunity is the result of the formation of an antitoxin a chemical body which destroys the toxic effects of the bacteria.

The first of these is not an accepted fact and it is certainly possible to recover from an infectious disease without resulting immunity.

With regard to the actual antitoxin no one has separated it or described it. It is not a thing of fact, but of theory. Theoretically it claims.

1. The production of immunity.

2. A curative agent.

3. That it is harmless.

1. With regard to the immunity which is brought about by an injection of antitoxin. Sixteen cases have been mentioned where immunity did not follow its use. In one Hospital I notice that as soon as a child is admitted it receives an injection of 20 c.c. of serum under the skin of the flank. If the subsequent bacteriological examination proves that it was not a case of true diphtheria the injection was not repeated.
children suffering from non-diphtheritic anginas were thus injected without the slightest ill-effect: the report states that in some cases the condition of the patient was improved although the condition was non-diphtheritic. It states that the children remained for some days in the diphtheritic ward without acquiring diphtheria. The report then concludes by saying that this is an experiment which shows the prophylactic value of the serum. I consider that this statement bears very little weight as I have made bacteriological statistics and find that at least 40% of the intimated cases to the Diphtheritic Wards in the City Hospital prove to be non-diphtheritic, but are usually kept in the diphtheritic ward until complete convalescence.

During the past 20 years not one of these so-called susceptible cases have been known to take true diphtheria, although they were undoubtedly subjected to a prolonged period of infection in the diphtheria wards.

Another curious fact in relation to the above Hospital, namely no nurse, doctor or attendant has fallen a victim to diphtheria during the same period of years.

2. It is claimed that the membrane disappears quickly, while the fever suddenly falls. This assertion is strongly denied by many clinicians, other forms of treatment have just as good results as Meyer who treated 60 cases of diphtheria with ice
of which a good number were severe with only one death, also Bonnebin by local treatment lost one out of 427 cases. The claim that all cases treated in the very early stage are cured is not sustained by facts as many cases have been recorded as treated in the very early stage and have succumbed. Also a number of paralyses have been observed following the treatment.

3. That it is harmless, many cases have been reported with pains and swelling of the joints, high fever sometimes above 104° and coma. Also it appears to have caused serious kidney trouble.

The preparation of the diphtheritic toxin by the method followed out by Roux is as follows: The toxin is produced by cultivating the virulent diphtheritic bacillus in broth, in the presence of air. Under usual conditions the cultures must be maintained for a number of months at a temperature of 37 C, in order to allow the poison to accumulate. This process is more rapidly performed in a current of damp air.

Fernbach's flasks are used provided with a lateral tube containing alkaline broth. After sterilization the flasks are impregnated with fresh and very virulent diphtheritic bacilli and placed in the incubator at 37 C. When the development has well begun the bent tube of each flask is connected by means of a rubber tube with a water blast pump. The air is driven through the fluid. After three weeks or a month the culture is sufficiently rich in toxin to be employed. At the bottom of
the flasks there is a heavy deposit of bacilli, while the surface is covered with a layer of younger microbes. The fluid is then filtered upon a Chamberland tube and the resulting clear fluid which is free from bacilli is collected in flasks and kept in the dark at a cool temperature. When the toxin is prepared in this manner about $\frac{1}{10}$ of c.c. will kill a guinea pig 500 grms in weight in about 48 hours.

The following is the method carried on at present by Klein. He commences by stating that the rationale or the method used by Roux seems to be difficult to accept from a theoretical point of view. Klein however does not for a moment deny that the serum prepared by the method of Roux has not antitoxic power, as the experiments which he gives are almost conclusive proof. The main objections being the great length of time which is required in the formation of antitoxin by this method and the large amounts of toxin that are required to be injected into the horse to stimulate and sustain the formation of antitoxin. After repeated doses of pure diphtheria toxin there is of course a certain amount of resistance in the horse by the formation of antitoxin in its blood, therefore this newly formed antitoxin has to be neutralized by more toxin before further antitoxin can be developed. It is probably due to this that the method carried on by Roux requires such a long period.

Taking these facts into consideration, Klein endeavoured to follow the natural process more closely. By this method
he states he obtains antitoxic serum in a much shorter period of time. The principle of his method is as follows: a few injections of attenuated living bacilli along with their toxin are subcutaneously introduced into the horse, in this way the horse is furnished with a certain degree of resistance. Then large quantities of living diphtheria bacilli minus their toxin are taken from the surface of solid cultures. These are injected subcutaneously in gradually increasing virulence and in this way they gradually produce within the body the toxin and then the antitoxin. These injections cause a rise of temperature usually about 1 c., and a local swelling, but he states there is no suppuration at the sight of injection. At the end of the third week the animal will bear the scrapings from the surface of two whole agar cultures. In one horse by carrying out this method he obtained antitoxic serum in 23 days in another in 26 days from the date of the first injection. After the first amount of serum has been removed from the horse it is then again injected with virulent living bacilli on two or three occasions, the further serum obtained from such a horse is said to possess even increased antitoxic power. This method of Klein's has not proved a great success as yet, the extreme difficulty in preventing contamination of the culture is very considerable, and in the case of several horses which have been injected in this way have fallen victims to the effect of the bacilli. Suppuration at the point of inoculation and
throughout the rest of the body is a common occurrence even when the greatest care is taken.

The clinical results obtained by this form of serum I shall detail later and I am almost convinced that it has more harmful effects than the other forms of antitoxin, and has not such a beneficial effect as that prepared by Roux's method.
In the early history of this treatment there was no mention of bad effects as compared with the present date. The cases showed a fall in temperature, improvement of the pulse and disappearance of the membrane with complete recovery and no sequelae. Since then various preparations have been put in the market with varying strengths of antitoxin qualities and containing impurities. These forms have been accompanied with various successes in the way of recovery and in many cases have been followed by rashes, pains in the joints and kidney trouble.

In a series of 61 cases treated with British Institute Antitoxin Drs. Washbourn, Goodall and Card mention the occurrence of a rash following the injection in 25% of the cases and that it appeared 7 - 19 days after the first injection. They described it as an erythematous rash sometimes accompanied with pyrexia. There were 6 cases developed joint pains, all of these had a rash, the hip joint was chiefly affected. I have mentioned these facts as they are of great importance when one wishes to come to a definite conclusion. With regard to the harmless nature of the fluid.

The results obtained by observers on this treatment up to the present date are on the whole pretty satisfactory. The harmful complications have certainly increased to a great extent since the adoption of the antitoxin prepared in Britain.

This fact must be carefully taken into consideration and not used as an argument against Dr. Aronson's antitoxin. The results obtained by Aronson's antitoxin up to the present date
are so scattered that it is extremely difficult to give definite numbers, but from the statistics I have been able to see, I gather the following points. The treatment by Aronson's diphtheria antitoxin last March in the Kaiser and Kaiserin Friedrich Hospital, during June and July nearly all the diphtheria cases were treated with the serum. The supply of serum was suddenly stopped on account of the death of the horse for the period of 7 weeks, the supply was then re-continued after the space of seven weeks. The total figures were as follows: 303 cases were treated with the serum and 230 without. The former had 13.2% deaths and the latter 47.8% deaths. Virchow considered the disease artificially produced in animals by means of Loeffler's bacillus had nothing to do anatomically with Bretonneau's diphtheria, nor did he consider the bacillus the cause of human diphtheria. But he continued in stating that "all considerations must give way to the brute force of these figures". The theoretical explanation is therefore by no means understood and remains for future research to describe it.

The mortality in the Trousseau Hospital during the years 90-93 was 51.7%, there were 3971 children admitted to the diphtheria department and 2029 died.

During the serum treatment all other treatment being carried on, as before the mortality was 24.5% there being 109 deaths out of 448 children admitted. During the months of February,
March, April and June, in the Trousseau Hospital there were 520 diphtheritic children who received no serum and among whom there were 316 deaths or a mortality of 60%. These numbers do not take into consideration the fact that many cases admitted into the Diphtheria wards are non-diphtheritic, but this point has been disregarded both before and after the serum was used. The same writer goes on to say that they have pseudo membranous anginas, without the Klebs Loeffler bacillus. These affections of course are much less dangerous and brought about by other organisms. Roux and Yersin mention that ¼ of the cases admitted into the diphtheritic wards are not true diphtheria from a bacteriological point of view.

Out of the 448 children treated, 128 had not true diphtheria, also 20 died shortly after admission and did not receive the serum. Taking these points into consideration 300 cases were treated with 78 deaths which gives a mortality of 26%. The researches of Roux and Yersin also of Martin and Chaillou have shown that in the same hospital the mortality among children affected with true diphtheria which was established by bacteriological examination, before the serum was used was 50%.

The results obtained at the Berlin Hospital are even better than those of Paris. Dr. Aronson stated that he had treated 192 patients suffering from diphtheria as ascertained by bacteriological examination. The mortality was 14%. In 23 cases the children were moribund when admitted, eliminating
these there remained 169 cases with 19 deaths which gives a mortality of 11.2%. The mortality in this same Hospital during 3 years before the adoption of the antitoxin treatment was from 32.5% to 41.7%.

The other Hospitals in Berlin give a mortality of 15.3% in those cases treated with the serum.

Koerte reports on 121 treated at the City Hospital Urban, 81 were cured and 40 died being a mortality of 33.1% these were all subjected to a bacteriological examination and revealed the presence of Loeffler's bacillus associated with other organisms. This period was followed by an elapse of time when the supply of antitoxin was discontinued, during this time the mortality under the same circumstances was 53.8%. Koerte divides his cases in three groups.

1. Severe cases with grave intoxication.
2. Moderately severe cases with grave local disease but without symptoms of grave general infection.
3. Mild cases.

The mortality in these divisions is as follows:
1. Severe cases 43 cases with a mortality of 58.2%
2. Moderately severe 47 cases with a mortality of 29.8%
3. Mild cases 31 cases with a mortality of 3.3%.

The effect on children under two years of age is of special importance there were 15 cases of this age 7 died and 8 recovered.
Tracheotomy was necessary in 42 of all the cases treated with serum with 20 recoveries being a mortality of 52.4%. The mortality in tracheotomy cases before the serum treatment was 77.5% by the same writer. This remedy has therefore reduced the mortality 25%.

Another point is that none of the cases treated before the tracheal stenosis was present required tracheotomy. Out of 108 children under 2 years of age, 108 had tracheotomy performed before the serum treatment came in use with only 9.2% recoveries. Whilst 8 cases which were treated with the serum and of the same age 3 recovered = 37.5% recovery.

The returns from Munich by Bucher, Von Ranke, Seitz and Emmerich give the following facts.

Out of 1048 cases treated during the last 7 years prior to the serum treatment the mortality was 49.2%. The operated cases had a mortality of 65.2%. They began the serum treatment in December 1893 but used too small doses. Later on when larger doses were given the mortality was reduced. In some cases of death the postmortem examination showed a peculiar form of infiltration of the lungs which was supposed to have some connection with the injections. In other cases the diphtheritic process had not ended even after a prolonged period of large doses of the serum. Emmerich laid great stress on the fact that all the fatal cases in Munich showed Loeffler's bacillus associated with other organisms such as streptococci.
staphylococci or the bacillus pyogenis fetid were found.

Rinne through Schubert reports 34 unselected cases all of whom happened to be severe diphtheria in children treated with the serum with a mortality of 17.9%. The post mortem examinations showed death was due to septic pneumonia in two cases, mechanical plugging of small bronchi in 2 cases, pronounced myocarditis and nephritis in one case, and the remaining case died after dismissal from the Hospital. He states the local conditions improved rapidly, the effect upon the general condition was more marked than any other (especially where there was a weak pulse), and a rash was noticed following the injection.

Sonnemann reports 44 cases with a mortality of 25%. 9 tracheotomies with a mortality of 37.8.

Strahlman reports 48 unselected cases with a mortality of 6.2%.

White of New York has collected statistics of 486 children treated for true diphtheria by various observers, with the various forms of antitoxin, out of these 116 have died on a mortality of 23.8% in a class of cases in which about 50% always die.

Nine years ago Henoch reported 319 cases with 208 deaths in Berlin or about 65.5% of a mortality. At the Hospital Trousseau in Paris 606 cases were treated by various measures with 391 deaths = 64.5% of a mortality. During the same
period cases in New York gave a mortality of 42.6%. Baginsky states that the antitoxin treatment reduces the mortality from 37% to 13%.

Many observers have stated that under this new form of treatment the severe symptoms subside in a few days and it was very rare for an early case to advance so as to require intubation or tracheotomy.

In 44 cases treated by English medical men that were published up to the end of the year and in which Aronson's antitoxin is mainly used gives a mortality of 9%. All these deaths were attributed to delay in commencing the treatment, and no bad results were noticed.

Professor Widerhofer gives the results in 100 cases treated with the serum with a mortality of 24%. The mortality during the previous 9 months without the serum was 52.6%. With these statistics it is evident that the antitoxin reduces the mortality from 20 to 30%.

I now wish to pass to the clinical notes of the cases I have had the opportunity of treating in the City Hospital, I am extremely indebted to the authorities of that Institution for the courtesy and kindness that I have received during these investigations.

These 40 cases of recovery and 18 fatal, represent a period of seven months trial of the antitoxin treatment in the City Hospital, Edinburgh.
The clinical notes of cases of diphtheria, treated with Antitoxin followed by recovery from 1st. Sept. 1894 to 5th. April 1895.

Case 1. S. B. female aged 5 years.
Admitted into City Hospital 1st. Sept. 1894.

27th. August. Patient became feverish and would take no food, slept badly at night.

31st. August. Became hoarse and slight difficulty in breathing.

1st. Sept. Being the 5th. day of disease at the time of admission. The child looked very distressed and restless. There were distinct signs of difficulty in inspiration, a continuous whistling sound being present during inspiration as well as expiration. There was marked indrawing of the intercostal spaces and epigastrium. Respirations were 28 per minute. Pulse 140 per minute regular but easily compressed. Temperature 97.8 F. The examination of the mouth revealed patches on both tonsils uvula and posterior pharyngeal wall. The glands on both sides of the neck towards the angles of the lower jaw were enlarged and tender on pressure. Albumin present in the urine.

The bacteriological examination showed a large number ofoeffler's bacillus in the film preparation along with
micrococci. Diplococci, the culture preparation exhibited colonies of Loeffler's bacillus. At 11:5 A.M. 9 min. of Aronson's Antitoxin were injected into the forearm. At the time of this injection the adult dose for Aronson's Antitoxin was 1 c.c. and taking the child's age into consideration only 9 min were injected. At mid-day however the child had not improved at all, the cot was surrounded with a flannel tent and steam applied. During the afternoon the indrawing became more marked, pulse became more rapid and compressible. The respirations became more frequent and difficultly increased. At 9 P.M. it became necessary to perform tracheotomy on account of impending death due to obstruction. The child was anaesthetised and the operation performed with some loss of blood as I wished to make a large tracheal wound with the view of removing as much membrane as possible. The opening of the trachea improved the breathing to a certain extent, small portions of membrane were removed with difficulty by means of a pair of curved forceps. Artificial respiration was required for 5 minutes before the patient was out of immediate danger. The cyanosis disappeared to a great extent and on the whole the patient was very much relieved by the operation.

The temperature an hour after was 98.4 F. Pulse 140 per minute. Respiration 32 per minute. Enemata of Valentine's meat juice, egg, whisky, Stropanthus 5 mins., and Strychnine
2 mins., every four hours, one drachm of whisky every hour by the mouth. The Peroxide of Hydrogen spray was used every three hours. The temperature gradually rose to 100 F. and gained 100.4 F at four in the afternoon. The patient however was losing ground, the breathing became again laboured and it was very evident that extension had already occurred below the tracheotomy wound. The child had considerable difficulty in swallowing. The temperature continued between 99 F and 100 F during the day. Pulse 130 - 148 per minute, respiration 28 - 36, per minute. At 11 P.M. 6 mins. Aronson's Antitoxin were injected into the forearm. At 3 A.M. next morning that is 40 hours after the first injection, the patient suddenly took a fit of coughing which separated the membrane and coming in contact with the lower end of the tracheotomy tube at once caused a sudden stoppage to the flow of air to the lungs. I immediately removed the tracheotomy tube and passed a curved pair of forceps into the trachea and removed the separated membrane which on subsequent examination proved to be a complete cast of the trachea and bifurcation. This cast consisted of a main branch which corresponded to the trachea between the lower end of the tracheotomy wound and the bifurcation, the lower end of this main branch divided into two parts each about one inch long, these of course represented the two bronchi. The photograph of this cast shows the
various parts exactly the same size as the actual specimen. The child was very much exhausted after this and required to be freely stimulated. At 10 A.M. the temperature had risen to 100.5 F. But the general condition of the patient was not improving. A considerable amount of albumin was in the urine (3%) at 5 P.M. the child appeared to be sinking, another injection of 5 min of Aronson's Antitoxin were introduced into the forarm. The child passed a better night, but next day the pulse was more rapid and the temperature had risen to 101 F. No improvement whatever in the general condition. During the next night I was called at 1 A.M. to see the patient with the report that it appeared to be dying, as a last resource another injection of 9 min of Aronson's Antitoxin were introduced into the forearm with very little hope in my own mind that I should see the child alive in the morning. However, it rallied after this last injection and steadily improved. The temperature fell to normal 9 hours after the injection and rose again to 101.6 F 6 hours later. This rise of temperature was not sustained and fell to normal and remained always below 99.5 F.

7th. Sept. There was a slight rise of temperature in the afternoon which however was of short duration. The pulse was regular and not so compressible, average rapidly being about 120 per min. Respirations were not laboured and on an average were about 24 per minute. The difficulty in swallowing
still continued and the enemata had to be continued in order to keep the strength up.

The tracheotomy tube was changed every day and the wound carefully cleansed and anointed with iodoform ointment.

13th. Sept. The day after the operation the child was breathing freely through the nose and mouth. The tube was removed, which was followed by no discomfort on the part of the patient. There was merely a trace of albumin in the urine at this date, about 20 ounces being passed per diem, on no occasion did this patient suffer from Anuria. The tracheal wound remained patent for a day or two, but healed up rapidly. Easton's Syrup was given regularly. The voice had a distinct nasal character, but as far as one could judge there was no paralysis of accommodation.

21st. Sept, the 21st. day after the operation the wound was thoroughly healed. No trace of albumin in the urine was present upon the 24th. day.

25th. Sept. On the 40th. day after the onset of the disease and 35 days after the operation the patient was discharged from Hospital in excellent health. The voice was entirely free from any nasal intonation and no other signs of paralysis were evident, the knee jerks were normal and the patient was quite active in running about the ward.

The points of interest in this particular case are as follows:-
The antitoxin treatment was commenced at the very least, on the 5th day of disease, it is probable that the disease had run for a longer time than this, the trachea had already become infected with membranous deposit. The condition of the patient on the evening of admission was so critical that it was imperative that some operative procedure should be carried out in the form of intubation or tracheotomy. The injection of the antitoxin gave rise to no local irritation and was followed by no form of rash. There was a rise of temperature following each injection which however was not sustained but fell to normal after a few hours. This was the first case treated with Antitoxin in the City Hospital, and as far as I know in Edinburgh, and it is a very curious coincidence worthy of note that it is the first case of tracheotomy in diphtheria that has recovered during the past 20 years in this hospital.

The membrane separated in toto 40 hours after the first injection. This has undoubtedly occurred in other cases of diphtheria before the antitoxin treatment was used. It is therefore difficult to decide if the antitoxin really assisted in the separation of the membrane as several cases which I shall mention later went on, developing fresh membrane irrespective of the antitoxin treatment, but in others where the membrane has followed the same course as described in this case. But
taking everything into consideration I certainly think that the antitoxin was the means of assisting the recovery of this case.

Case 2.

J.M. female aged 23 years.

Admitted into the City Hospital on 25th, Sept. 1894.

20th. Sept. The patient complained of headache and sore throat and went to bed on 21st. Sept. On the following day the headache was not so severe, but the throat was more painful and the patient remained in bed up to the day of admission into Hospital. During the time prior to entering the Hospital she was under careful medical treatment both local and general treatment being systematically carried.

25th. Sept. On admission being the 5th. day of illness the patient appeared to be suffering from the general effects of the poison as well as considerable local inconvenience. The left tonsil, and to a lesser extent the right tonsil and also the uvula were covered with a well formed white membrane. This membranous deposit extended posteriorly to the posterior pharyngeal wall. Glands of the neck slightly enlarged and tender. A portion of the membrane was removed and carefully examined, it was fibrous and well formed, when inserted into water it did not disintegrate but retained its shape. A
film preparation prepared from a portion of the membrane exhibited an abundance of Loeffler's bacillus associated with Micrococi and diplococci. The culture preparation gave numerous small colonies of Loeffler's bacillus in the course of 24 hours. The diphtheritic process had not extended to the trachea. Considerable difficulty was experienced in swallowing. Distinct trace of albumin in the urine.

At 3:15 P.M. 1 c.c. of Aronson's Antitoxin was injected. The throat was sprayed with a 5% solution of cocaine, followed by a spray of peroxide of Hydrogen. The membrane was then carefully removed without any injury to the unaffected parts. Chlorine gargle was frequently applied to the throat during the remainder of the day. A carbolic and lead acetate compress was applied to the neck externally. Two drachms of whisky were given thrice daily.

26th. Sept. Next day the membrane had returned to the same position as it had occupied yesterday, but there was no actual spread to any unaffected parts. This newly developed membrane was carefully examined and was found to contain a very pure culture of Loeffler's bacillus. The albumin in the urine had not increased in amount. The difficulty in swallowing was still complained of, but was relieved with a cocaine spray. The patient felt not quite so depressed as on the day of admission. The parts affected in
the mouth were again carefully treated and all trace of mem-
brane removed. This however again returned on the following
day, but was not nearly so thick as the first deposit.

28th. Sept. There was no improvement in the appearance
of the membrane. Albumin still present in the urine.

30th. Sept. Patches still present on the tonsils, uvula
and posterior pharyngeal wall, but very much thinner. The
pulse was much better in character and had fallen to 80 per
minute, the respirations were 18 per minute.

3rd. Oct. The right tonsil was free from membrane al-
though present on the left tonsil and uvula.

6th. Oct. All trace of membrane has disappeared and
Albumin absent in the urine.

23rd. Oct. Discharged free from infection, no Loeffler's
bacilli having been found in the mouth during the last six
days. Knee jerks normal, no paralysis of palate or accomodation.

The points of interest in this case are as follows: -

Even with the combination of very careful
local treatment along with the antitoxin, the membrane returned for several days.
But a very important point in favour of the antitoxin, was
that absolutely no increase in extension of the membranous
deposit to other parts occurred after the antitoxin was in-
jected. All the return of membrane that occurred was in-
variably on the sites where it had previously been. The
albumin in this case was not increased after the injection. There was no local reaction at the site of injection, and no rash followed. No form of Paralysis followed the attack.

Case 3. M. G. female aged 5 years.

Admitted into the City Hospital 20th. Sept 1894. 16th. Sept. Patient complained of headache and sore throat, this became worse and patient was brought to Hospital on the 5th. day of disease.

20th. Sept. On admission the Temperature was 101.2 F. Pulse 152 per minute. Respiration 29 per minute. Both tonsils, sides and base of uvula covered with a well formed whitish membrane. Posterior Pharyngeal wall free from deposit. Upper part of Trachea however appeared to be implicated as there was a slight whistling sound during inspiration, no trace however of indrawing in the intercostal spaces or epigastrium. The glands at angles of jaw enlarged and tender. The patient seemed depressed and anxious, and at times rather restless. The appetite was good and only slight discomfort on swallowing. Albumin present in the urine (0.04%) Acid reaction Sp. Gr. 1022. The examination of the swab and portion of the membrane removed, exhibited rod shaped bacilli which proved to be Loeffler's bacillus on culture. At 1:30 P.M. X min of Aronson's Antitoxin were injected into the forearm. At 5 P.M. the Temperature was 100F. Pulse 140 per minute. Respiration 32 per minute, became sick and vomited some curdled
matter. At 8 P.M. the patient received two drachms of Castor-oil and was sick shortly afterwards, expectorating a large portion of membrane. This separation of the membrane occurred 7½ hours after the injection of the antitoxin. On carefully examining the portion of membrane, it was quite evident it had been expelled from the trachea, it consisted of a distinct tube with two fenestra on the one side. These openings were separated from one another by bands of membrane, this may point to the method of extension in the trachea. The bands appear to have been passed along the grooves between the tracheal rings and then extension occurring over the ridges formed by the projecting tracheal rings. (See photograph in Appendix.)

The patient passed a restless night, but settled somewhat towards morning.

21st. Sept. The Temperature was still 100 F. Pulse 136 per minute, respirations 28 per minute II min. Strychnine every 4 hours along with one drachm of whisky was given. One grain of Calomel was also given with a view of clearing the intestinal tract. This was followed by three motions.

23rd. Sept. One grain of Calomel was ordered to be given every 4 hours, 3 grs. in all were given followed by four motions. After this the patient appeared brighter and not nearly so restless, the temperature fell to normal, pulse was 128 per minute. Respiration were 24 per minute. The appetite being not so good nutrient enemata were given every 4
hours. Peroxide of Hydrogen alternated with 1 - 1000 Corrosive Sublimate sprays were applied to the throat every 3 hours. Carbolic and lead acetate fomentations were applied to the neck externally.


30th. Sept. All trace of membrane has disappeared, this being the 15th. day of the disease.

8th. Oct. This patient was discharged from the Hospital perfectly free from infection.

The main points in this case are, first the separation of the diphtheritic membrane from the trachea, although it still remained on the tonsils and uvula. Secondly, a very interesting feature is the implication of the trachea without the posterior pharyngeal wall being implicated, the course of the membrane appears to have been first on the tonsils, then up the anterior pillars of the fauces on to the root of the uvula and then the next site in a downward direction being the trachea. This case undoubtedly appeared to have a very beneficial effect as a result of the antitoxin treatment. The temperature fell to normal twenty-four hours after the injection and remained there during the rest of the case. The pulse also improved in character and became less rapid. The Calomel assisted to remove any injurious matter in the intestinal tract as well as acting as an antiseptic.
Case 5. C. W. a female aged 17 years.

Admitted to the City Hospital on 28th. Sept 1894.

25th. Sept. Complained of headache and sore throat. This increased until day of admission which was the 4th. day of disease. Both tonsils were covered with a greyish white membrane, also a small patch at the base of the uvula. Posterior pharyngeal wall free. Great discomfort on swallowing and very poor appetite. Glands of the neck slightly enlarged and tender on pressure. Bacteriological examination revealed Loeffler's bacillus associated with Micrococi, diplococci and streptococci. At 6:30 P.M. 14 min of Aronson's Antitoxin were injected into the forearm. The temperature at the time of injection was 101.2 F. Pulse 112 per minute. Respirations 29 per minute. Urine free from albumin.

29th. Sept. The temperature had fallen to 100 F. pulse 100 per minute. Respirations 26 per minute. No increase of the membrane. No albumin in the urine.

30th. Sept. Temperature normal. Pulse 92 per minute. Respirations 18 per minute. Patient felt much better. Membrane less in amount. Swallowing accompanied with much less discomfort. Patient progressed favourably and made an uninterrupted recovery and was discharged perfectly cured on 8th. October 1894.

In this case the fall of temperature was a little more
prolonged than in the last case. The urine was free from albumin throughout the whole course of the disease.

**Case 7. M. A. C.** female, aged 7 years.

Admitted to the City Hospital on 18th. Oct. 1894.

16th. Oct. The patient complained of malaise and sore throat, the throat became rapidly worse and patient was admitted into Hospital on the third day of disease. The condition on admission was as follows:- The general condition of the patient appeared to be fairly good. Appetite good, swallowing only caused slight discomfort. Both tonsils were covered with a dirty white membrane. The uvula however was quite free from exudate. On removing a portion of membrane the remaining surface bled slightly. The tonsils were both considerably enlarged and could be felt externally as small masses through the skin and pretty tender on pressure. The breath had a very distinct offensive odour. Tongue furred. Temperature 100 F. Pulse 120 per minute. Respirations 24 per minute. Albuminuria present in the urine. A film preparation prepared from a small portion of the membrane from one of the tonsils revealed an immense number of micrococci and diplococci with a few rod shaped bodies scattered here and there. On culture the first colonies to appear on the surface of the medium were Loeffler's bacilli, which were examined before the micrococci appeared on the surface of the agar agar.
At 1 P.M. on the day of admission X min of Aronson's Antitoxin were injected into the forearm. At midnight the temperature rose to 101.6 F. Pulse 112 per minute and slightly better in character, the respirations 24 per minute.

19th. Oct. The temperature at 11 A.M. had fallen to 98.6 F pulse 108 per minute and respirations 20 per minute. The local condition had extended on to the uvula directly from the tonsils. A portion of this membrane on the tonsil was bacteriologically examined and showed Loeffler's bacillus associated with Micrococci and diplococci. The temperature rose in the evening to 101.8 F. The child became more restless and appeared to be not so well.

21st. Oct. There was no further extension of membrane, but the temperature rose to 102.4 F at 12 noon. Pulse 134 per minute. Respirations 30 per minute. The local treatment up to this point in this case was confined to spray of peroxide of Hydrogen and Chlorine gargle, no membrane was removed by means of swabs or forceps except the portions that were required for examination.

22nd. Oct. The posterior pharyngeal wall had now become implicated, but, however there were no signs of extension to the trachea. The temperature was still 102 F at noon. Pulse 132 per minute. The tonsils, uvula and posterior pharyngeal wall were thoroughly swabbed to-day and all membrane was removed as carefully as possible.
23rd. Oct. The local condition appeared to be much more satisfactory to-day, but the posterior pharyngeal wall was again partly covered with membranous deposit.

The temperature had fallen to 99 F, pulse 120 per minute, respirations 24 per minute.

24th. Oct. Distinct signs of tracheal implication were evident to-day, there being a distinct whistling sound during inspiration. There was slight indrawing of the intercostal spaces and epigastrium. The child appeared to be very anxious and became rather restless. At 12 noon X min of Aronson’s Antitoxin were injected into the forearm. This was followed by a distinct fall in the temperature, it being 98 F. Pulse 120 per minute, respiration 24 per minute.

25th. Oct. Distinct improvement, the whistling sound was scarcely perceptible and indrawing of the intercostal spaces very much decreased. Temperature was now normal, pulse 100 per minute, respirations 24 per minute. After this date the patient made a rapid recovery. On one or two occasions there were signs of paralysis of the palate, which however was of short duration and caused only slight inconvenience. The voice was distinctly nasal in character. Patient was discharged on 19th. Nov. that is, the 35th. day since the onset of the disease, free from infection or any trace of paralysis.

The interesting feature in this case is the extension of
the membrane on to the uvula on the day following the first injection. The injection undoubtedly was small in amount, but at the time it was given in accordance with the directions given with that particular form of Antitoxin. But, on the other hand there was marked improvement after the second injection, for the indrawing which was distinctly marked gradually disappeared after the second dose. The combination of these two injections exceeded the adult dose which was stated at that time. The albuminuria was not increased in amount after the injections in this case.

Case 8. S. G. male, 14 years of age.

Admitted into City Hospital on 28th. October 1894.

25th. Oct. The patient complained of headache and sore throat, the throat continued to be troublesome and patient was admitted to the Hospital on the 3rd. day of disease. The temperature was 97.6 F, pulse very slow and weak in character 52 per minute. The left tonsil was covered with a membranous deposit, the right only slightly affected. The uvula was free from membrane, but was slightly red and swollen. The posterior pharyngeal wall was inflamed and covered with a mucoid deposit. No albuminuria in the urine. The film preparation contained micrococci and rod-shaped bodies which on culture preparation proved to be Loeffler's bacillus. XII min. Aronson's Antitoxin
were injected into the forearm. Local treatment was carried on in the form of Corrosive Sublimate (1-1000) spray also a compress of Carbolic and lead acetate applied to the neck externally.

29th. Oct. The membrane again returned to the left tonsil and was removed. Temperature still subnormal, the pulse however is improving, two drachms of whisky every four hours having been ordered,

30th. Oct. Membrane still present on the left tonsil, but much thinner.

31st. Oct. The membrane has almost disappeared. Patient feels very much better. Pulse however still slow being 57 per minute and compressible. Easton's syrup ordered along with Parrish's syrup and whisky still continued.

1st. Nov. All trace of membrane has disappeared and patient made a rapid recovery and was discharged on 19th. Nov. perfectly well.

In this case the membrane returned the day after the injection to the same site as it had occupied prior to the injection. This was again removed and the case then went on to a satisfactory termination.
9th. Case. J. T. Female aged 9 years.

Admitted into City Hospital 29th. October 1894.

Attack began on 26th. October 1894, admitted on the fourth day of disease. Commenced with headache and sore throat. The parts affected were both tonsils which were covered with membrane; also down both lateral aspects of the uvula, posterior pharyngeal wall free.

Bacteriological report revealed Loeffler's bacillus associated with micrococci, and diplococci. The temperature is 100.2 F. Pulse 112 per minute. Respiration 20 per minute. The child appeared to have an anxious expression, but there was no difficulty in breathing, and apparently the trachea was not implicated. 10 mins. Aronson's antitoxin were injected into the forearm, which caused only slight discomfort. Four hours after the injection the temperature fell to normal, the pulse improved in quality and became somewhat slower.

30th. October. The temperature still remained normal, pulse 108 per minute. Respiration 20 per minute. Three grains of Calomel were given internally at four in the afternoon. The temperature in the evening registered 100 F, and pulse 108 per minute. Respiration 20 per minute. The next day the temperature was normal, pulse 108 per minute, respiration 20 per minute, and there were distinct signs of improvement evidenced on the tonsils and uvula. The membrane appeared
to be thinner down the lateral aspects of the uvula. The posterior pharyngeal wall was perfectly free from membrane.

31st. October. Patient did not appear to be quite so well to-day, but improved as the day progressed.

1st. November. The temperature rose to 102 F. Pulse 120 per minute. Respirations 20 per minute. Herpes developed around the mouth and the child seemed distressed, although there was no evident extension of membrane visible. The temperature fell as the day progressed till it reached 100 F.

2nd. November. Temperature was still oscillating, between 101.6 F and 99 F., but on the whole the child's condition was more satisfactory. There was a trace of albumin in the urine, the amount passed per diem, averaging 20 ounces.


4th. November. Three grains of Calomel again given internally, which was followed by a copious motion of the bowels.

5th. November. The membrane on tonsils very much thinner, and evidently the child was in a fair way to recovery.

6th. November. Temperature normal, pulse 100 per minute. Respirations 18 per minute, almost all trace of membrane having disappeared.

26th. November. Distinct paralysis of the palate was observed also slight want of accommodation. This paralysis continued until her dismissal from the Hospital, the patient being discharged on 7th. December 1894, otherwise in perfectly good health.

The points of interest in this case are as follows:

The whole Uvula was not implicated, the extension of the membrane merely being down the lateral aspects of the uvula. The antitoxin undoubtedly appeared to have a beneficial effect upon the separation of the membrane. The fall of temperature was marked immediately after the injection, which was followed by a rise of temperature on the third day after the injection. This rise of temperature was probably due to a slight pulmonary condition, which very rapidly passed off. The interesting point is, that Post Diphtheritic Paralysis occurred in this case where the primary seat of infection was of comparatively small extent, namely the tonsils and the lateral aspects of the uvula. In this case the local treatment was in abeyance, and the case will compare favourably with cases I shall describe later, where the local treatment was carried on and still followed by Post Diphtheritic Paralysis.

10th Case. J. A. Male aged 9 years.

Admitted to City Hospital 18th. Nov. 1894.

Attack began on 16th Nov with sickness, sore throat and
headache.

18th November. The sore throat had become worse and the patient felt very much depressed.

The tonsils and uvula were covered with a thin whitish membrane. The posterior pharyngeal wall was free. The glands of the neck were only slightly enlarged with slight pain and pressure. The temperature was 98°F, the pulse 98 per min, respirations 24 per minute. Albumin was absent in the urine.

The bacteriological examination revealed Loeffler's Bacillus along with micrococci.

At 8 p.m. XII min of Aronson's Antitoxin were injected into the forearm.

19th November.

The patient passed a comfortable night, there was no elevation of the temperature 99°F being the highest point reached. Pulse was 102 per min, respirations 24 per min.

The membrane had not extended, no local treatment was adopted except an occasional gargle.

Three grains of calomel were given, followed by an enema 6 hours afterwards which gave a copious movement of the bowels. No Albuminuria present.

20th November. The temperature rose to 99.4°F, pulse was 96 per min, respirations 28 per min.
The membrane appeared to be much thinner in parts and was smaller in extent. The patient stated that he felt very much better and took his food with greater relish.

21st. November. Almost all the membrane had disappeared from the right tonsil, and was very thin on the left tonsil and uvula.

24th November. All trace of membrane had disappeared.

7th December. Improved rapidly since last note and was discharged perfectly cured on this date.

This case was one of the mild cases of diphtheria which terminated rapidly in an excellent recovery. The Antitoxin certainly appeared to have a beneficial effect. No Albuminuria or rash of any description was observed throughout the whole course of the disease.

12th Case. J. S. Male Aged 2 years.
Admitted to the City Hospital 6th December 1894.
Attack began on 29th Nov. 1894.
7th day of disease on admission.
This patient is a brother of the cases 11th and 13th.

History.

29th November. Patient was feverish and slept badly. Next day he was flushed, went off his food, was sick and complained of his throat had considerable difficulty in swallowing.

2nd. December. He was examined by his doctor who found a
patch on his throat. Local treatment was applied.

6th. December. On admission the patient's temperature was normal. His pulse strong and regular 96 per min. His breathing was somewhat rapid 23 per min, but quite easy. Appetite was good. The glands behind the angles of the lower jaw were slightly enlarged and tender especially on pressure.

The patient was well nourished, but looked wearied.

The tonsils uvula and soft palate were red and oedematous. Well marked patches of membrane were present on both tonsils and a small one on the left margin of the uvula near the base. The membrane was of a yellowish grey colour and could be stripped off with the aid of a pair of forceps. The posterior pharyngeal wall was free from membrane, but was covered with a considerable mucoid secretion. The bacteriological report revealed Loeffler's Bacillus accompanied with micrococci and diplococci. Streptococci appeared in the culture preparation after the Loeffler's Bacilli had appeared.

At 4 p.m. patient received 25 min of Kleins Antitoxin

7th December. There was no local reaction. Patient's condition was the same as yesterday. Temperature from 97.6°F to 99.6°F. Pulse 100 to 120 per min. Respiration 20 to 30 per min. Skin was moist and patient was perspiring freely. One drachm of whisky was given every three hours. There was no change whatever in the local condition. At 4.30 p.m. 25
min of Klein's Antitoxin were injected. Four hours later the temperature rose one degree, from 98°F to 99°F.

8th. December. The patient looked better today. Temperature 99.2°F. Pulse was good ranging from 104 to 120 per min. Respiration 20 to 24 per min. A good deal of coughing occurred during the day. The patches on both tonsils were still well marked, but there was no extension, the posterior pharyngeal wall was red and swollen. The uvula was still red and oedematous and a small patch was still on the left side.

9th. December. Patient was somewhat improved, pulse was better in character, and the respirations were quite normal. There was still a considerable amount of coughing but not nearly so frequent as it was on the 8th. There was no difficulty in swallowing. The patches on the tonsils were still well marked, and the small patch on the uvula was thinner

10th December. Patient was decidedly better to day and took food with greater relish. The local condition was much improved, the patches were much thinner on the tonsils, and the uvula was quite free. The swelling and redness were less.

11th. December. The patches of membrane on the tonsils were less especially on the right side.

12th. December. Patient continued to improve, the membrane had disappeared from the right tonsil, but there was still a slight patch on the left tonsil. A bacteriological
examination showed all the presence of Loeffler's Bacillus with micro-cocci.

13th. December. There was a slight trace of Albumin in the urine for the first time.

16th. December. The tonsils were quite free from membrane and the swelling was very much diminished.

17th. December. The local condition was not quite so satisfactory the tonsils were slightly more swollen. The glands at the angles of the lower jaw were swollen slightly but not painful.

20th. December. Patient was not so well to day. He was very flushed and restless. The glands were more swollen and very tender. There was a scarlatiniform rash over his body especially marked on the thorax. The throat was redder than before but no membrane was present. The temperature rose from normal to 102.2°F the pulse was weaker and rapid being 160 per min. Respirations were 36 per min.

21st December. Patient was slightly better to day and the rash was more marked on the extremities.

22nd. December. The rash was almost faded, the urine was free from Albumin.

24th December. Rash had entirely disappeared.

11th. January. Rapidly improved since last date, no desquamation was detected. He was discharged from Hospital
free from infection. The bacteriological examination being negative with regard to the presence of Loeffler's Bacillus.

In this case the Antitoxin was slow in its action 10 days having elapsed before the membrane had disappeared after the injection. On the 14th. day after the injection a scarlatiniform rash appeared similar in character to the other cases which developed a rash. There was no desquamation visible to the naked eye in this case.

13th. Case. W.L. Male aged 4 years.

Admitted 6th. December 1894, on 6th day of illness.

Patient's sister aged 5½ years died of diphtheria on December 4th. 1894 after being ill 10 days.

History of illness.

1st. December. Patient's father noticed that the child was feverish, and slept very little during that night.

2nd. December. Patient was flushed, and distinctly off his food. He was sick and vomited once during the day, complained of his throat being sore, and had difficulty in swallowing. During the night he was delirious, and a slight red rash appeared on the face.

3rd. December. His medical attendant examined the throat and found a patch on the tonsil, and it was diagnosed as being a case of diphtheria. The patient's throat was painted
daily, but in spite of the treatment gradually grew worse, and he was brought to the City Hospital on the 6th December, being the sixth day of the disease. On the day of admission patient's temperature was 98°F his pulse was very weak and rapid 118 per min, the respirations were regular and easy, being 28 per min. There was no indrawing of the intercostal spaces or epigastrium. There was however an occasional croupy cough. His appetite was fairly good, and he seemed to have only slight discomfort in swallowing. There was no glandular enlargement at the angles of the lower jaw. No Albumin was present in the urine. The patient looked pale and worried although his general appearance was one of a well nourished child. The throat was examined with considerable difficulty on account of resistance on the part of the patient, but it was made out that tonsils, uvula, and soft palate were red and swollen, but no patches could be seen. The throat was swabbed and sprayed with peroxide of Hydrogen, and Corrosive sublimate, 1 to 1000 was given. A mixture of digitalis, 3 min, and strychnine 2 min every four hours.

7th. December. Patient's condition was much the same, but pulse a little stronger. Temperature in afternoon rose to 99.8°F. He vomited once and still had the croupy cough. Local examination revealed no patches on the throat, which however was still red and swollen.
The throat was treated as before, but in addition it was swabbed with Toluol mixture.

8th. December. Patient practically the same; no further vomiting cough still present., no albumin in the urine.

9th December. Patient's pulse 116 per min but was weaker. Liq. Strychnine 3 min and tincture of digitalis 2 min given every four hours, along with one drachm of whisky. Patient's respirations were easy, but the cough was very croupy, the same treatment was continued as yesterday. Patient's appetite and power of swallowing were good. The tonsils were more inflamed and there was a slight patch on each. There was also a slight patch on the uvula. The membrane was grey and thin, and as much as possible was taken off with forceps, and the parts were carefully swabbed with toluol mixture.

12th. December. Patient's pulse was more rapid, ranging from 104 to 122 per minute, and weaker in character. His respirations ranged from 20 to 26 per minute. Temperature 98.4 to 99.2F. The patches on the uvula and both tonsils had increased in size and seemed to be thicker. Treatment as above Albumin present in the urine .05 per cent.

The bacteriological report revealed Loeffler's Bacillus associated with micrococci and diplococci. 25 min. Klein's
Antitoxin were injected subcutaneously, between the shoulders. The patient struggled a good deal and it seemed to cause him considerable pain, but very shortly this passed off.

13th, December. The patient's general condition seemed better, but his pulse and respirations were still the same. There was no reaction at the site of injection. The patch on the right side of the tonsil had distinctly lessened, in appearance, but otherwise there was not much change. Albumin slightly increased in amount. At 6:30 P.M. Patient had 50 min Klein's Antitoxin injected subcutaneously. This again seemed to cause great pain which however rapidly passed off. At midnight his temperature rose from normal to 101.2°F., but there was no local reaction.

14th, December. Patient's temperature was normal. Pulse was stronger, and the digitalis was stopped. He still had a slight cough, and the steam was stopped. Appetite and power of swallowing continued to be good. His urine still contained albumin, but less in amount, being merely a trace. There was no local reaction at the site of injection, and the patient's skin was distinctly moist. The throat was less red, the right tonsil was free from patches but there was a thin grey patch on the uvula. The left side of the palate and tonsil were also slightly implicated. Local treatment was carried on as before.
15th. December. Patient was much worse, pulse very weak and rapid 140 per min. Patient was coughing more, but his throat was not examined, as it was thought that his struggles might endanger his heart's action. The Toluol mixture was stopped, and the throat was sprayed with peroxide of hydrogen and corrosive sublimate (1:1000). He was ordered one drachm of whisky every two hours. The digitalis and Strychnine were resumed every four hours. At 2.30 P.M. one drachm of Klien's Antitoxin was injected at the usual site, with the usual precautions. About half-an-hour afterwards the patient became quite quiet and drowsy, and remained so during the rest of the evening. At midnight the pulse was a little stronger and the temperature was normal.

16th. December. Patient's condition was better than on the previous day, his pulse was stronger until the evening when it became more rapid. One drachm of whisky was given every 3 hours, the appetite still remained good. The patient slept well and coughed very much less. He was put on Easton's Syrup 30 mins, three times a day.

17th. December. The general condition was good. The pulse ranged from 118 to 122, and had improved in strength. Respiration 22 to 26 per min. Patient seemed to take his food with more relish. Appetite was very good.
20th December. At 1 a.m. the pulse became weaker, 120 per min. The patient was given a dose of liq. Strychnine 3 mins, and Tincture of Digitalis 2 mins. At 10 p.m. his pulse had improved in strength, and was 108 per min. General condition was good.

23rd December. The patient's continued to improve and all stimulants were stopped. He took more relish in things that were going on around him.

26th December. The pulse again became rather feeble, and the patient was again put upon cardiac tonics. It was observed that he had developed an erythematous subcuticular rash over the lower part of the abdomen, the anterior part of the legs and arms and that he had intense pain in moving the hip joint.

27th December. General condition much improved. The rash that had appeared on the previous day, had almost faded out of sight. There were only traces to be seen here and there on the arms and legs. The pulse was greatly improved. Temperature 103°3F. Respirations quite normal.

28th December. The pain in the hip had quite disappeared and no trace of the rash could be detected. The general condition was progressing to a favourable issue. The pulse was normal, respirations were easy, and the temperature normal.

30th December. Patient sitting up and bright, and now is on ordinary convalescent diet, along with Easton's Syrup.

The points of interest in this case are as follows:-

The history that a sister of the patient died of diphtheria two days before the patient's admission to the Hospital. No actual trace of membrane was visible on the tonsils until 11th. December. It was on this account that there was a delay in the injection of the Antitoxin. The albumin appeared in the urine prior to the first injection of the Antitoxin was slightly increased after the injection, and then rapidly disappeared. The erythematous rash appeared 14 days after the first injection, and 11 days after the last injection of Antitoxin. This rash was undoubtedly similar to the rashes that had been already seen following Antitoxin injections. Its duration was, however, short all traces having disappeared 24 hours after its first appearance. It is interesting to note that the age of the sister who died was 5½ years whereas the age of this patient was 4 years consequently the chances of the latter having a fatal termination were almost greater than in the case of the former, and it is probable that the Antitoxin was the means of obviating this fatal termination.
14th. Case. S.S. Male Age 22 years.

Admitted into Hospital 8th December 1894 on the third day of disease.

8th. December. Complained of having a headache and sore throat and feeling feverish towards evening. His throat became worse, and he had difficulty in swallowing. There was no hoarseness.

7th. December. He felt no better, and in addition had a slight cough.

8th. December. His condition became much worse and he was advised to come to the City Hospital.

State on admission. His temperature was normal. Pulse strong and regular, being 80 per min. Respirations regular and easy being 22 per min. His appetite was not good, and he had eaten nothing since the commencement of his illness. He was however quite able to swallow, but it caused him slight pain. Patient was a well built muscular man. He was however very flushed and uncomfortable looking. The uvula and soft palate were red and oedematous. The tonsils were enlarged and on the left one there was a greyish membrane, which extended to the anterior and posterior fauces. At the base of the uvula there was a small greyish deposit about the size of half a split pea. The right tonsil was swollen and inflamed and these was a small patch on it. The posterior
pharyngeal wall was clean but somewhat reddened. The bacteriological examination revealed Loeffler's Bacillus, associated with micrococci diplococci, and streptococci. The parts were swabbed with Toluol mixture and the membrane was easily removed by means of forceps without any injury of the mucous membrane. At 6 p.m. 25 mins of Klein's Antitoxin were injected in the subcutaneous tissue of the back. This small dose was given on account of the limited supply of the serum. The injection caused considerable pain, which however rapidly passed off. At 8 p.m. the temperature rose a half degreeF while the pulse fell from 80 to 70 per min. He had local applications to the throat every hour a swab of boro-glycerine alternated with a spray of peroxide of hydrogen, and corrosive sublimate 1 to 1000. He passed a comfortable night.

9th. December. His general condition had improved and he said he felt much better, except for the discomfort in his throat. The volume of the pulse was much better 64 to 80 per min his respirations had fallen to 18 per minute. The appetite had improved and he was able to take a very fair meal. There was no local reaction at the site of injection. The uvula and soft palate were less reddened and oedematous and the membrane on the left tonsil was thinner but a little more marked on the anterior pillar of the fauces, the patch had disappeared from the right tonsil. The uvula still had a
patch on the left side. The pharynx was quite free from membrane. At 7.30 p.m. 50 mins of Klein's Antitoxin were injected at the usual site. At 8 p.m. his temperature had risen from 97.4°F to 99°F his respirations and pulse were slightly increased. The injection caused him considerable pain at the time.

10th. December. Patient's general condition was very good his pulse ranged from 72 to 56 per min, it was regular and of good volume. His appetite continued to improve, but he had still pain on swallowing. No Albumin was present, in the urine. The membrane on the left tonsil was thinner, but there was a slight extension of the patch at the base of the uvula. The palate was still red and swollen.

11th. December. There seemed to be no change either for better or for worse in the patient's condition. At 4 p.m. 50 mins of Klein's Antitoxin were again injected. This was followed by no rise of temperature, and pulse and respirations remained as before.

12th. December. The whole of the membrane was removed from the tonsils, uvula and pillars by means of the toluol mixture and forceps. The membrane was thin and came away in small pieces. The surface left was a slightly bleeding one, but no pain was caused by the removal of the membrane the parts were carefully swabbed with toluol mixture. The patient's general
condition continued to be excellent and there followed no local reaction at the site of injection.

13th. December. Patient passed a good night and general condition was very good. There was no return of the membrane at the centre of the tonsil, but there were still two patches at its anterior and posterior aspects. The anterior pillar was still covered with membrane. The uvula and soft palate were still oedematous. Patient's appetite was good and he had less difficulty in swallowing. His pulse, respirations and temperature were normal.

14th. December. Patient's general and local condition were the same as yesterday. He was ordered one drachm of Easton's Syrup three times a day.

15th. December. General condition was good but the pulse was not quite so strong. The patient was ordered an ounce of whisky every six hours. The uvula is still oedematous with a slight membranous deposit also the anterior and posterior pillars of the fauces on the left side. The posterior wall of the pharynx is granular and covered with a mucoid secretion, left tonsil covered with a thin membrane.

16th. December. Patient's general condition was good, temperature 97.4°F to 98°F. The throat was less red and swollen. The membrane on left tonsil was thinner and did not extend to the anterior pillar of the fauces but slightly involved
the posterior pillar. The palate and uvula were less red and swollen.

17th December. The patient's general condition was very good. The temperature was subnormal the appetite was good, and there was no pain in swallowing. The throat was less red, and the uvula and soft palate continued to improve. There was a slight membrane on the left tonsil extending to the posterior pillar of the fauces. The anterior pillar was very slightly involved. The throat had local applications for 6 hours.

18th December. The general condition and appetite of the patient were good. The temperature was slightly subnormal. There was a very small patch on the left tonsil which was thin and of a dark grey colour. It was easily removed and left no bleeding surface. There was a slight grey membranous deposit on the anterior and posterior pillars of the fauces. The condition of the patient had improved considerably since the previous day.

19th December. Patient was very well and pulse was excellent. The membrane was still present on the left tonsil and pillars of the fauces. Towards night the patient had slight diarrhoea which however stopped towards evening. The membrane on the left tonsil was very thin, posterior pillar free, slight membrane on anterior pillar.
22nd. December. The patient was very well and local condition was much the same as yesterday.

23rd. December. The patient was still very well. There was but an almost imperceptible patch on the posterior pillar of the fauces. The rest of the throat was free from membrane and slightly reddened.

24th. December. All trace of membrane had disappeared and the redness was very much less.

28th. December. Patient discharged from Hospital recovered. No trace of Loeffler's Bacillus could be found in any part of the throat.

A point of interest in this case was the absence of Albumin and after the four injections of Antitoxin there was no trace of Albumin in the urine. The temperature was remarkable in never rising above 99°F and always tending to be slightly subnormal. There was no appearance of any rash in this case the separation of the membrane was somewhat delayed. There was no trace of paralysis following this attack.

15th. Case. Name J.M. Male Age 20 admitted to the City Hospital 9th December 1894 on second day of illness.

7th. December. Patient complained of his throat in the evening. He had not been feeling well during the winter having suffered a great deal from dyspepsia.
8th, December. He felt very much fatigued and feverish. The condition of his throat had become worse and he experienced considerable difficulty in swallowing especially any dry substance like bread. He had pain and swelling at the angle of the jaw at his right side. He was hoarse and speaking was somewhat painful.

9th. December. The pulse was of good tension but rather rapid - 100 per min, his temperature was 102.6°F. His respirations were quite easy and numbered 24 per min. Swallowing was very painful and he had no appetite. The glands on the right side of the angle of the lower jaw were enlarged and tender and the general appearance of the patient was that of one somewhat distressed. The soft palate was very red and along the line of the palatal arch it was of a purplish colour. There was a great amount of oedema, the uvula was very much swollen and there were small grey patches about the size of a pin's head scattered over it. The right tonsil was red, swollen and covered with a dirty dark grey membrane. This membrane did not involve the pillars of the fauces and was easily detached, leaving a raw but non-bleeding surface. The left tonsil and pharynx were inflamed but there was no patches on them. The membrane was carefully removed with forceps and a large portion came away, which was very thick. The tonsils and uvula were swabbed with toluol mixture which caused some considerable
pain. Half an ounce of whisky was given internally every four hours.

10th. December. The patient did not feel much better. His temperature had fallen to 98.6°F and his pulse was 84 per minute. A patch of membrane about the size of a split pea was noticed on the posterior pharyngeal wall. The uvula and soft palate were red and oedematous while the pin head points of membrane on the uvula had become confluent and almost covered it. The local treatment was carried on as before. An examination of the urine showed no Albumin, acid reaction, and deposit of urates.

11th. December. The patient's general condition was worse he felt weak, had great pain in his throat and his pulse was more rapid and weaker. The bacteriological examination revealed Loeffler's Antitoxin associated with micrococci and diplococci and streptococci. At 4 P.M. 25 mins of Klein's Antitoxin were injected sub-cutaneously between the scapulae. The patient was ordered Liq. Strychnine hydrochlorate mins 5 every four hours and the whisky was continued. Four hours after the injection the patient's temperature rose to 102.4°F. There was also a slight increase in the rapidity of the pulse and respirations, but on the whole the patient passed a fairly good night.

12th. December. The patient's temperature kept up, ranging from 100.6°F at noon to 102.6°F at midnight. His pulse was
slightly better but ranged from 90 to 96 per min. His respirations were practically the same as on the previous day. There was no reaction at the site of injection. The condition of the throat was the same as on the previous day but after his throat was swabbed, the patient expectorated a large piece of grey membrane, which on further examination proved to be almost a complete cast of the uvula. At 7.30 P.M. 25 mins, of Klein's Antitoxin were injected. The local treatment was still carried on, with the addition of Boro-Glycerine and sprayed with peroxide of hydrogen, and corrosive sublimate 1 to 1000. The examination of the urine showed no albumin, acid reaction, and the specific gravity of 1030.

13th. December. The patient felt much better. The temperature had fallen from 102.6°F. to 100.6°F., the respirations were much the same, but the pulse was much stronger. There was no reaction at the site of injection. The tonsil and palate had decidedly improved, being less red and oedematous whilst the membrane on the tonsil and the uvula was distinctly thinner, and had not quite such a dirty appearance. The membrane was again removed from the tonsil and the uvula and the remaining surface bled slightly. The pharynx was quite clear of membranous deposit. The local treatment was carried on every half hour. On examination the urine showed a slight trace of albumin with acid reaction.
14th. December. The patient continued to improve, his temperature kept between 99 to 100, his pulse ranged from 74 to 100 and his respirations from 18 to 22 per min. His appetite had improved, and he did not complain so much of the pain in his throat when swallowing. The glands at the angle of the jaw were swollen but not tender. Locally the palate, tonsils, and uvula were less red, and the membrane on the right tonsil and uvula distinctly less. The albumin was still present in the urine, although less in amount.

15th. December. The patient still continued to improve, the temperature having fallen to 98.6°F. The uvula was less oedematous. The membrane was distinctly smaller in amount, the right tonsil quite free, and the posterior pharyngeal wall only slightly red, and granular. The left tonsil was quite free from membrane. The swelling of the glands at the angle of the jaw were becoming less.

16th. December. The patient continued to feel very well. The membrane on the right tonsil became thinner, the uvula was free, but still rather red, and raw looking as if a considerable amount of necrotic process had occurred in its substance. The left tonsil was very red, but perfectly free from any membranous deposit. The patient was ordered one drachm of Easton's Syrup every 6 hours.

17th. December. The patient felt better today, and his
appetite had considerably improved. There was only a very slight thin membrane on the right tonsil and posterior pillar of the fauces. The left tonsil was free and much less swollen. The local treatment was applied every six hours.

18th. December. There were distinct signs of post diphtheritic paralysis, small quantities of fluid being discharged through the nose during the act of swallowing, and the voice had a distinct nasall tone. The membrane had disappeared from the right tonsil, there was still a trace of albumin in the urine.

19th. December. The patient had slightly improved. The temperature was normal, the pulse 74 to 90 per min. The affected parts of the throat were still red and granular. There was a slight deposit on the right tonsil but the uvula and pillars were not involved. There was still a trace of albumin in the urine.

21st. December. The general condition of the patient continued to improve, but at 4 P.M. his temperature rose to 99.8°F. He complained of pains in the small of the back. The trace of albumin was now very small.

22nd. December. The patient felt much better, all pain in the back having disappeared.

29th. December. The patient was allowed up to-day. No trace of membrane could be detected in the mouth, and all that
remained of the uvula was a small stump at the apex of the palatal arch, the substance of the uvula having sloughed off as a result of the necrotic process.

10th January 1895. The patient was discharged having made a most satisfactory recovery. There was no trace of albumin in the urine, and the throat was quite free from membrane. The examination of the secretion taken from the posterior pharyngeal wall and the tonsils was found to be free from Loeffler's Bacillus. The points of interest in this case were as follows:— the temperature fell to nearly normal by mid-day of the second day of the patient's admission to the Hospital and the Antitoxin was not injected until the third day after admission. This fall in temperature, therefore had nothing to do with the influence of the antitoxin. The local treatment was carried on very carefully. After the Antitoxin was injected the temperature remained above 101°F for over 24 hours. It then gradually fell a second dose of Antitoxin being given, as the temperature seemed to be remaining high for too long a period. After this injection the temperature fell to 99.6°F, and did not rise above that point throughout the remainder of the patient's sojourn in the Hospital. This was undoubtedly a very severe case of Diphtheria, as evidenced by the amount of necrosis which occurred and the fact that it was followed by post diphtheritic paralysis of the soft palate.
The patient himself asserted that he felt better after the injections of Antitoxin, and always slept well on the evening following the injections.

17th. Case. Name A.T. Female aged 12 years.

Admitted into the Hospital on 13th. Dec. 1894, on the third day of illness.

11th. December. Patient complained of sore throat and difficulty on swallowing owing to the pain. There was pain also at the left angle of the jaw, but there was no hoarseness. She had been troubled with head-ache and unable to take any food. She had felt very ill and was feverish all night. The patient's sister had just recovered from an attack of diphtheria, which had been followed by paralysis of the soft palate. This sister had just returned to the house three days before the patient's illness commenced.

13th. December. On admission the patient's temperature was 100.4°F. Her pulse was fairly good, being 100 per min., her respirations were quite easy, being 24 per min. There was no cough. Her appetite was bad, and she had considerable pain in swallowing. There was a large glandular swelling on the left side towards the angle of the lower jaw, which was very tender on pressure. The patient was well nourished and looked quite healthy. There was a tendency to cyanosis on both cheeks. There was however no cardiac lesion that could be
detected. The soft palate and uvula were red and oedematous. The left tonsil was enlarged and inflamed and covered with a thin grey membrane, to which extended for about one eighth of an inch on to the left side of the palatal arch. The membrane extended slightly forward on the left anterior pillar of the fauces. The right tonsil was inflamed, but there was no patches on it. The uvula was red but clean. The posterior pharyngeal wall was not involved. The membrane was carefully removed with forceps and the whole part swabbed with toluol mixture. The throat then was sprayed hourly with peroxide of hydrogen and corrosive sublimate solution 1 to 1000. the patient had two drachms of whisky every four hours. The bacteriological examination showed Loeffler's Bacillus, associated with micrococci, diplococci, and streptococci.

14th. December. The patient's temperature was 97·6°F. Her power of swallowing was better, otherwise her general and local condition were somewhat the same as on the previous day. Examination of the urine showed no traces of albumin, acid reaction. Sp. gr. 1025.

15th. December. The patient's general condition was somewhat better. Her pulse ranged from 88 to 74 per min., her respirations were 18 to 24 per min., and her temperature ranged from 97·6°F to 98·8°F. The patient said she was better, and swallowed with greater ease.
Her bowels had not been moved and she was ordered two drachms of castor oil. The local condition was slightly worse. The membrane on the left tonsil was thicker and had extended slightly further on to the palatal arch, and from this point had extended on to the left lateral and anterior aspects of the uvula. The posterior surface of the uvula was not involved. The glands on the left side were slightly more swollen.

16th. December. The patient said she did not feel so well to-day, she complained of greater pain in the throat and did not feel so strong. The difficulty in swallowing was considerably increased. The temperature rose to 100·4°F in the evening. Her pulse was weaker and more rapid, ranging from 74 to 100 per min. She was ordered two drachms of whisky every three hours. The membrane had extended farther on to the left side of the soft palate. There was more inflammation of the left tonsil and posterior pharyngeal wall was also red. Glands on the left side were swollen and tender. At 2.30 p.m. 90 mins of Klein's Antitoxin were injected at the usual site, with antiseptic precautions. After the injection the patient lay quite still and seemed to be drowsy. She however complained of some considerable pain at the site of injection. Towards evening she slept fairly well. The temperature rose to 103·2°F and the pulse remained good.

12th. December. After 12 o'clock midnight, the patient
was restless and complained of pain, especially on the right of the throat. There was great tenderness at the site of injection, but no discolouration. In the morning her temperature fell from 102.2°F to normal. There was a scarlatiniform rash over the upper part of the thorax, which was most marked on the posterior aspect. She complained a great deal of the pain in the back, but there was no special localised discolouration or swelling at the site of injection. The right side of the throat, tonsil, and the pillars of the fauces were red, and slightly more swollen. On the right tonsil the membrane was much the same as yesterday, but that on the left side of the uvula was less in extent, and distinctly thinner. There was still swelling and tenderness of the glands on the left side. The examination of the urine still showed no albumin. Sp. gr. 1032.

18th. December. The patient's temperature ranged from 98.5°F to 100.6°F her pulse, which was not strong, ranged from 94 to 102 per min. Two drachms of whisky were given every four hours. The pain in the back had lessened considerably. The rash had extended over the body, but was most marked towards the upper part of the thorax. The patient on the whole felt a little better. The membrane on tonsil and uvula were less in extent and thinner, but extended about the same distance as formerly, on to the pillars of the fauces and palatal arch. The
redness and swelling had not decreased. The examination of the urine showed a very slight trace of albumin. Sp. gr. 1024 also a deposit of urates.

13th. December. Patient's temperature rose to 104°F her pulse to 130, respirations as usual. The patient did not feel quite so well to-day. The rash had now considerably faded, on the thorax, but was brighter on the lower extremities. The local condition had improved. The membrane on the left tonsil was smaller and thinner, and it was confined to the upper and left part of the uvula. There was none on the palatal arch or pillar of the fauces. The redness and swelling of the tonsils were considerably lessened. The glands were however very tender. Examination of the urine showed a distinct trace of albumin. Sp. gr. 1024.

20th. December. The patient felt weaker to-day, her pulse was more rapid, 120 to 136 per min, and weaker. Her temperature ranged from 101.4°F to 103.6°F. There was no tenderness on the back, and the rash had almost faded. The throat was more painful, red and swollen. The membrane on the left tonsil was thicker. The uvula was more swollen and red, but the patch of membrane on the left side was only about the size of a small pea. The glands were very tender, and there was a tendency to suppuration at the lower part of the swelling. Carbolic acid (1 to 40) and lead acetate fomentations were applied. The patient had one drachm of whisky every three
21st. December. The patient vomited slightly during the night and felt a little better during the day. But the cheeks were more cyanotic and there was a considerable swelling of the left cheek. The pulse had improved in strength and ranged from 101 to 120 per min, and the temperature ranged from 100.6°F to 102.1°F. The rash was fading. The glands on the left side were very much enlarged and tender, but the small soft area at the lower part of the mass had not increased. The membrane on the left tonsil was thinner and the swelling of the uvula had also lessened. The membrane on the uvula was thin but slightly larger in amount than on the previous day. The membrane on the anterior pillar was also very thin and smaller in extent. There was a small patch on the right tonsil.

22nd. December. The general condition of the patient was much the same as on the previous day. At 8 P.M. 60 mins of Klein's Antitoxin were injected at the usual site. At midnight the temperature rose from 101.2°F to 103.4°F.

23rd. December. The patient did not feel quite so well. The temperature ranged from 100.4°F to 102.4°F the pulse was good ranging from 100 to 120 per min. The cheeks were still cyanotic the left one being more swollen than on the previous day. The condition of the throat was not so good. The left tonsil was covered with a grey membrane which again extended
on to the anterior pillar of the fauces. The membrane had a clearly differentiated margin. The left side of the uvula was also covered with a thick grey membrane, the other parts were much as before. The rash had now almost disappeared but there was a tendency to erythema on the side on which the patient lay. There was no local reaction at the site of injection.

**24th. December.** The patient felt much better, and took a greater interest in things around her. During the night however she was rather restless and complained a good deal of pain in the back. There was a slight blush at the site of injection. The patient's temperature ranged from 100°F to 102°F the pulse was good 108 to 120 per min. The membrane on the left tonsil and pillar of the fauces was not so thick as on the previous day. The glanular swelling had not decreased and was still very tender.

**27th. December.** The patient looked seriously ill the cheeks being cyanotic and the lips hacked. Breathing was not nearly so easy and the patient bore an anxious expression. At 12.40 a.m. 120 mins of Klein's Antitoxin were again injected at the usual site.

**28th. December.** The patient seemed to be very much better and stronger in every way. The patch on the left tonsil still remained, but the general state of the throat was not so congested. The pulse being much better the cardiac tonics
were stopped.

29th. December. The general condition of the patient was not so good she was rather feverish and more restless.

The examination of the urine still showed a slight trace of albumin Sp. gr. 1025. The swollen gland on the left side of the neck were still tender and elastic. No very distinct fluctuation would be made out.

31st. December. The patient was somewhat restless, complained of headache, and was rather sleepless. The pulse was rapid soft and small in volume. The respirations were normal. The general condition of the patient was somewhat languid, the cheeks however were not so cyanotic as they had been formerly. Her appetite was good and she appeared to take her food with relish. The urine showed still a faint trace of albumin. The parts affected in the throat were much clearer, but the glands in the neck were more swollen and on palpation fluctuation could be easily made out.

1st. January. The membrane was mostly confined to the posterior pharyngeal wall, the tonsils and the uvula being quite clean. At 11.30 A.M. the abscess in the neck was opened about 2 ounces of brownish yellow pus was removed and a drainage tube inserted. The bacteriological examination made from this pus revealed the presence of micrococi but no Loeffler's Bacillus.
2nd. January. The patient looked much brighter and took more interest in things around her, the temperature was 98°F, the throat looked very much better. There was only a slight grey patch on the left tonsil and the right tonsil was quite clean. An erythematous brilliant rash appeared on the arms and legs. It was most marked about the elbows and legs.

3rd. January. The rash still remained much the same upon the neck and extremities, and was seen although faintly on the chest and abdomen.

4th. January. The general condition continued to improve. The portion of membrane which was situated on the left tonsil was easily removed. The neck was dressed and only a very small discharge of fluid matter occurred. There was still a trace of albumin on the urine.

8th. January. The rash had now quite faded on the arms and legs and was only to be seen here and there upon the chest and abdomen, as small red pin points upon a diffuse lighter red background. The membrane still persisted on the left tonsil. The local treatment was still continued every 6 hours.

16th. January. There was a diffused white scaly desquamation over the arms and parts that had been previously affected with the rash. There was a distinct discharge from the nose, and the membrane still persisted on the tonsil. A bacteriological examination was made which revealed Loeffler's
Bacillus associated with micro-cocci. There was still a faint trace of albumin in the urine.

20th. January. The throat looked very much better. All trace of membrane had disappeared. There however still remained a trace of albumin in the urine.

26th. January. The patient was discharged free from all infection.

The points worthy of note in this case are as follows:- the Antitoxin was not injected until the third day after the patient's admission into the Hospital. Immediately after the injection the temperature rose to 103.2°F. and then some hours afterwards fell to normal. The first rash appeared on the day after the injection and disappeared seven days afterwards, the second rash appeared seven days after the fourth injection and disappeared in seven days. Rheumatic pains appeared in the legs and arms five days after the fourth injection. 8 days after the third injection and 9 days after the second injection 15 days after the first injection. This patient passed through a severe illness during her sojourn in the Hospital and on several occasions the prognosis appeared to be most unfavourable. These rashes which have been described were undoubtedly the result of the Antitoxin, and the general feeling with regard to the effect of the Antitoxin in this case was that it delayed matters instead of improving them. The
total amount of Antitoxin injected in this case was 5 drachms 55 mins. The last trace of membrane disappeared 25 days after the last injection.

Case No. 19.
Name: - J. S. Female. Aged 10.

Admitted to City Hospital 20th. Dec. 1894.


20th. December. The day of admission was stated to be the second of illness. The temperature was 104°F. pulse was rapid but of good tension. The respirations were quite easy and numbered 35 per minute. There was no cough. Patient's appetite was good and she had no difficulty in swallowing. The glands at the angles of the lower jaw were enlarged and were slightly tender on pressure on the right side. The patient was a pale and delicate looking child of a highly nervous disposition.

The tonsils, soft palate and uvula were red and swollen. There was a slight mucoid deposit on both tonsils but not any membrane. The rest of the parts were free even from this mucoid deposit.

Local treatment was carried on in the form of Toluol mixture with the addition of sprays of peroxide of hydrogen and corrosive sublimate (1:1000). One drachm of whisky was
ordered to be given every 4 hours.

21st, December. The temperature fell to 99.4°F. Pulse was good and ranged from 77 to 130 per minute, respirations were 17 to 32 per minute. Appetite and power of swallowing were good. Glands in the neck were still swollen and tender. The palate was very red and oedematous, the tonsils were swollen and were still covered with a mucoid secretion. The uvula was red and swollen but had no membrane deposit upon it.

22nd, December. Temperature ranged between 98.8°F. to 100.2°F. Pulse was strong being 76 to 90 per minute. There was a slight membranous deposit on the left tonsil which was slightly swollen. The uvula was also involved towards the left side. The right tonsil was swollen and covered with a grey patch.

The bacteriological examination revealed Loeffler's Bacillus associated with micrococci and diplococci.

At 7 p.m. 60 min. of Klein's Antitoxin were injected at the usual site.

At midnight the patient complained of a great deal of pain in the back. The temperature rose about half a degree. The pulse was a little more rapid being 90 per minute, the respirations also were increased to 22 per minute.

23rd, December. There were two patches about the size of half a threepenny piece on each anterior pillar towards the upper part. There was also a patch on the base of the uvula
and also another was on the right side of the soft palate. The left tonsil was still covered with a thin membrane and also two small patches were on the right tonsil. The rest of the throat was distinctly red. The glands of the neck were distinctly less tender.

24th. December. Patient's general condition was much improved. The temperature was between 98°F and 99.6°F. The patches were all thinner and were easily removed.

25th. December. The membrane was very thin on both tonsils, there was still a small patch on either palatal arch. The uvula was free from membrane. The patches on the anterior pillars were diminished to about the size of a split pea.

28th. December. General state was satisfactory and was progressing towards recovery. There was only a portion of membrane on the right anterior pillar of the fauces. All the other parts were clean. The swabbing and the local treatment were reduced to every three hours. The bacteriological examination revealed involuted forms of Loeffler's Bacillus along with micrococci.

30th. December. Swallowing was easier, the tongue was cleaner and appetite much improved. The urine still continued to show a trace of albumin. Complained of pain in the knees and elbows.

31st. December. The anterior pillar still showed a
small patch on the right side which was removed by means of
the forceps. No albumin in the urine.

5th. January. No sign of membrane was visible. The
bacteriological examination revealed a few involuted forms of
Loeffler's Bacillus and a few micrococci.

13th. January. There was no trace of membrane or
congestion of the throat.

20th. January. Patient was discharged perfectly cured.

The bacteriological examination of the swab gave rise to
no colonies of Loeffler's Bacillus.

An interesting point in this case was the high temperature
on admission being 104°F, this was probably due to the child's
neurotic temperament also the micrococcal infection. This
temperature however fell next day to 100°F and the highest point
gained after this point was 100.4°F.

This fall of temperature had nothing to do whatever with
the action of the Antitoxin as the first injection was made
on the 22nd. December, that is a day after the fall of tem-
perature. The Antitoxin was not given until the membrane
actually made its appearance, which was on the 22nd. December.

All trace of membrane had disappeared 13 days after the
injection, which was rather a prolonged period. There was no
rash in this case following the injections, but marked pains
were complained of in the knees and elbows 8 days after the
injection of Antitoxin. These pains were probably the result of the Antitoxin, but on the whole it appeared to have a beneficial effect on the progress of the case.

20th. Case. Name R.S. Male aged 8 years. Admitted to the City Hospital on 7th. December 1894.

30th. November. Patient complained of pain in the right side of the throat. He was feverish and had no appetite. In the evening he became worse and was very restless during the night.

2nd. December. He was sick and vomited, he complained of pain in the left side of the throat, became hoarse and swallowed with difficulty.

5th. December. Began to cough frequently although not of a croupy character, throat was still sore.

6th. December. The cough became croupy and the patient's general condition worse.

7th. December. Day of admission was the 7th. day of disease. The temperature was 99°8F, the pulse was 160 per min and fairly good in character, the respirations were 20 per min and were quite easy and regular. There was a frequent croupy cough present. The patient had no desire for food and swallowing caused him considerable pain. His voice was distinctly hoarse.
The glands at the angles of the lower jaw were swollen and tender on pressure, this was most marked on the right side.

The soft palate and fauces were red, the uvula was swollen but it was free from membrane.

Both tonsils were enlarged and inflamed. There was a small patch on the left tonsil, whilst the right was almost entirely covered with a greyish yellow patch distinctly separated from one another. The visible portion of tonsil between these patches was almost of a purple hue. The posterior pharyngeal wall was free from membrane. The bacteriological examination revealed Loeffler's Bacillus associated with micrococi, diplococci and streptococci.

The throat was then sprayed with 5% solution of cocaine and all the membrane was removed with great care by means of forceps and then the throat was swabbed with the toluol mixture. The patient received one drachm of whisky every three hours. At 4.30 p.m. 25 min of Klein's Antitoxin were injected between the scapulae with the usual precautions. At 8 p.m. the patches on the right tonsil had almost become confluent. This deposit was again removed by means of forceps and swabbed with toluol. The patient passed a fairly good night.

8th. December. The tonsils, soft palate and uvula were still very red and swollen especially the tonsil on the right
side, but the membrane was distinctly thinner. The pharynx was still clean. The cough was still present. The swallowing was accompanied with less pain. The temperature at 8 a.m. was 99.8°F, pulse 92 regular but rather compressible, the respirations were 24 per min.

At 5 p.m. 25 mins of Klein's Antitoxin were injected at the usual site. The injection caused a considerable amount of pain. The temperature fell at 8 p.m. from 99.8°F to 99.2°F, the pulse from 92 to 80 per minute. The respirations were 24 per minute. The patient passed a good night.

9th, December. The temperature ranged from 98.4°F to 99°F. The pulse was still rather compressible, varying from 74 to 92 per minute, the respirations were 20 to 22 per minute. The general condition was just about the same. These grains of calomel were ordered as the bowels had not been opened the day before. There was no pain or discolouration at the site of injection. The swelling of the right tonsil had not decreased but the membrane was thinner and less distinct. The patch on the left tonsil had disappeared, but there was still considerable redness and swelling. The posterior pharyngeal wall and fauces were clean. The swelling and tenderness of the glands on the right side were still present, on the left side the glands were slightly enlarged but were not tender. Towards the evening the pulse became weaker but not more rapid, was
ordered Liq. Strychnine min 2 and Tinct digitalis min 3 every 4 hours.

At 7p.m. 25 mins of Klein's Antitoxin were again injected. The pain caused by the injection passed off quickly. The temperature which was 99°F. was not affected by the injection, but the pulse fell from 84 to 74 per minute.

10th. December. The pulse was stronger, ranged from 68 to 88 per minute. The temperature was slightly lower. The patient coughed very seldom and it had lost the croupy character. The membrane was thinner and the tonsil was less swollen.

12th. December. The patient felt much better. The appetite had improved considerably. The glandular swelling on the right side was diminished in size and tenderness. There was no tenderness on the left side. The right tonsil was less swollen and not so inflamed, it had a somewhat ragged appearance due to the slight excavations which had been formed. The left tonsil was slightly swollen but was without any patch on its surface. There was a small patch of membrane about the size of a split pea on the right side of the palatal arch.

13th. December. The patch on the palatal arch had disappeared, but still a thin membrane was present on the right tonsil.

14th. December. At 8a.m. the pulse fell to 60 per minute, and the cardiac tonics were stopped.
Ordered Easton's and Parrish's syrups 15 min each three times a day. The glands on the right side are still enlarged and tender. The right tonsil was cleaner, the membrane being very thin. The crypts of the tonsils were much enlarged and were filled with a yellow secretion.

20th. December. The membrane on the right tonsil was much more mucoid in character. The rest of the throat was practically normal.

23rd. December. Patient was not so well to-day, less appetite and slightly languid. The local condition was much improved. The throat was free from membrane. The glands of the neck were now only slightly enlarged but not tender.

24th. December. Patient was sick and vomited. The temperature rose to 101°F. pulse was 72 to 100 per minute, respirations were 20 to 24 per minute. Nothing could be made out to account for this rise of temperature, the tongue was clean, bowels regular, throat was practically normal, no redness or swelling. The glands were not tender and there was no rash. The patient was restless at night.

25th. December. The patient was better to-day. The temperature was 99.8°F.

30th. December. Patient was permitted to get up to-day for an hour.

A bacteriological examination revealed a small number of
involved Loeffler's Bacilli with a few micrococci.

16th. January. The patient was thoroughly convalescent no Loeffler's Bacilli were detected in the swab preparation. Discharged perfectly free from infection.

This case was a brother to case 19 and it is a curious coincidence that the actual disappearance of the membrane occurred 13 days after the last injection of Antitoxin which was exactly the amount of time which elapsed in Case 19. The amount of Antitoxin given to case 19 was 10 mins more than that given to case 20. There were no pains in the joints complained of in this case although the Antitoxin used was the same as in the other case.

21st. Case. Name L.R. Female aged 9 years.
Admitted to the City Hospital 4th. January 1895.
1st. January. Was not very well and felt as if she had caught cold.
2nd. January. Patient had slight shiverings and headache.
4th. January. Day of admission probably was about the 3rd. day of disease. The patient was well nourished. Had no expression of anxiety or restlessness. The glands of the neck were slightly swollen but not tender on pressure. The right tonsil and uvula were much enlarged, the left tonsil was only
slightly inflamed. On the surface of the enlarged right tonsil there was a large white patch of membrane. The left tonsil and posterior pharyngeal wall were free from membrane. The throat was very sensitive and there was considerable discomfort during the examination.

A bacteriological examination report was not made until the fourth day in Hospital which revealed the presence of Loeffler's Bacillus along with micrococci diplococci and streptococci.

The examination of the urine showed a thick deposit of mucus and urates. There was no albumin present.

6th. January. The temperature rose to 101.2°F. At 8 P.M. was 102.6°F. The right tonsil was so much enlarged that it completely occluded the posterior pharyngeal wall from view. The uvula was also much enlarged. The right tonsil was entirely covered with a thick yellowish membrane which extended on to the uvula. The left tonsil was free from membrane.

The affected parts were carefully denuded of the membrane and the parts swabbed with boro-glyceride and peroxide of hydrogen every 2 hours.

7th. January. At 6.30 P.M. 120 mins of Klein's Antitoxin were injected. At the time of injection the temperature was 100°F pulse was 112 per min respirations were 22 per min. At midnight the temperature had risen to 103°F the pulse was 112 per min, full and strong, the respirations were 22.
per minute.

8th. January. The urine showed a distinct trace of albumin. The throat looked cleaner, the right tonsil and uvula were less swollen but membrane was still present on the former sites.

9th. January. Pulse was better being 120 per min. Patient swallowed with greater ease. The left tonsil was quite clean and was not so congested. The right tonsil was less inflamed and the membrane was thinner. There was a faint brownish blue discolouration at the site of injection. Albuminuria 1.35%.

10th. January. Slight rise in the temperature it being 99.4°F. Still albumin in the urine. There was less membrane on the right tonsil, the tip of the uvula appeared through the covering of the membrane which extended over the rest of the uvula. The posterior pharyngeal wall which was now visible had a thick exudation of membrane on its surface. At 4.30 P.M. 120 mins of Klein's Antitoxin were injected at the usual site.

11th. January. The temperature was 99°F. The pulse was slower. The urine still contained a large amount of albumin. The right tonsil and posterior pharyngeal wall were cleaner and there was more of the uvula apparent.

12th. January. The temperature was normal. The uvula
was almost clean throughout its whole extent. The membrane and the right tonsil and Pharynx was much less in amount.

15th. January. The uvula was entirely devoid of membrane and the swelling had disappeared. The anterior part of the right tonsil was devoid of membrane and was much less congested, however there was a yellowish white membrane on the posterior part of the tonsil which was continuous with the membrane which lined the posterior pharyngeal wall.

17th. January. Patient complained of pain in the infrascapulae region of the right side at the site of the last injection of antitoxin it being seven days since the injection was made. There was a distinct swelling with a red area in the centre. In the evening this swelling had a distinct sense of fluctuation.

18th. January. The temperature was 100.6°F. Pulse 92 per minute full and regular. The albumin was less in amount in the urine. At 12.30 P.M. the abscess in the back was opened and a large quantity of pus was removed. A culture preparation was made from the pus removed which afterwards showed colonies of micrococci. All antiseptic precautions had been taken but it probably was that some contamination had occurred, as it was the first time this particular syringe had been used. In the evening the temperature fell to normal.

20th. January. Some thin membrane deposit was still on the
base of the uvula on to the edge of each tonsil.

22nd. January. No sign whatever of membrane was detected in the throat.

11th. February. There was a marked nasal tone of voice noticed on this date. Still a faint trace of albumin was detected in the urine. The opening in abscess of the back is quite healed.

17th. February. The albumin was still present in the urine. The nasal tone of the voice was still well marked. The knee jerks were quite normal.

1st. March. Was allowed up. All trace of albumin had disappeared from the urine.

19th. March. Discharged cured. The nasal tone was almost entirely absent. Knee jerks were normal.

The bacteriological report showed the presence of a few micrococci and no Loeffler's Bacilli.

The points of interest in his case are; the temperature fell after the first injection of Antitoxin and then rose again to 103°F. 18 Hours afterwards then fell to normal 24 hours after. The albumin in the urine was not present until the day after the first injection and continued to be present for 51 days.

The paralysis of the soft palate first appeared 35 days after the first injection, 32 days after the second injection.
22nd. Case. M.A. Female aged 6 years.

Admitted to the City Hospital 23rd. January 1895. This patient had scarlatina during November and December 1894 and was discharged from the City Hospital during the first week of January. Some few days after dismissal from the Hospital she contracted measles and was treated at home. The child never quite recovered from the attack of measles so that the parents could not distinctly say on what day the present illness really began. Their attention was only brought to bear upon the acute condition of the throat 3 days ago. The medical attendant decided to send the child to the City Hospital for observation as a brother of the patient's had died of diphtheria the day before.

Taking these facts into consideration the child was admitted into the Hospital at the very least on the third day of disease.

State on admission.

The child complained of sore throat and difficulty in swallowing. The general condition looked rather below par. She was pale and bore an anxious expression. There were no signs of membrane on either the soft palate or uvula, but these parts were both slightly congested. The tonsils and the posterior pharyngeal wall were covered with a thin greyish white membrane. The bacteriological examination revealed
Loeffler's Bacillus associated with micrococci diplococci and streptococci. The glands of the neck were not enlarged nor tender on pressure. The urine showed a faint trace of albumin, the temperature was 99.8F. The pulse was 92 per min of very fair character. The respirations were 30 per min and were not laboured. 8.30 P.M. two drachms of Behrings Antitoxin were injected into the interscapulae region.

24th. January. The patient passed a comfortable night. There was no change on the local or general condition, but there was a distinct nasal discharge of a watery consistency. The trace of albumin in the urine had disappeared.

25th. January. The patient's general condition was slightly better, her appetite however was not very satisfactory and her pulse was not quite so strong. A mixture of Tincture of digitalis 2 mins and Liq. strychnine 1 min. along with 2 drachms of whisky were given every three hours. There was a distinct swelling of the glands on the right side of the neck which had appeared for the first time and was distinctly tender on pressure.

28th. January. No trace of membrane was seen anywhere in the throat. The pulse was much slower fuller in volume and regular. The digitalis and strychnine were stopped and the whisky reduced in amount. The temperature was normal, the pulse 94 per min and respirations 20 per min.
3rd. February. The throat was much less congested and there was no trace of membrane. The glands which were enlarged and tender at the angle of the lower jaw had subsided, and all pain disappeared. The pulse had improved considerably being 88 per min. The appetite was very much improved.

5th. February. The patient was discharged perfectly cured.

This case is of interest on account of the brother of the patient dying the day before admission to the Hospital, also the attack of diphtheria being subsequent to measles consequently increased the gravity of the case. The membranous deposit in this case certainly disappeared in a remarkable manner, after the injection of the Antitoxin. Another interesting point is the fact that the trace of Albumin which was present on the day of admission disappeared on the second day in Hospital and did not return. Undoubtedly the antitoxin had a most beneficial effect in this case.

23rd. Case B.A. Female age 34.

Admitted to the City Hospital on the 24th. January 1894. This patient was the mother of the last case. She had complained of sore throat commencing on the day before appearing at the Hospital. She had been continually nursing her child which had died at home and was very much run down in consequence. On examining the throat no membrane was detected except a very
small trace on the left tonsil. This was removed and the throat was sprayed with hydrogen peroxide and corrosive sublimate solution (1-1000) every six hours. The temperature was normal the pulse 88 per min and pretty fair in character.

26th. January. The patient did not feel quite so well. The throat looked red and congested. A bacteriological examination was made from a swabbed preparation and revealed the presence of Loeffler's Bacillus associated with micrococci. The temperature still remained normal and the pulse was about 82 per min. The local treatment was still continued.

27th. January. The patient not feeling quite so well received two drachms of the Behrings Antitoxin no. 1. This was the fifth day of actual illness. The urine was free from Albumin the glands of the neck were not enlarged and there was no discharge from the nose.

28th. January. The throat condition had so far improved that local treatment was suspended and a simple gargle was ordered. The patient stated that she felt very much better and rapidly regained her strength and took her food with greater relish.

3rd. February. The patient was discharged from the Hospital perfectly cured. This case of course was a very mild attack, but undoubtedly the antitoxin had a most beneficial effect in preventing any extension of the disease. And also
the bacteriological examination was of great service in definitely diagnosing the condition.

24th. Case. J.A. Male aged 3½ years.

Admitted to the City Hospital on the 22nd. January 1894.

This is another child of the same family being a brother to case No. 22. This patient also had scarlatina during Nov. and Dec. and also developed measles at the same time as the other two members of the family. It is therefore difficult in this case to definitely state when the actual onset of the disease occurred.

22nd. January. On admission the child looked distressed and decidedly ill. There was profuse diarrhoea, the tongue was furred and the breath offensive. There was no signs of membrane anywhere in the throat. There was distinct congestion of tonsils and posterior pharyngeal wall. There was a copious yellow discharge from the nostrils. There was no swelling of the glands in the neck. Both bases of the lungs appeared to be slightly congested, more especially the right. A bacteriological examination of the mucoid secretion from the pharynx revealed Loeffler’s Bacillus associated with micrococci. The temperature was 103°F and the pulse 144 per min. — very compressible. The urine gave a very copious deposit of albumin.

23rd. January. The throat was carefully swabbed and
sprayed every six hours special attention being paid to the nostrils. A bacteriological examination of the discharge from the nostrils revealed Loeffler's Bacillus, associated with micrococci. 90 mins. of Behring's Antitoxin were injected. The temperature at the time of injection was 102°F. Pulse 120 per min, and respirations 29 per min. Four hours after the injection the temperature was 101.8°F Pulse 150 and respirations 50 per min.

24th. January. The child seemed somewhat better. No signs of local reaction were observed at the site of injection. The pulse was more rapid and weaker in character. Tincture of digitalis 2 mins. Liq. Strychnine 1 min along with 2 drachms of whisky every three hours were ordered. The temperature rose to 102°F. Pulse 150 per min respirations 52 per min. No signs whatever of membranous deposit could be detected in the throat and there was no indication that the trachea was affected. The albumin was still very copious in the urine.

25th. January. The patient was very sick during the night but the temperature fell by four o'clock in the afternoon to 99.8°F. The pulse was 116 per min and respirations 40 per min. The patient certainly seemed to be a little better, but the diarrhoea still continued.

26th. January. The diarrhoea was much less, and the sickness had diminished. The pulse had improved to a consider-
extent, and the cardiac tonics were stopped and the whisky reduced in amount. The temperature remained about 100F pulse was 132 per min, and respirations 30 per min.

28th. January. The nasal discharge still continued to be pretty profuse, and a bacteriological examination revealed the presence of Loeffler's Bacillus although the film preparation undoubtedly showed the bacillus fewer in number.

1st. February. The temperature was now normal, but the pulse still remained rather rapid and weak in character. The nasal discharge was still present. Albumin was also present in the urine.

16th. February. The patient was allowed up for the first time as the character of the heart sounds had considerably improved since the last note. The pulse was 100 per min and respirations 28 per min. There was no albumin in the urine, but still a slight nasal discharge which however was found to be free from Loeffler's Bacillus.

20th. February. The patient was discharged perfectly cured.

This case undoubtedly was rather an exception to the general rule. The local conditions was almost entirely confined to the nasal mucous membrane. The usual sites of the throat being entirely free from membranous deposit. The toxic
effects were well marked as shown from the copious deposit of albumin in the urine and in the weak character of the heart. The child undoubtedly on several occasions showed distinct signs of heart failure, which were tided over by means of strychnine and stimulants combined with the effect of the Antitoxin.


Admitted to the City Hospital on 24th. Jan 1894.
This patient was another brother of Case No. 22. The condition was almost identical with Case. No. 24. There was no membrane in the throat, but a very copious nasal discharge. The bacteriological examination of this discharge revealed Loeffler's Bacillus along with micrococcii. 120 mins of Behring's Antitoxin were injected. The nose was repeatedly syringed, and the further history of the case was almost identical with Case No. 24. It made a speedy recovery, and was discharged on the 20th. February perfectly cured. In summing up this interesting series of cases, occurring in one family one member of the family, as before stated had died of diphtheria two days before the youngest child was admitted to the Hospital. These three children had all had scarlatina and measles, and this was followed by an attack of diphtheria which probably was exactly of the same character as in the case which had ter-
minated fatally at their own house. It is a fact that has been proved by statistics that diphtheria following measles is certainly a very grave condition, and proves in a large number of cases to be fatal. I therefore consider that the Antitoxin played a very important part in the treatment of these three cases, and probably was the means of avoiding a fatal termination.

26th. Case. A.F. Female aged 12 years.

Admitted to the City Hospital 28th. Jan. 1894.


28th. January. (being the second day of disease). Parent was admitted for treatment into the City Hospital. The child was well nourished and had a good complexion, and seemed only to have a slight discomfort. The pulse was 96 per min. Regular but very small in volume. The temperature was 99.6°F. the respirations 20 per min. regular and normal. The tongue was covered with a white fur, the breath was rather offensive, and there was a slight pain in swallowing. The heart and lungs were normal. Locally the glands on the right side of the neck were enlarged and slightly tender on pressure. There was no discharge from the nostrils. The throat showed great oedema and redness on the whole of the right side. There was a large adherent thick yellow membrane extending over the right
tonsil on to the palate. The bacteriological examination revealed Loeffler's Bacillus, along with micrococci and diplococci in large numbers. The temperature was 100.4°F pulse 96 per min. Respiration 20 per min. The examination of the urine revealed no albumin, acid reaction Sp. gr. 1020.

29th. January. 120 mins of Behring's Antitoxin were injected at two P.M. a mixture of Digitalis and styrchnine were ordered as the pulse was not quite so strong. The membrane was only apparent on the right tonsil and palatal arch.

30th. January. The membrane had considerably extended quite covering the whole uvula, and on to the posterior pharyngeal wall, and was of a yellowish grey colour. Local treatment in the form of hydrogen peroxide, and corrosive sublimate (1 to 1000) sprays were used every three hours, also swabbed with the toluol mixture, three times a day.

31st. January. The patient looked much better. The tongue was cleaner. The membrane however was very considerable in amount, covering the uvula and the right side of the soft palate, the right tonsil, and to a less extent the posterior pharyngeal wall. No albumin was found present in the urine.

1st. February. The glands on the right side of the neck were much smaller, the examination of the throat showed that the left tonsil was quite free from membrane. A large patch however
was very easily removed with a pair of forceps. The local
treatment was continued.

4th. February. The throat was uniformly congested and all
that remained of the membrane consisted of a few dots here and
there.

5th. February. The urine showed a faint trace of albumin.
There was no sign of inflammation at the site of injection while
no sign whatever of any skin eruption could be found all
local treatment was entirely stopped.

10th. February. All trace of membrane had disappeared
and the general congestion of the throat had to a great extent
subsided. There was still a trace of albumin in the urine.

12th. February. The patient was allowed up for a short
time. Albumin was still present in the urine.

17th. February. The albumin had disappeared from the
urine.

26th. February. The child was discharged perfectly
cured.

This was by no means a severe case of diphtheria but the
Antitoxin appeared to have prevented any further extensive
implication, the membrane advanced upon the uvula, which up to
that time had not been affected, and it was on this account
that the local treatment was superadded to the Antitoxin.
The temperature came to normal on the day following the injec-
tion, and remained throughout the further progress of the case.

27th. Case.  S.D. Female aged 56.
Admitted to the City Hospital 31st. Jan 1895.

30th. January. The throat began to feel sore followed shortly afterwards by headache and a sense of general weakness. The throat gradually became worse and there was considerable pain in swallowing. The medical attendant was called in. He examined the throat and opened a abscess which had formed behind the left upper molar on the left side and advised the patient to go to the Hospital for further treatment.

31st. January. (being the sixth day of illness). The patient's condition was somewhat anaemic. The pulse was fair in volume 70 per min. And the temperature and respirations were normal. The appetite was good. The tongue was rather flabby and somewhat coated. The examination of the throat revealed a considerable congestion of the posterior pharyngeal wall along with a considerable swelling of the left tonsil, and the right side of the soft palate.

The opening of the abscess behind the left upper molar was apparent. A thin adhering layer of white greyish membrane covered the left palatal arch, about the size of a shilling. There was no sign of membrane upon the uvula posterior pharyngeal wall or tonsils on either side. The bacteriological examination revealed the presence of Loeffler's Bacillus assoc-
iated with micrococci and diplococci.

Local treatment was carried out in the form of sprays of peroxide of hydrogen and corrosive sublimate, (1 to 1000) every four hours, with the addition of swabbing with the toluol mixture.

4th. February. The membrane on the left side of the soft palate showed marked signs of disappearing, but a new area of dark grey adhering membrane had formed on the fauces, extending to the base of the uvula. This had occurred on both sides, but more especially on the left side. The urine showed a distinct trace of albumin.

5th. February. The right tonsil was distinctly swollen and angry in appearance, but there was no membrane on its surface. The albumin had increased in the urine. At 2 P.M. a full dose of Behring's Antitoxin No. 1 was injected into the usual site.

6th. February. The throat was very much better, and the membrane on the right side between the uvula and the right tonsil was much less in amount. The uvula was swollen but free from membrane. The albumin was less in amount in the evening.

8th. February. The patient felt very much better. The membrane had become very much diminished in amount. There was a trace of Albumin in the urine.

10th. February. The local treatment was carried out
every six hours. All membrane had disappeared with the exception of a few specks, on the surface of the left tonsil. There was still a trace of albumin in the urine.

16th. February. All trace of membrane had disappeared. The examination of the urine revealed no albumin.

19th. February. The patient was discharged perfectly free from infection. This was undoubtedly a mild case of diphtheria and it appeared that the Antitoxin had a beneficial effect in assisting the recovery of the patient. The patient on her own account made the statement that she felt very much better after the injection, and certainly there was no increase of membrane after the injection was given. The albumin in the urine was not increased, but rather diminished after the Antitoxin. It took however, some considerable time to disappear entirely from the urine, all trace having disappeared eleven days after the injection.

29th. Case. G.D. Male aged 12½ years.

Admitted to the City Hospital 1st. February 1895.

29th. January. The patient complained of headache sore throat and a general sense of weakness.

1st. February. (Being the fourth day of illness) there was no discomfort on swallowing, the appetite was good and there was no albumin in the urine. There was a deposit of urates,
Sp. Gr. 1020. There was no sign of rash or other skin eruption. The examination of the throat showed slight congestion of the tonsils, and posterior pharyngeal wall, with a slight deposit of membrane at the base of the uvula, extending on to the edge of the right tonsil. The other parts of the throat were quite free from membranous deposit. The glands of the neck on the right side were slightly enlarged and tender on pressure. The bacteriological examination showed the presence of Loeffler's Bacillus, micrococci diplococci leptothrix and vibrio threads. At 7.30 P.M. a full dose of Behring's No.1 Antitoxin was injected at the usual site.

2nd. February. There was no reaction at the site of injection, no change in the condition of the throat, no albumin in the urine.

3rd. February. Local treatment in the form of toluol and peroxide of hydrogen spray, was carried on every four hours. The glands on the right side of the neck were distinctly enlarged.

6th. February. All trace of membrane had disappeared and the patient felt very much better, there was no trace of albumin in the urine.

8th. February. The patient complained of slight pain in the region of the left tonsil, but no sign of membrane was apparent. All local treatment was stopped. The patient was
was ordered a tonic in the form of Easton’s Syrup one drachm three times a day.

11th. February. The pain which has been mentioned had completely disappeared, the throat looked quite normal.

12th. February. Patient discharged. No trace of Loeffler’s Bacillus could be detected in the swab preparation but only a few micrococci scattered here and there. This case was another of undoubtedly mild diphtheria. It was so mild that if it were not for the definite statement of the bacteriological examination, one would have doubted the presence of diphtheria. The antitoxin in this case certainly seemed to help on the recovery. No bad results followed the injection in the form of a rash or albumin in the urine.

29th. Case. Name W.H. Male aged 19 years.

Admitted to the City Hospital 1st. February 1894.

30th. January. The patient was suddenly attacked with headache and felt a general sense of weakness.

31st. January. The throat felt sore and there was some difficulty in swallowing.

1st. February. The temperature was 100.2°F pulse and respirations were normal. Appetite was good but he had considerable difficulty in swallowing.

There was considerable congestion of the entire throat, the right tonsil and the right side of the soft palate, some
along with the uvula were very much enlarged. This enlargement prevented an examination of the posterior pharyngeal wall. These parts with the exception of the right side of the palate were free from membrane. The right side of the soft palate now covered with a fairly adherent whitish membrane which extended back almost to the tonsil. On removal with the swab there was a slightly bleeding surface left. The bacteriological examination revealed Loeffler's Bacilli were not detected until the culture preparation was examined.

The glands on both sides of the neck were enlarged and tender on pressure. There was no albumin present in the urine.

2nd. February. Local treatment was carried on in the form of sprays of peroxide or hydrogen and corrosive sublimate (1-1000) and swabbed with toluol mixture.

The Loeffler's Bacillus which had not been detected on the day of admission appeared on the nutrient medium and were at once reported as being present.

The temperature was 98.6F in the afternoon the pulse was 78 per min., respirations 19 per min.

4th. February. The throat looked rather worse was more swollen and the membrane was much more extensive. The interval between the pillars of the fauces was covered with a thick-
yellowish white membrane which extended forward on both sides to the pillars of the fauces. The uvula was covered with membrane on the posterior aspects but the tip and anterior aspects were perfectly free from membrane. The temperature was 103°F in the afternoon, pulse was 92 per min and the respirations were 19 per min.

8th, February. The membrane had extended over the entire right tonsil.

At 2 P.M. Behring's No. 1 Antitoxin full dose was injected at the usual site. The temperature at the time of injection was 100.2°F pulse was 80 per min respirations 18 per min.

6th, February. There was distinctly less injection of the affected parts, but the amount of membranous deposit was unchanged. There was no change at the site of injection. The glands on the right side of the jaw were not so tender. The temperature was 99.2°F pulse 84 per min respirations were 84 per min. The urine showed a faint trace of albumin.

7th, February. The dysphagia was more marked. The right tonsil does not look so inflamed and the surface is practically free from membrane. There was still a considerable amount of membrane on the right side of the uvula and the posterior aspect of the uvula. The tonsil was very much less swollen and it was possible to see the posterior pharyngeal wall which was covered with a yellowish white membranous deposit. There was still a faint trace of albumin in the urine. The temperature
was normal. Pulse good, respirations were easy.

8th. February. The membrane on the posterior aspect of the uvula was disappearing gradually, and the patch on the soft palate was much smaller in extent. The swelling of the other parts were also very much less.

9th. February. Local treatment still continued every 4 hours there was still a trace of albumin in the urine.

10th. February. The patient felt much brighter but the pulse was rather feeble. The appetite was considerably improved there was almost no dysphagia. The throat was improved, the amount of membrane was gradually becoming less. There was a considerable increase in the albumin as compared with the day before.

14th. February. There were faint traces of membrane on the right side of the soft palate, all the other parts of the throat were free from membrane. There was still a faint trace of albumin in the urine. The stimulants were stopped.

21st. February. All trace of membrane had disappeared the urine was free from albumin.

28th. February. Discharged the throat was free from swelling or congestion. The bacteriological examination showed the pressure of micrococci but no Loeffler’s Bacillus.

The antitoxin was unavoidably delayed in being injected on account of the defective supply. It was however injected on the 6th. day of disease. The next day there was an distinct
trace of albumin in the urine which appeared for the first time since the patient's admission to the Hospital. This trace of albumin varied slightly in amount from day to day and persisted for 16 days after the injection. There was no rash in this case and no pains in the joints. There were no signs of paralysis up till the time of dismissal from Hospital.

30th. Case. Name M.D.M.C. Femele aged 4 years.
Admitted to the City Hospital 23rd. February 1895.

14th. February. The child caught cold and developed a severe cough, this however almost disappeared in the course of four days.

18th. February. She became rather restless and pevish, with a falling off of appetite accompanied with signs of general weakness.

21st. February. The throat was noticed for the first time as being the source of annoyance to the child. No local treatment was carried on in the throat. The chest had been frequently poulticed.

23rd. February. The throat had become very much worse and was admitted on the sixth day of disease. The general aspect of the child indicated advanced acute general symptoms, there was considerable malaise, the expression was wearied and collapsed. There was a considerable amount of cyanosis of the lips. The pulse was soft and deficient in volume and had a
tendency to irregularity it was 135 per min, the respiration
were 30 per min were very laboured and accompanied with in-
drawing of the intercostal spaces and the epigastrium, there
was a frequent laryngeal cough. The temperature was 100.6F.
The tongue was covered with a white fur, swallowing was performed
with difficulty. The heart sound had no accompaniments or
murmurs. The vocal resonance on the left side posteriorly
was more marked than that of the right, the vocal fremitus was
also more marked on the left side, there was a slight dulness or
persistence over the left base posteriorly with a few coarse
ronchi on auscultation. The glands on both sides of the neck
were enlarged and tender, the glands in the left axilla were
also slightly enlarged.

There was considerable congestion of the entire posterior
aspect of the throat. There were thick yellowish white patches
of membrane on both tonsils and on the greater part of the
uvula. But there was no appearance of membrane on either
the soft palate or the posterior pharyngeal wall. The bacterio-
logical examination revealed the presence of Loeffler's
Bacillus associated with micrococci and diplococci. There was
no albumin in the urine. At 8.45 P.M. 5 C.C. of Aronson's
Antitoxin were injected at the usual site. The temperature
being 98.4F pulse 120 per min. and the respirations 30 per min.
In seven hours after the injection the temperature was 100.8°F, the pulse was 136 per min, respirations 32 per min. The local treatment was carried on in the form of peroxide of hydrogen spray along with corrosive sublimate (1-1000) and the affected parts were swabbed with toluol mixture every 3 hours. One drachm of whisky was given every three hours. Tinct. digitalis min 2 and Liq. strychnine Hydrochlor min 1 also every three hours. There was still no albumin in the urine.

24th. February. The patient was very much worse, the indrawing had become more marked and it was very evident that extension was rapidly occurring further down the trachea.

25th. February. At 2.30 A.M. the breathing became so laboured and the indrawing of the chest walls became so exaggerated that it was necessary to perform tracheotomy. During the operation the patient became very cyanosed, but the opening in the trachea gave considerable relief. A large quantity of loose membrane and dirty fluid matter was removed from the trachea. The patient rallied after the operation and at 3 A.M. received another injection of 5 C.C. of Aronson’s Antitoxin at the usual site in the back.

The patient progressed favourably during the day, the temperature rose to 101°F pulse was 140 per min, respirations 34 per min. The child took food pretty well nutrient enemata were also ordered. There was a considerable trace of albumin
in the urine which had appeared for the first time.

26th. February. The general aspect was good, complexion was rosy, pulse and respirations both full, deep and regular. The patient was not so inclined to take food, nutrient suppositions were given every four hours. The temperature had fallen somewhat being below 100F. The albumin was absent from the urine.

27th. February. The child was progressing favourably, there was no indrawing whatever. No albumin in the urine. The tube was changed daily.

2nd. March. Digitalis and strychnine stopped.

4th. March. The tracheotomy tube was removed which was seven days after the operation, the wound was dressed with a simple dry iodoform dressing. There was no discomfort after the tube was removed.

All trace of membrane had disappeared from the throat. The temperature always rose to about 99.5F every afternoon about 3 o'clock.

12th. March. This rise in temperature still continued otherwise the child appeared to have made an excellent recovery. The condition of the base of the left lung had considerably improved, but probably the rise of temperature was due to some slight pulmonary condition. There was distinctly a nasal tone of voice noticed on this date.

28th. March. The wound in the neck was practically
healed to-day. The temperature was normal, pulse and respirations were full and regular.

1st. April. Discharged. There was a still a trace of the nasal tone of voice. The knee jerks were normal. The wound in the neck thoroughly healed up.

This case was the second case of tracheotomy which had occurred during the antitoxin treatment. The form of antitoxin was the same as that used in the first case of tracheotomy which recovered, namely Aronson's. The total amount used was 10 C.C. The child made undoubtedly a splendid recovery, as the condition on admission appeared to be hopeless. The fact that the left lung was considerably affected also increased the gravity of the case. Albumin appeared in the urine for one day after the second injection. Paralysis of the soft palate appeared 15 days after the second injection and 17 days after the first injection.

The tracheotomy tube was removed seven days after the operation, this was to allow the upper passages to come into play once more and prevent any further lung complication. The membrane in this case came away very freely and disappeared altogether eight days after the first injection and 10 days after the first injection.

31st. Case. Name: M.H. Female aged 19 months.

Admitted to the City Hospital 4th. February 1895.
2nd. February. About a week prior to this date the child took measles. The parents noticed the throat condition for the first time on this date. They noticed the breathing was more rapid and laboured and exaggerated signs of uneasiness and general restlessness.

4th. February. On day of admission were were evident signs of acute general symptoms, so that the child must have been several days ill before admission. There was a great deal of restlessness and grinding of the teeth. The pulse was small and irregular being 150 per min. The temperature was 100.2°F. The respirations were 50 per min they were laboured and accompanied with considerable indrawing of the chest walls. There was a considerable amount of albumin in the urine. The rash of the attack of measles could be detected here and there over the body.

There was congestion of the tonsils, fauces and posterior pharyngeal wall. There was no sign of membrane in any part of the throat. There was no discharge from the nostrils. The glands of the neck were not enlarged. The bacteriological examination revealed the presence of Loeffler's Bacillus micro-cocci streptococci and leptothrix threads.

5th. February. There was a slight trace of membrane on the left tonsil. At 2 P.M. an injection of Behring's Antitoxin no.1 half dose was introduced into the back.
This was followed by a rise of temperature to 103.2°F, five hours after the injection.

6th. February. The temperature fell to 99.5°F but rose again to 104°F at mid-day. The albumin was considerably smaller in amount.

7th. February. Temperature was still oscillating considerably. There were distinct signs of pneumonia of both bases, especially on the left side. The throat however was much improved no trace of membrane was visible. The pulse was rather weak and rapid being 160 per minute.

12th. February. There was a good deal of coughing and still a dull note or percussion on the left side, also copious moist sound on the right side posteriorly.

15th. February. The pulse was very much better. Albumin was still present in the urine. The left lung was clearing up, the dull note not being so well marked and extensive in area.

25th. February. Discharged, the lung condition had cleared up and the child was rapidly gaining strength.

The Antitoxin undoubtedly assisted this patient in passing through a most severe and dangerous illness. The child had already taken measles, and the lungs were extensively implicated. Superadded to this diphtheria occurred, but was evidently short by the injection of Antitoxin, as no increase of
membrane occurred after the injection. An attack of diphtheria following measles in a subject only 19 months old, of course is a most serious complication. Therefore it is all the more credit that the case recovered.

**33rd Case.** Name: J.D.L. Male 5 years.

Admitted to the City Hospital 7th. March 1895.

1st. March. Complained of headache and sickness.

3rd. March. The patient noticed pain in the throat especially on swallowing.

7th. March. Day of admission being the seventh day of disease.

The temperature was 101.2°F pulse 120 per min, respirations 36 per min. There were signs of commencing general poisoning. The child had a very anxious expression and was rather restless. There was marked cyanosis of the lips. The respirations were somewhat laboured and there was a slight amount of indrawing present.

The tonsils uvula and posterior pharyngeal wall were congested and covered with a thick muco-purulent secretion but no membrane was visible.

The bacteriological examination revealed the presence of Loeffler's Bacillus along with micrococci and diplocoeci. There was a distinct trace of albumin in the urine.

8th. March. 5 C.C. of Aronson's Antitoxin were injected
at the usual site. The temperature at the time of injection was 102.2°F, pulse was 120 per min and respirations 28 per min. One drachm of whisky was given every four hours. The indrawing of the intercostal spaces were still marked and the cyanosis more marked. 8 Hours after the injection the temperature fell to 99.4°F. The pulse and respirations were unaltered.

9th. March. The indrawing of the chest wall was not so marked to-day but was still present. Albumin was still present in the urine.

10th. March. The temperature rose to 102.8°F. The pulse however was slower and better in character being 104 per min. The respirations were 32 per min. All trace of indrawing had disappeared the secretion in the throat was much less marked also the congestion of the parts were considerably reduced.

11th. March. Discharge appeared from the nostrils. This was attended to by means of a peroxide of hydrogen spray with corrosive sublimate (1 - 1000) every four hours.

23rd. March. Had progressed favourably since last note. A scarlatiniform rash appeared upon the chest, abdomen and back being 15 days since the injection of Antitoxin. The temperature had risen to 103.6°F, pulse 136 per min, respirations 28 per min. The urine showed no trace of albumin. Sp. gr.
27th. March. The temperature after several oscillations regained normal. The rash had entirely disappeared.

6th. April. Discharged. No sign of paralysis and the child appeared to be regaining strength rapidly. The case made an excellent recovery, the larynx was becoming implicated when the injection was given. The indrawing and cyanosis rapidly disappeared. The scarlatiniform rash appeared 15 days after the injection, its character was similar to those already mentioned as occurring after the Antitoxin.

34th. Case. Name. H.S. Male aged 22 years.

Admitted to the City Hospital on 9th. March 1895.

The patient had been feeling out of sorts for at least a fortnight, he had experienced several attacks of feverishness and general malaise.

2nd. March. Complained of want of appetite and headache.

4th. March. The throat became uncomfortable and had slight discomfort in swallowing.

9th. March. The throat had developed a membranous deposit and was admitted on the 5th. day of disease. The temperature was 104.6°F, pulse full and regular being 100 per min the respirations were full and regular numbering 18 per min, they were accompanied with considerable whistling sounds indicating some slight obstruction to the flow of air. The
tongue was flabby. The urine had a trace of albumin. There was an enormous oedema of both tonsils, and uvula and soft palate. The posterior pharyngeal wall was quite obliterated from view. A thick layer of whitish membrane was seen on the left tonsil which extended slightly on to the base of the uvula on the left side. A small deposit of membrane was visible on the right tonsil. The palate and the greater part of the uvula although congested were quite free from membrane.

The bacteriological examination revealed the presence of Loeffler's Bacillus along with micrococci and diplococci. No albumin in the urine.

Local treatment was carried on in the form of hydrogen peroxide and corrosive sublimate (1:1000) also toluol mixture was applied every two hours.

11th. March. The membrane had extended in spite of the local treatment.

At 2.45 P.M. 15 C.C. of British Institute Antitoxin were injected the temperature rose from 100.2F to 102F. The pulse was 96 per min respirations 24 per min.

Albumin was present in the urine, acid reaction SP. Gr. 1025.

15th. March. The membrane had diminished to a considerable extent only a slight trace was visible on the posterior aspect of the left tonsil. The swelling of the tonsils had very
much diminished. And the posterior pharyngeal wall became apparent and was covered with a thick yellow mucoid secretion.

16th. March. All trace of membrane had disappeared. Was allowed up to-day for the first time.

30th. March. Discharged, regaining strength rapidly.

This case was a moderately severe one of diphtheria and the Antitoxin appeared to have a beneficial effect on the disappearance of the membrane.

36th. Case. Name L.P. Female aged 3 years.

Admitted to the City Hospital on March 9th, 1895.

3rd. March. She became feverish and depressed, there was also a considerable amount of coughing.

4th. March. The patient felt somewhat better but in the evening it was discovered by the parents that the glands of the neck on both sides were enlarged.

6th. March. The child gradually had become worse the cough was now croupy.

7th. March. The cough was distinctly more croupy with some difficulty in breathing. The voice was hoarse and considerable pain was experienced on swallowing.

9th. March. Day of admission which was the 7th. day of disease. There was general evidence of distressed breathing and feverishness. The pulse was feeble and small being 130 per min, with a tendency to irregularity. The respirations
were very laboured with considerable indrawing of the chest wall. The temperature was 99.8°F. The glands of the neck were slightly enlarged. There was slight dullness over the base of both lungs, accompanied with a few moist sounds. There was a general congestion of the throat and pharynx. There were small patches of well formed whitish yellow membrane to be seen on both tonsils, larger on the right than on the left tonsil. The uvula, palatal arch and posterior pharyngeal wall were all affected with membrane. There was a distinct muco-purulent nasal discharge.

The bacteriological examination revealed the presence of Loeffler's Bacillus along with micrococci and diplococci.

There was a distinct trace of albumin in the urine, acid reaction, deposit of urates Sp. Gr. 1035. Stimulants and local treatment were carried on.

10th. March. At 1 A.M. 5 C.C. of Aronson's Antitoxin were injected, the indrawing was more marked and the child was very restless, and it was evident the disease was progressing unfavourably.

11th. March. The child appeared to be slightly better the indrawing was not increased in amount. The temperature was 100°F pulse was 136 per minute the respirations were 30 per min.

12th. March. Was distinctly better. The indrawing was
less marked. Slight diminution in the amount of albumin in the urine.

14th. March. The indrawing had now disappeared. The membrane in the throat had almost entirely disappeared. Only a slight trace of albumin in the urine.

15th. March. The patient was improving rapidly, taking food well. Albumin was absent in the urine.

22nd. March. Was allowed up for a short time. No sign whatever of paralysis. Urine entirely free from albumin.

2nd. April. Discharged in excellent health.

This is another very severe case which recovered under the Antitoxin treatment, the indrawing was very marked and in all probability would have progressed to a fatal termination. Of course it is utterly impossible to definitely state the case would have progressed unfavourably, if it had not received treatment, but taking unto account the age of the child which was three years, the marked indrawing and albumin in the urine would undoubtedly lead one to give a very guarded prognosis. This case evidently did receive great benefit as a result of the injection.

38th. Case. G.M. Male aged 24 years.

Admitted to the City Hospital 18th. March 1895.

11th. March. Complained of slight pain on the right side of the throat which caused slight discomfort on swallowing.
12th. March. The patient felt chilly during the entire day, and had several shivering fits.

13th. March. He felt very sick and could take no nourishment.

14th. March. The patient was confined to bed, the throat having become much worse and the glands of the neck swollen and painful on both sides.

17th. March. A portion of membrane which had developed on the right tonsil was sent to the Hospital for examination and on a bacteriological examination being made, Loeffler's Bacillus was found in large numbers.

18th. March. The patient was admitted to the Hospital on the eighth day of disease. There was much congestion of the throat, the right tonsil and the right side of the soft palate were very much enlarged. The uvula was also very much swollen. A dark yellow badly formed membrane covered the surface of both tonsils, and there were also patches here and there upon the surface of the posterior pharyngeal wall and soft palate. There was also a very small patch on the anterior aspect of the uvula. There was no nasal discharge. The glands on both sides of the neck were considerably enlarged and tender on pressure. There was a distinct trace of albumin in the urine. The temperature was 100°F, the pulse 80 per min, and respirations 24 per min. At 9.30 P.M. 5 c.c. of Aronson's Antitoxin were
injected.

19th. March. The membrane upon both tonsils and posterior pharyngeal wall was distinctly thinner. The right tonsil was not nearly so swollen. The albumin however was increased in amount.

20th. March. The membrane was thinner and rapidly disappearing. The albumin in the urine was less in amount.

22nd. March. All sign of membrane had disappeared and nearly all the swelling subsided. There was still a distinct trace of albumin in the urine.

28th. March. All trace of membrane had entirely disappeared, and the patient was allowed up for the first time. All trace of albumin had disappeared from the urine.

7th. April. Patient was discharged, regaining strength rapidly. This case was one of moderately severe diphtheria and made an uninterrupted recovery, after the injection of Antitoxin.


Admitted to the City Hospital on March 13th. 1895.

The patient complained of a slight sore throat upon returning from his office in the evening. During the night he experienced headache and pains in the limbs and throughout the body.

14th. March. The throat became decidedly worse. A
specimen of membrane was removed from the throat and was sent to the Hospital for a bacteriological examination. Next day typical colonies of Loeffler's Bacillus appeared on the agar agar and this report was sent to the medical man in attendance.

18th. March. The patient was admitted upon the seventh day of disease. During the previous week he had slept in the same bed with Case No. 38 who had a very severe attack of diphtheria. There was considerable congestion of the entire throat but there was no marked enlargement of any particular part. Upon the surface of each tonsil there was a yellow white fairly adherent membrane. The uvula, soft palate and posterior pharyngeal wall although congested were quite free from membrane. There was no nasal discharge. The bacteriological examination was again made and revealed the presence of Loeffler's Bacillus associated with micrococci and diplococci. There was no albumin in the urine. The temperature was 99.2F and the pulse 76 per min. full and regular. The respirations were 16 per min and quite easy. 15 C.C. Antitoxin British Institute No.1 were injected.

19th. March. The temperature had fallen to 98F the pulse was 80 per min respirations 17 per min. The patient stated that he felt very much better. The membrane on the tonsils was very much thinner. There was no albumin in the urine.
20th. March. The membrane had entirely disappeared from the tonsils and the patient had a very good appetite. He made a very satisfactory recovery and was discharged on 30th. March 1895.

This case was a very mild one and certainly seemed to improve rapidly under the Antitoxin treatment. It also illustrates the importance of the bacteriological examination in mild cases, because the clinical aspects of the case pointed to an appearance similar to a follicular tonsillitis as being the state of affairs.

40th. Case. E.Y. Male aged 15 months.

Admitted to the City Hospital 23rd. March 1895.

About a fortnight previously the patient was troubled with frequent sickness and excessive diarrhoea. The child had only been weaned about three weeks previously. After a few days of diarrhoea and sickness it got slightly better, but on the whole it seemed worse it was dull and heavy in expression, taking its food very badly. The diarrhoea however, was very much less.

19th. March. The mother noticed that the child had considerable difficulty in swallowing and observed a dirty appearance at the back of the throat. The medical attendant was called in and he at once pronounced it to be a case of diphtheria.
23rd. March. Admitted to the Hospital on the sixth day of disease. The patient had suffered from measles during the month of January and made a good recovery. The patient's appearance of a weakly pale, feebly developed child, but there was no marked evidence of any constitutional disease. The pulse was very small in character being 140 per min, quite regular, and the respirations were 30 per min and not at all laboured. There was no indrawing of the chest wall. The temperature was 100.8°F. The tongue was furred. The abdomen was very prominent and there was considerable diarrhoea. There was a distinct trace of albumin in the urine. There was marked redness of the entire posterior aspect of the throat. Both tonsils posterior pharyngeal wall and uvula were thickly covered with a brownish yellow membrane. The membrane of the uvula was almost black in places. The soft palate was very red and congested, but quite free from membrane. There was no nasal discharge. The glands on both sides of the neck were enlarged and tender on palpation. The bacteriological report revealed the presence of Loeffler's Bacillus with micrococci and diplococci. At 7.30 P.M. 5 C.C. of Aronson's Antitoxin were injected. The temperature at the time of injection was 101°F pulse 132 per min respirations 30 per min. 8 hours after the injection the temperature had fallen to 99°F the pulse to 112 per min and the respirations to 3 per min.
24th. March. The membrane was much thinner on the surface of both tonsils and on the anterior aspect of the uvula. There was considerable diarrhoea and albumin was still present in the urine.

25th. March. The condition of the throat had rapidly improved difficulty in breathing was less marked, and the child was taking food in a more satisfactory manner. The trace of albumin was greatly diminished.

26th. March. The tonsils were now quite free from membrane, but considerably congested. There also remained a small patch of membrane on the front of the uvula. All the other parts of the throat were free from membrane. There was no albumin in the urine.

27th. March. There was a slight swelling at the site of injection, which had an elastic consistency and rather obscured fluctuation.

28th. March. The swelling at the site of injection was slightly larger but was not softer. All trace of membrane had disappeared from the throat.

30th. March. The swelling at the site of injection, the child taking food in a satisfactory manner, and progressing to a satisfactory recovery.

1st. April. The swelling in the back had entirely disappeared and the child took its food well.
9th, April. The patient was discharged. This case, being a child of 15 months old and following shortly an attack of measles, was most satisfactory in favour of the treatment of Antitoxin.

The child's appearance on the admission to the Hospital was one in which a most unfavourable prognosis would be given in the ordinary course of events. The antitoxin in this case undoubtedly appeared to have a beneficial effect.
Table I.

Ages of cases that have recovered under the Antitoxin treatment from 1st. Sept 1894 to 5th. April 1895.

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two years and younger</td>
<td>3</td>
<td>75%</td>
</tr>
<tr>
<td>Between 3 and 5 years</td>
<td>8</td>
<td>20%</td>
</tr>
<tr>
<td>Between 5 and 7 years</td>
<td>7</td>
<td>17.5%</td>
</tr>
<tr>
<td>Between 7 and 9 years</td>
<td>5</td>
<td>12.5%</td>
</tr>
<tr>
<td>Between 9 and 11 years</td>
<td>3</td>
<td>7.5%</td>
</tr>
<tr>
<td>Between 11 and 13 years</td>
<td>3</td>
<td>7.5%</td>
</tr>
<tr>
<td>Between 13 and 15 years</td>
<td>1</td>
<td>2.5%</td>
</tr>
<tr>
<td>Above 15 years</td>
<td>10</td>
<td>25%</td>
</tr>
<tr>
<td>Sum total</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

Table II.

Sex of cases that have recovered under the Antitoxin treatment during the same period.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>24</td>
<td>60%</td>
</tr>
<tr>
<td>Male</td>
<td>16</td>
<td>40%</td>
</tr>
<tr>
<td>Sum total</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>
Table III.

Day of disease on admission to the City Hospital of cases that have recovered under the Antitoxin treatment.

<table>
<thead>
<tr>
<th>Day</th>
<th>Cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st. day</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>2nd. day</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>3rd. day</td>
<td>7</td>
<td>17.5</td>
</tr>
<tr>
<td>4th. day</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>5th. day</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>6th. day</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>7th. day</td>
<td>5</td>
<td>12.5</td>
</tr>
<tr>
<td>8th. day</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>Sum total</td>
<td></td>
<td>40</td>
</tr>
</tbody>
</table>

Table IV.

Day of disease when first injection of Antitoxin was given.

<table>
<thead>
<tr>
<th>Day</th>
<th>Cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd. day</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>4th. day</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>5th. day</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>6th. day</td>
<td>9</td>
<td>22.5</td>
</tr>
<tr>
<td>7th. day</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>8th. day</td>
<td>3</td>
<td>7.5</td>
</tr>
<tr>
<td>11th. day</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Sum total</td>
<td></td>
<td>40</td>
</tr>
</tbody>
</table>
Table V.

The form of Antitoxin used.

<table>
<thead>
<tr>
<th>Form</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aronson</td>
<td>16</td>
</tr>
<tr>
<td>Klein</td>
<td>8</td>
</tr>
<tr>
<td>Behring</td>
<td>10</td>
</tr>
<tr>
<td>British Institute</td>
<td>6</td>
</tr>
<tr>
<td>Sum total</td>
<td>40</td>
</tr>
</tbody>
</table>

Table VI.

Character of the cases which recovered under the Antitoxin treatment.

<table>
<thead>
<tr>
<th>Character</th>
<th>Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Severe</td>
<td>7</td>
<td>17.5%</td>
</tr>
<tr>
<td>II. Moderately Severe</td>
<td>13</td>
<td>32.5%</td>
</tr>
<tr>
<td>III. Mild</td>
<td>20</td>
<td>50%</td>
</tr>
<tr>
<td>Sum total</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

Table VII.

Albuminuria in the cases of recovery.

<table>
<thead>
<tr>
<th>Type</th>
<th>Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuminuria</td>
<td>22</td>
<td>55%</td>
</tr>
<tr>
<td>&quot; absent</td>
<td>18</td>
<td>45%</td>
</tr>
<tr>
<td>Sum total</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>
The above tables give an idea of the results in those cases which have recovered. 10% of the cases developed post-diphtheritic paralysis. The rashes which followed the injections only occurred after Klein's Antitoxin. The temperature in the majority of the cases fell after the injection and if a second injection was necessary it usually fell further. In milder cases this fall usually took place the day after the injection. In severe cases however it required two or more injections before the temperature fell. The pulse is not so rapidly affected, it often continues to remain rapid for a day or two after the injection.

The respirations are not affected to any great extent and I have certainly observed that the majority of cases which are treated before stenosis has set in, rarely go on to that condition, however I have seen exceptions, but only in cases where the micrococcal injection is excessive.

The membrane as a general rule does not extend after the injection.
The Clinical Notes of FATAL CASES of DIPHTHERIA treated with ANTITOXIN, from 1st. September 1894 to 5th. April 1895.

Case No. 1.

Name: J.M. Male. Aged 10 months.

Admitted to City Hospital 4th. Sept. 1894.

4th. day of disease on the day of admission.

4th. September.

Poor small emaciated child. Patches of membrane on both tonsils and slightly on the uvula.

5th. September.

No further improvement. Extension of membrane downwards, distinctly croupy cough. Bacteriological examination revealed Loeffler's Bacillus with micro-cocci and diplococci. X min of Aronson's Antitoxin were injected. The temperature was 99.8\(^\circ\)F. in the morning and fell to normal in the evening. Pulse, 100 per min. Respirations 26 per min. Albuminuria present. In the evening there was distinct indrawing of the intercostal spaces and epigastrium. The steam apparatus was applied which gave a certain amount of relief.

6th. September.

The child's condition was no better, the indrawing was slightly increased. The temperature was only slightly raised above normal, but the heart had now become more rapid and
weaker. Stimulants were ordered in the form of whisky and digitalis.

7th. September.

The indrawing had considerably increased during the night and the child being in a dangerous condition another injection of 6 min of Antitoxin were injected into the forearm and tracheotomy performed. Pulse 156 per min. During the operation the child became very cyanosed but obtained instant relief when the trachea was opened. It was then found that extension had occurred below the level of the tracheotomy wound, but as much membrane as possible was removed. In the evening the temperature had risen to 100.4°F. Pulse 146 per min, respirations 32 per min. The child was certainly in a much more comfortable condition than it was prior to the operation. There was great difficulty however in swallowing, even when small quantities of fluid were introduced into the mouth a small quantity invariably passed into the trachea. All feeding by the mouth had therefore to be stopped. Nutrient enemata were used three times a day as well as the nasal tube, the later caused very little inconvenience and passed into the stomach with great ease. The tracheotomy tube was removed in the evening, the wound was cleansed and iodoform ointment applied, the tube was then reintroduced. The temperature however had risen to 102.4°F. Pulse 148 per min, respirations 32.
8th. September. The child was somewhat better than yesterday. Temperature 98.8°F. Pulse 142 per min respirations 36 per min. Still distinct signs of membrane in the trachea, small portions were expectorated from time to time. These portions of membrane contained Loeffler's Bacillus which were demonstrated both by film-preparation and culture. In the evening the tracheotomy tube was again replaced by a clean one.

12th. September. Since the last note the patient had been in a fairly good condition seemed to assimilate the nourishment given by the nasal tube and enemata. The pulse was 126 per min and respirations 30 per min. No sign whatever of membrane in the trachea there being no indrawing or distress in the act of respiration.

13th. September. The child had become very irritable this appeared to be in a great part due to two teeth that appeared on the point of cutting the gum. Still being fed by means of the nasal tube.

14th. September. The restlessness was increased, tossing about the bed and will not remain quiet for a minute. The pulse was becoming more rapid 134 per min and distinct signs of heart failure seemed to be impending. The cardiac tonics and stimulants were increased in amount. The tracheotomy tube was replaced and the wound
attended to.

15th. September.

Child was much worse. The temperature had risen to 101.4°F. Pulse 136 per min, respiration 48 per min. The character of the pulse was not at all improved.

17th. September.

The patient gradually became worse and died at 4 a.m. on the 18th Sept. Prior to death the temperature rose to 103°F. Pulse became very rapid and difficult to count.

The post mortem examination revealed a very oedematous glottis, which was probably the cause of the difficulty in swallowing in allowing small quantities of fluid to escape into the trachea. The mucous membrane of the trachea was considerably inflamed but all trace of membrane had disappeared. A scrape preparation from the tracheal mucous membrane was examined and showed rod-shaped bodies somewhat shorter than the typical Loeffler's Bacillus along with micro-cocci.

The posterior lip of the tracheotomy tube had caused a distinct abrasion of the mucous membrane on the posterior wall of the trachea. Since seeing this abrasion I have always used an India-rubber tracheotomy tube after the fifth day of operation and in this way prevent any erosion of the mucous membranes. The lungs had no trace of pneumonia although undoubtedly small quantities of fluid had escaped into the
trachea, but probably very little had actually reached the lungs. The blood was distinctly fluid and of a very dark colour. Cultures made from the kidneys showed no Loeffler's Bacillus. The cause of death in this case was I consider the combination of paralysis of the heart assisted by the nervous irritation of the teething and also the lowered state of the patient as the result of the operation, the oedema of the glottis also necessitating the use of the nasal tube which was certainly exhausting especially for a child of 11 months of age.

Case No. 2.

Name: N. S. Female, 4 years of age.

Admitted into the City Hospital 6th. September 1894.

The history states that difficulty of breathing commenced on 3rd. September 1894, so that the child had been suffering from difficulty of breathing for 3 days at the time of admission to the Hospital. It is therefore somewhat difficult to fix the exact day of disease on admission, undoubtedly it was more than 6 days before the actual onset of the disease.

6th. September.

Temperature 100°F. Pulse 168 per min weak and easily compressed. Respiration 32 per min laboured with marked indrawing of the intercostal spaces. The patient was restless and looked extremely ill. Both tonsils, uvula and posterior
pharyngeal wall were covered with membrane. Albuminuria was present. Bacteriological examination revealed the presence of Löeffler's Bacillus, with a large number of micro-cocci.

At 5. 30. P.M. X min Aronson's Antitoxin were injected into the forearm. The child was in an extremely dangerous condition, the indrawing had now become excessive and cyanosis well marked. Tracheotomy was necessary at 7.30 P.M. as the case would not have lived much longer on account of the excessive obstruction to the respiration. The operation gave considerable relief, and as much membrane was removed through the tracheotomy wound as possible. It was then very evident that extension had occurred further down than the tracheotomy wound.

7th. September.

The child passed a fair night, but there was still marked sounds of obstruction to respiration, the indrawing of the intercostal spaces being present but to a less extent than prior to the operation. At 2.30 P.M. the membrane separated almost in toto, after all the portions of membrane had been removed through the tracheotomy wound the child's condition was much more satisfactory, the pulse fell from 152 per min to 120 per min, and improved in character.

The photograph shows the portions of membrane in apposition showing the whole extent of the trachea below the tracheotomy
into the wound, with two branches representing the two bronchi. A small portion of glass rod is passed through the respective lumens of these branches. The temperature however continued above 101°F.

8th. September.

Child still in a dangerous condition no further expectoration of membrane although it was still evident there was still some obstruction probably in the bronchi. X min Aronson's Antitoxin were injected. There were distinct signs of heart failure setting in, the pulse becoming more rapid and compressible. Ether and Strychnine were injected hypodermically but still the heart failed and the patient died at 11 p.m.

The post mortem examination revealed the membrane above the tracheotomy wound, it was well formed and whitish in colour. The trachea below the tracheotomy wound was free from membrane but very much inflamed. There were portions of membrane in both bronchi which however were loose in their attachments but quite sufficient to account for the obstruction to respiration. The membrane extended into the smaller bronchi. There were no signs of pneumonia, the lungs being deeply congested posteriorly. The tracheal glands were considerably enlarged. Culture preparations from these glands gave negative results with regard to the presence of Loeffler's Bacillus. The cause of death in this case was due to the combination of obstruction to respiration in the bronchi with paralysis of
the heart.

The Antitoxin of course was at a great disadvantage owing to the advanced state of the disease at the time of the first injection. But there is certainly the fact that the membrane separated from the trachea in a remarkable manner 19 hours after the injection and the portions of membrane which remained in the air passage were found to be very loosely attached to the mucous membrane at post mortem examination. Another important point is the mixed infection in this case was very marked, which probably was one of the main factor in sustaining the high temperature.

Case No. 3.

Name: R. S. Male. Aged 4 years.

Admitted to the City Hospital 11 Sept., 1894.

It was stated by the parents that it was the 7th day of illness.

4th. September, 1894.

Patient became languid and would take no food, distinct hoarseness of voice.

6th. September.

Became quite croupy and very restless.

11th. September.

Has steadily become worse and on admission was very
cyanosed and restless. There were marked signs of advanced obstruction to respiration. The intercostal spaces and epigastrium were violently indrawn. All the extraordinary muscles of respiration were called into action. The temperature was normal, pulse 144 per min easily compressed. Respirations laboured 40 per min. The tonsils and uvula were covered with membranous exudate, the posterior pharyngeal wall was also effected. Albuminuria is present in large amount. The Bacteriological examination revealed Loeffler's Bacillus associated with micro-cocci diplococci and streptococci.

At 6 p.m. X min Aronson's Antitoxin were injected. At 7.30 p.m. the child's condition became so critical that operative procedure was necessary. Tracheotomy was performed which was accompanied with instant alleviation of the more acute symptoms.

12th. September.

The temperature rose to 100F. Pulse 136 per min. Respirations were shallow 40 per min. Portions of membrane were periodically expectorated, distinct signs of obstruction to respiration still marked.

At 44 P.M. VI min Aronson's Antitoxin were injected as the heart appeared to be giving way.

At 8 P.M. the patient suddenly died of heart failure along with partial obstruction to respiration.
Post mortem examination revealed membranous deposit above the tracheotomy wound. The trachea was free from membrane although very much inflamed. There were membranous deposits in both bronchi which extended into the smaller air passages. There was also a certain amount of frothy fluid in the lumen of the tube formed by the membrane. The lungs were congested but showed no consolidation. The tracheal glands were enlarged and on section showed a marked purplish colour. Culture preparations from these glands gave negative results with regard to the presence of Loeffler's Bacillus.

The kidneys were examined but no naked eye lesion was detected. The capsule was removed with ease and the section of the kidney appeared to be normal. Cultures were made but showed no Loeffler's Bacilli.

The blood was very dark in colour and markedly fluid only slight trace of clots in the right side of the heart.

The cause of death was obstruction to respiration along with paralysis of the heart. The case was too far advanced for the Antitoxin to exert any beneficial effect.

Case No. 4.

Name: J. R. Male. Age 6 years.

Admitted to the Cith Hospital 24th. Sept. 1894.

17th. September.

The patient was sick and vomited several times.
Complained of sore throat.

18th. September.

Hoarseness commenced.

22nd. September.

Difficulty in breathing commenced.

24th. September.

The difficulty in breathing had become very much worse, marked indrawing of the intercostal spaces and epigastrium. The tonsils and uvula were covered with membrane. The posterior pharyngeal wall was also effected. Albumin was present in the urine.

Bacteriological examination revealed Leoffler's Baccilus along with micro-cocci and diplococci. At 3. P.M. X min Aronson's Antitoxin were injected. Tracheotomy was however absolutely necessary at 4.30 p.m. on account of the excessive obstruction. The pulse was 154 per min. Temperature 100 2°F. Respirations 44 per min. A large quantity of semi-solid matter along with portions of membrane were removed through the tracheotomy wound at the time of the operation. The trachea was cleaned out as far as possible. After the operation the patient was very much cyanosed and required artificial respirations for ten minutes. Stimulants were applied freely and after prolonged exertions the patient rallied. at 9 P.M. the patient exhibited a much better colour, the
pulse had improved considerably and respirations were easier, still however 40 per min.

Swallowing was accompanied with no discomfort, none escaping into the trachea. Was slightly sick and expectorated portions of membrane. Calomel gr II were given as the tongue was very dirty and the bowels had not been moved since admission 25th. September.

The temperature had fallen to 100°. Pulse 144 per min. slightly better in character. Respirations 44 per min full and deep.

The temperature rose during the day and it was evident the septic process had invaded the lungs.

At 11 a.m. VIII min Aronson’s Antitoxin were injected, and also an expectorant mixture ordered to assist in the expulsion of the tenacious fluid matter which tended to accumulate in the trachea. Pulse not so good 150 per min.

At 9 p.m. X min Aronson’s Antitoxin were injected as the patient appeared to be sinking.

26th. September.

The temperature gradually fell to 96°. Pulse very rapid and weak 156 per min. Respirations 50 per min. The trachea seemed to be gradually becoming occluded far down beyond the reach of any instrument.

The temperature rose to 101° at 1 p.m. and the child died.
at 1.25 p.m. as a result of obstruction to respiration.

Post mortem examination revealed the diphtheritic process well marked throughout the whole respiratory tract. As in the other cases described the membrane above the tracheotomy wound was more fibrous and better formed than that below the tracheotomy wound. This being mainly due to the comparative quiescent state of the trachea above the tube as compared with the parts below the tracheotomy tube which are being continually irritated by the flow of air. The larynx was quite occluded with membranous deposit. Lower down the trachea was covered with a greenish slimy deposit which increased in amount as it descended towards the bronchi.

The left bronchus was perfectly occluded, the air apparently only entering by the right bronchus during the last hours of life. The smaller air passages were filled with this yellowish green deposit (see photograph). A film preparation of this deposit revealed a large number of miccio-cocci and diplococci with Loeffler's Bacilli in smaller numbers.

The glands around the trachea were markedly enlarged. The blood was very dark in colour and coagulated very slowly. A culture preparation from the blood gave no growth whatever. The cause of death was undoubtedly obstruction to respiration. The Antitoxin appeared to have no beneficial effect, in the first place the case was very far advanced when it was admitted
into the Hospital and in the second place the micrococcal infection appeared to play the most important part in the causation of this particular case, and therefore it was not expected that the Antitoxin would have a curative effect.

**Case No. A.**

Name: T. P. Male. Aged 2 years.

Admitted to the City Hospital October 6th, 1894.

This patient had been ill 8 days and exhibited marked signs of obstruction and general poisoning, it died shortly after admission to Hospital.

No Antitoxin was injected and no post mortem examination was allowed.

**Case No. 6.**

Name: S. F. Male. Aged 2 years.

Admitted to the City Hospital October 18th, 1894.

The onset of the disease occurred on October 6th, 1894. Patient complained of sore throat and sickness. Difficulty of breathing then set in and steadily increased until the 18th October being the day of admission. The temperature was 99° F. Pulse 130 per min weak in character. Respirations 36 per min.

The tonsils, uvula and posterior pharyngeal wall were covered with membrane. Marked signs of stenosis of trachea. At 6 p.m. X min Aronson's Antitoxin were injected. Bacteriological examination revealed Loeffler's Bacillus associated with
micro-cocci in large numbers. Albuminuria present.

October 19th.

Temperature rose to 102. 8F. Pulse 150 per min more thready than yesterday. Respiration more laboured 44 per min. The indrawing of intercostal spaces had increased considerably. The parents would not allow any operative procedure. Pulse became very rapid 186 per min and weak in character, the temperature rose to 103 F. and then fell in the evening to 100F.

22nd. October.

The patient was very much worse and sinking rapidly. The temperature rose to 102. 2F. Pulse 184 per min. Respirations 48 per min. Died at 11 a.m.

Post mortem examination revealed membrane extending down to the bronchi accompanied with a large amount of fluid exudate. The membrane was well organised and whitish in colour, its attachment to the mucous membrane was loose and could easily be lifted off the surface of the trachea (see photograph). There was no pneumonia patch in the lungs. The tracheal glands were enlarged. The Antitoxin in this case had no effect on account of the delay in admitting the case into Hospital, also the obstruction was so pronounced and the toxic effects were so well marked. The membrane was however loosely attached to the trachea mucous membrane which may have been
assisted by the action of the Antitoxin.

Case No. 7.

Name: W. R. Male. Aged 2½ years.

Admitted to City Hospital on 29th Sept. 1894.

This case was a brother of case 4. When case 4 was admitted to the Hospital I asked the parents to be sure and call in their medical man if any other members of the family showed the slightest sign of being ill and in this way allow the case to come under the influence of the Antitoxin as soon as possible.

In watching the case 4, I noticed that the Antitoxin exerted only a slight beneficial effect, and as mentioned the case had a fatal termination. I therefore considered that if the brother was brought into the Hospital without delay it would give the Antitoxin a better chance of saving the child's life.

This case was admitted on the 29th Sept. 1894 on the second day of illness.

The mother noticed the child was not well and took food badly, she called in her medical attendant who advised the mother to allow the child to be removed to the Hospital and be subjected to the Antitoxin treatment.

The throat was only inflamed when the Medical attendant examined it for the first time, but taking into
consideration that the brother had died of diphtheria in the Hospital only two days ago he considered it was advisable to send the patient into Hospital. On admission the child looked ill and restless, the throat was examined and no membrane could be detected. However there was a distinctly croupy cough.

A Bacteriological examination revealed nothing except micro-cocci.

Albuminuria was present. Although there was a negative bacteriological report with regard to the presence of Loeffler's Bacillus XII min of Aronson's Antitoxin were reinjected. The croupy cough increased and the steam apparatus was applied with only slight relief. The temperature was 99°F pulse 112 per min. Respiration 24 per min.

30th September.

No improvement, croupy cough more marked and there was a slight appearance of membrane on the posterior pharyngeal wall and tonsils. This was examined Bacteriologically and was found that it contained Loeffler's Bacilli associated with micro-cocci in large numbers.

The temperature had risen to 99°F. Pulse 136 per min, respirations 28. The child had violent fits of coughing which were accompanied with a considerable amount of cyanosis.

An expectorant mixture was ordered as well as an emetic.
At 8.30, p.m. VII min of Aronson's Antitoxin were injected. The child vomited but no membrane was expectorated. The child was undoubtedly getting worse and it was very evident that extension was occurring down the trachea, indrawing being quite marked.

October 1st.

The patient was worse to-day. The indrawing is still more marked. Albuminuria increased in amount.

At 1.30, p.m. VII min Aronson's Antitoxin were injected. Expectorant continued.

October 2nd.

Indrawing still more marked. A full dose of Vini Ipecacuanha was given and followed by vomiting but no membrane was expelled. The temperature was 99°F pulse very weak and rapid being 160 per min.

At 4 P.M. the child died of obstruction to breathing along with heart failure.

The post mortem examination revealed a condition almost identical with that of the brother described in Case 4. (see photograph) Cause of death being obstruction to respiration with heart failure.

This was a most discouraging case, the fact that the brother had already died in the Hospital of course made the case
graver with regard to prognosis. But although it is stated that the Antitoxin was injected on the second day of disease, it must be noted that Albuminuria was present on the day of admission which point I consider tends to point, that the case had been longer ill than two days.

Another interesting point in this case is the undoubted primary implantation of membrane in the trachea, the croupy cough being well marked on admission, with all the visible parts of the throat free from membrane. These parts as noted in the case became affected later on. The Antitoxin was given in doses in proportion to the age of the child, the directions given with the particular strength used being 1.0.C.C. for an adult dose.

Although the Antitoxin was given every day on looking back I now feel that larger doses should have been given. One distinct point in favour of the Antitoxin in this case was the great predominance of the micro-coccal infection.

Case No. 8.

Name E. S. Female aged 7 years.

Admitted to the City Hospital 14th. October 1894.

The onset of the disease was said to have been 7th. Oct. 1894 headache and sore throat.

11th. October.

Croupy cough began and difficulty in breathing.
14th. October.

Admitted on the seventh day of disease. The child looked extremely ill, pale and thin. Temperature 97.4°F. pulse 160 weak and compressible. Respirations 30 per min. The breathing was very laboured and accompanied with a very considerable amount of indrawing of the intercostal spaces and epigastrium. The tonsils were both covered with membrane, although the uvula was perfectly free. Bacteriological examination revealed Loeffler's Bacillus associated with a large number of the micro-cocci and diplococci.

At 12 noon XII min Aronson's Antitoxin were injected.

2 p.m. The patient was so dangerously ill that it was necessary to perform the tracheotony. A large tracheal wound was made and as much membrane was removed as possible, there was also a large amount of watery purulent material expelled through the tracheal wound.

The child rallied from the operation in a wonderful manner. The act of swallowing was easily performed and the child took food eagerly.

At 4.30 p.m. another injection of X min of Aronson's Antitoxin was given.

At 6 p.m. the temperature had risen to 104°F. pulse 172 per min, respiration 38 per min.

11 p.m. temperature had fallen to 101°F pulse 140 per min
respirations 38 per min. The tracheotomy tube was changed. The child passed a comfortable night and slept soundly.

15th. October.

The temperature still remains about 102°F. pulse 156 per min, respirations 44 per min.

At 3 p.m. the tube was changed and a large portion of inspissated mucus was removed. The membrane was quite apparent through the tracheal wound but only small portions would come away. The child's condition however was not improving, the indrawing was increasing. Cyanosis was becoming more marked.

The bases of both lungs appeared to be very much congested and fluid was rapidly accumulating in the air passages.

16th. October.

The child gradually became more cyanotic and died at 12 noon.

Post mortem examination showed the trachea lined with a well-formed membrane. The average thickness being between 1/8 inch and 1/16 inch. This membrane extended from the tonsils (uvula free) down to the smallest ramifications of the air passages. The membrane was removed from the mucous membrane with great ease. Lying in the lumen of the membrane there was a greyish purulent fluid which was probably the actual cause of death and the cause of the progressive cyanosis of course along with the presence of the membrane.
On section the lungs were very much congested especially posteriorly and portions were quite consolidated. Those consolidated portions of lung when introduced into water however floated on the surface. On pressure being exerted on the lungs the cut surface exuded a greyish fluid which escaped from the small air passages.

The tracheal glands were very much enlarged.

The cause of death in this case was obstruction to respiration due to the presence of membrane and the accumulation of fluid, also septic pneumonia with heart failure.

The Antitoxin was of very little service in this case, the micro-coccal infection was very marked, the septic pneumonia being a very strong factor in causing the death of the child.

Case No. B.

Name: R. Y. Male. Aged 19 months.

Admitted to the Gith Hospital 13th Oct. 1894.

This was a case of croup which died 8 days after admission to the diphtheria wards.

There was no membrane visible on the tonsils or uvula.

The bacteriological report was negative with regard to the presence of Loeffler's Bacillus. No Antitoxin was injected. No post mortem examination allowed.
Case No. 11.

Name: H. M. Male. Aged 14 years.

Admitted to the City Hospital 9th Nov. 1894.

4th. November 1894.

Patient became ill and feverish, complained of headache, and had no appetite for food.

6th. November 1894.

Complained of sore throat and difficulty in swallowing.

9th. November.

Patient therefore being admitted on the 5th day of disease, complained of pain in the throat, difficult in swallowing, slight trouble in breathing and loss of appetite. The temperature was 100.6°F, the pulse was 108 per min. rather compressible. The respirations were 20 per min. Both tonsils and uvula were very thickly coated with a dirty grey membrane. The posterior pharyngeal wall was also affected. The odour of the breath was very offensive, owing to the very dirty state of the mouth in general.

The bacteriological examination revealed Loeffler's Bacillus associated with numerous quantities of micro-cocci and diplococci.

12 p.m. XII mins of Aronson's Antitoxin were injected into the forearm. A mixture of Strychnine and digitalis was also
given. The temperature fell to 98.4°F. pulse 96 per min., respirations 16 per min.

10th November.

Was slightly worse, complained of more difficulty in breathing. The mouth was slightly cleaner and the breath was not quite so offensive.

The temperature was 101°F pulse 106 per min., respirations 16 per min.

12 p.m. XII min Aronson's Antitoxin were injected. Three grains of calomel were also given.

There was 23 ounces of urine passed with a slight trace of Albumin. Steam was applied.

11th November.

Patient felt no better, still difficulty in breathing. The temperature ranged between 101°F. and 100°F. respirations 20 per min. The toxic poisoning was much more marked today, the patient's general expression was painful to witness, the anxiety and continual restlessness. The character of the pulse became weaker as the day progressed. Albuminuria more marked.

12th November.

No improvement whatever, the toxaemia became more marked. The temperature was still between 101°F. and 100°F. pulse became more rapid and still more compressible. The difficulty in breathing was still more marked. The patient had great trouble
in swallowing nourishment, nutrient enemata were freely administered.

The Albuminuria had considerably increased.

13th. November.

There were distinct signs of profound toxaemia and also obstruction, the indrawing was more marked. Another injection of X min of Aronson's Antitoxin was injected. The temperature was 101°F, pulse was very rapid being 168 per min. and although freely stimulated the heart failed and the patient died at 12 p.m. on the 9th. day of disease.

No post mortem examination was allowed in this case, but undoubtedly the trachea was pretty extensively affected, although the important factor in the causation of the death in this patient was the profound effect the poisonous products eliminated from the organisms in the air passage appeared to exert on the general mechanism of the body. The toxaemia was fairly well marked from the first day of admission to the Hospital and the Antitoxin appeared to exert no check whatever to the attack of the poison. The Albuminuria increased in large amounts as the case progressed, the amount of urine passed daily was always above twenty ounces.

Case No. 15.

Name: P. W. Aged 4 years.
Admitted to the City Hospital 18th November 1894.

13th. November.

The patient complained of not feeling well, vomited and severe headache and slight sore throat.

16th. November.

The sore throat was increased in severity, pain was present on swallowing and the appetite was very poor.

18th. November.

Admitted on the 5th day of disease. During the last two days prior to admission there has been an increasing difficulty in breathing. This difficulty was well marked on admission, there being a distinct stridor during inspiration, with indrawing of the intercostal spaces and epigastrium.

The patient was very distressed and restless. The tonsils, uvula and posterior pharyngeal wall were covered with membrane.

A bacteriological examination revealed Loeffler's Bacillus associated with micro-cocci and diplococci in immense numbers.

XII mins of Aronson's Antitoxin were injected at 4p.m. the temperature was 99.2°F, pulse 144 per min very weak and thready. Albuminuria present. Liquor strychnine min 3 and Tincture Strophanthus min 5 were given every four hours. One drachm of whisky every 3 hours.

* The obstruction however was so excessive that tracheotomy
was necessary and was performed at 10:30 p.M. The operation relieved the acute symptoms of obstruction and the patient passed a fairly comfortable night.

19th. November.

The child seemed to be more comfortable in the morning although there were still evident signs of obstruction further down the trachea.

The indrawing of the intercostal spaces undoubtedly was less although still present to a considerable degree. The temperature had risen to 102F and the pulse was 150 per min. The bases of the lungs were congested and coarse moist sounds were easily detected. The child swallowed fairly well and nutrient enemata were also given.

20th November.

At 4 a.m. X min of Aronson's Antitoxin were injected as the patient apparently was making no progress in the way of recovery. After this injection the temperature fell to normal, the pulse became slower being 132 per min. and was slightly better in character. The obstruction however was not relieved, no expectoration of membrane occurred.

At 12 p.m. XII min of Aronson's Antitoxin were injected with a hope of improving matters.

21st. November.

No improvement whatever, the obstruction was increased
and the restlessness more marked. The temperature had risen again to 101°F, pulse 134 per min, respirations 48 per min. Albuminuria increased in amount. In the evening the heart showed marked signs of giving way. The pulse was very rapid and weak in character, cyanosis being very marked.

22nd. November.

The toxaemia was very marked and it was very evident the child would not last long. The temperature rose to 102.8°F during the day, the pulse was 160 per min and the respirations became very rapid being 70 per min and shallow in character. The Albuminuria was considerably increased being 0.7%.

23rd. November.

The child's condition was hopeless, the bronchi appeared to be almost completely occluded with membrane and fluid. The temperature fell to 99.4°F shortly before death which occurred at 12 noon.

The post mortem examination revealed a membranous condition affecting the larynx trachea and bronchi. There was also a large quantity of dark frothy fluid in the lumen of the air passages. A bacteriological examination of the membrane in the trachea revealed Loeffler's Bacillus along with large numbers of micrococci. Cultures made from the kidneys failed to demonstrate the presence of Loeffler's Bacillus, but showed colonies of micrococci. The left lung had a distinct area of
consolidation extending from the root of the lung posteriorly to the surface of the lung. The tracheal glands were considerably enlarged. No. 5 photograph in the appendix is a representation of the trachea removed from this case.

The cause of death in this case was the combination of obstruction to respiration, toxaemia, septic pneumonia and cardiac failure.

The Antitoxin could not be expected to have any very beneficial effect in this case, on account of the advanced stage of the disease before the first injection, the micrococcal infection and the pneumonia were all agents which tended to bring about a fatal termination.

9th. Case. Name. N.M. Female aged 2½ years.
Admitted to the City Hospital 18th. November 1894.

12th. November. The child became feverish and loss of appetite.

on

15th. November. Difficulty swallowing appeared, along with some difficulty in breathing.

18th. November. Day of admission was the eighth day of disease. The temperature was 99.2°F the pulse was 148 per min, respirations 24 per min. There was a marked croupy cough with marked stridor during respirations. There were patches on both tonsils, uvula and posterior pharyngeal wall.
A bacteriological examination revealed Loeffler's Bacillus along with micrococci. X min of Aronson's Antitoxin were injected into the forearm.

19th. November. The indrawing had become very much worse and the child was rapidly sinking. One grain of calomel was given.

20th. November. The breathing had become very laboured and it was very evident that the air passages were gradually becoming occluded with membrane and fluid matter. The temperature rapidly rose to 102.2°F, the pulse was 160 per min, very weak in character. The child died at 12 mid-day.

The post mortem examination revealed the trachea and bronchi almost obliterated with membrane and slimy fluid. The photograph number 9 in the appendix shows the immense deposit of membrane extending from the larynx down to the small divisions of the bronchi. An examination of this membranous deposit at various levels revealed the presence of Loeffler's Bacillus along with micrococci. The lungs were congested but showed no pneumatic patches.

The tracheal glands were enlarged. The blood was very dark in colour and extremely fluid. There were slight traces of ante-mortem clots in the right side of the heart.

10th. Case. Name. G.R. Female aged 4½ years.
Admitted to the City Hospital 21st. December 94.
13th. December. The child began to cough and became feversh.

21st. December. Admitted on the eighth day of disease
Child was very pale and markedly cyanotic. The alae nasi moved rapidly with respiration. There was considerable indrawing of the lower ribs and intercostal spaces. There was a distinctly laryngeal cough present. The pulse was very weak and rapid being 180 per min. The child swallows with difficulty. The glands were enlarged and tender on both sides of the neck. The tonsils were enlarged and red with a distinct membranous deposit on the left tonsil. The uvula was red and swollen with membrane on its left side. The soft palate and posterior pharyngeal wall were red and oedematous but there was no membrane visible.

A bacteriological examination revealed Loeffler's Bacillus associated with micrococci and diplococci.

10 C.C. of Kleins Antitoxin was injected into the subcutaneous tissue of the abdominal wall. Whisky, strychnine and digitalis were administered.

The child however became more restless, frequently clutching at her throat. The pulse became more rapid and weaker the patient died at 8.20 P.M. which was 4½ hours after admission.

The post mortem examination revealed the trachea and bronchi extremely implicated. (see photograph No. 10 in the appendix.) The tracheal glands were enlarged. No pneumonic patches in the lungs.

12th. Case. Name L.B. Female aged 3 years 9 months.
Admitted to the City Hospital 25th. December 1894.


24th. December. Throat increased in severity also diarrhoea set in.

25th. December. On the third day of disease was admitted to the Hospital. The palate and tonsils were congested and swollen no membrane could be detected. There however was a marked croupy cough present. No albumin in the urine. Steam apparatus applied.

26th. December. The croupy cough was worse. There was no change in the throat. 2 grains of calomel were given internally.

27th. December. The croupy cough was still present. A trace of albumin appeared in the urine.

28th. December. The first appearance of membrane on the right side of the uvula was visible it extended almost to the palatal arch.

A bacteriological examination was made and revealed the presence of Loeffler's Bacillus associated with micrococci streptococci and diplococci. There was a distinct trace of albumin in the urine. The temperature which had remained only slightly raised had risen to 102.6F. The pulse 142 per min respirations 22 per min.

29th. December. At 3.15 P.M. 90 min of Klein's Antitoxin
were injected. The membrane had extended on to both tonsils and had a whitish grey colour. The glands on the neck were enlarged and tender. Both bases of the lungs were congested.

30th. December. The patient passed a very bad night, was very restless, repeatedly clutching anything that came within her grasp.

31st. December. Patient died at 10.5 A.M. and appeared up to the last to be in a rather excited nervous state. There was a marked indrawing or obstruction to breathing.

The post mortem examination revealed both lungs much congested. The larynx, trachea and bronchi were slightly injected but no trace of membrane could be found except that already described on the tonsils and uvula. (See photograph No. 12 in the appendix) The blood coagulated very slowly, there were slight traces of ante mortem clot in the right side of the heart.

This was a very discouraging case; the regret was that the Antitoxin had not been given sooner. The process appeared to commence either in the trachea or larynx and extended upwards to the uvula and tonsils. The severe congestion of the lungs appeared to assist very much in bringing about the child's death. During the last day of life the pulse was 160 per min. The Antitoxin appeared to have very little effect whatever on the progress of this case.

Admitted to the City Hospital on 6th. January 1895.

5th. January. Child developed a croupy cough which rapidly became worse, the previous history was uncertain.

6th. January. Admitted probably on the 6th. day of disease, although the parents stated this was only the second day of illness. This attack had followed upon measles which the child had had 3 weeks ago. Both tonsils were very much swollen, quite occluded the view of the posterior pharyngeal wall. There was a brownish white membrane covering each tonsil which was difficult to remove. The bacteriological examination revealed Loeffler's Bacillus associated with an immense number of micrococci and diplococci.

The pulse was weak and rapid being 160 per minute. The respirations were laboured with a marked crowing sound. The temperature was 99.4°F. The glands of the neck were not enlarged. At 8.30 P.M. 90 mins of Klein's Antitoxin were injected.

7th. January. Child passed a very restless night and died at 6.35 A.M.

The post-mortem examination revealed the membrane implicating the larynx and upper part of the trachea. The cause of death being partial obstruction with the addition of toxic poisoning.

The case had too far advanced for the Antitoxin to exert any beneficial effect.
14th. Case. Name M. McG. Female aged 3 years.
Admitted to the City Hospital 11th. January 1895.

11th. January. A very indefinite history was obtained in this case, headache and sickness were said to have commenced two days prior to admission. The patient was a badly developed emaciated child with a very restless and anxious expression. Indrawing was very marked. Albumin was present in the urine. At 4.30 P.M. 90 min of K&lein's Antitoxin were injected. The child died at 6.10 P.M.

No post-mortem examination was allowed. This case was very ill on admission and far too far advanced for Antitoxin to have any effect whatever.

15th. Case. Name F. A. Male aged 2 years.
Admitted to the City Hospital Jan 22nd 1895.

22nd. January. The history stated that the child had been six days ill. The child was very restless pale and worn out. The breathing was rapid with evident signs of obstruction both in the trachea and in the nose.

The respirations were 40 per min with considerable indrawing of the chest wall. The temperature was 103°F. The pulse was weak and rapid. Frequent cough, on auscultation there were wheezing sounds and over both lungs and consolidation of both bases. The urine gave a copious deposit of Albumin.
There was considerable congestion of the parts in the throat but no membrane was visible. There however was a copious yellowish discharge from the nose which when examined bacteriologically revealed Loeffler's Bacillus along with micrococci and diplococci.

There was a slight enlargement of the glands beneath the angle of the jaw on the right side.

23rd. January. At 8.30 A.M. 90 mins of Behring's Antitoxin No. 1 were injected.

24th. January. There was no improvement, indrawing was more marked, there was a very copious deposit of Albumin.

25th. January. 60 mins of Behring's Antitoxin No. 1 were injected at 11.30 A.M. Child died shortly afterwards.

The post mortem examination showed:

The larynx was lined with diphtheritic membrane extending into the trachea for about 3/4 of an inch, it was thin light in colour and easily detached. The mucous membrane of the trachea and bronchi were congested but had no membrane. (See photograph no 15 in the appendix). The glands around the trachea were considerably enlarged and on section were of a deep purple hue? The posterior aspect of both lungs were consolidated and the section when pressed exuded a thin purulent secretion. The spleen was not enlarged but congested. The
heart appeared to be normal, the blood was dark coloured and coagulated slowly.

The cause of death was diphtheria with double septic pneumonia.

The micrococcal infection and the double pneumonia were sufficient reasons for the Antitoxin not saving this patient.

16th. Case. Name J.P. Male aged 4 years 3 months.

Admitted to the City Hospital Feb 15th. 1895.

15th. February. The parents stated that the child had been four days ill, it therefore came under treatment in Hospital on the 5th. day of disease. The patient was a robust well nourished child. There were marked signs of acute general symptoms, expression was scared. The respirations were 28 per min, they caused considerable stridor and accompanied by indrawing of the chest wall. The pulse was full and regular being 120 per minute. The temperature was 102.4F. The lungs were dull or percussion at both bases. The dullness on the right side extended higher than on the left. Rales and moist sounds heard copiously over the dull areas. There was a considerable trace of Albumin in the urine. There was a whitish yellow patch of membrane upon the left tonsil, also on the right tonsil there are small points of developing membrane. The uvula and pharyngeal wall though swollen and injected in appearance were quite free of membrane. There was a considerable dull watery discharge from the nostrils especially the
right. A bacteriological examination of this discharge and membrane revealed micrococci and diplococci but no Loeffler's Bacillus.

17th. February. Another careful examination was made with another negative result with regard to the presence of Loeffler's Bacillus.

18th. February. As the case was rapidly becoming worse at 2.30 P.M. a full dose of Behring's Antitoxin No 1 was injected.

At 5.30 P.M. tracheotomy was necessary.

19th. February. Was coughing frequently but took nourishment well.

20th. February. At 5.30 P.M. died of heart failure.

The post mortem examination revealed the membrane extending from the larynx down to within an inch of the bifurcation. (See photograph No.16 in the appendix). The bronchi and small tubes were partially filled with a brownish fluid which swelled up when pressure was exerted on the lungs.

Both bases were very much congested the left was distinctly consolidated in parts.

The tracheal glands were slightly implicated a very careful further examination of the membrane in the trachea and larynx again failed to show Loeffler's Bacilli but only micrococci and diplococci with streptococci.
This case is extremely interesting in the fact that it was a perfectly typical clinical diphtheria and yet failed to show Loeffler's Bacilli. My method of examination was most careful and in my own mind I could eliminate the Bacillus. The condition was a septic process with a membranous deposit and a septic pneumonia. Of course the Antitoxin could not be expected to exert any beneficial effect.

17th. Case. Name J.A.A. Female 22 months.

Admitted to the City Hospital 1st March 95.

This attack of diphtheria had followed immediately after measles of which there are still visible signs. The child had pneumonia during the attack of measles and it was only two days before admission that the parents noticed a difficulty on breathing. On admission there were marked signs of acute general poisoning. The face was pale, lips were cyanotic. Respirations were 70 per minute they were laboured and croupy accompanied with a considerable amount of indrawing of the chest wall. The pulse was 150 per min and was very feeble in character and distinctly irregular. The temperature was 101.6°F Distinct signs were present indicating a double basal pneumonia. The throat shows very little membrane, there was a thick mucoid deposit on both tonsils, with a great deal of muco-purulent secretion in the pharynx.

A bacteriological examination revealed the presence of
Loeffler's Bacillus associated with micrococci and diplococci.

2nd. March. At 4.30 P.M. 15 C.C. of British Institute Antitoxin were injected.

3rd. March. No improvement whatever, no Albumin was present in the urine.

4th. March. Patient died at 1.35 P.M.

The post mortem examination revealed membrane in the larynx. The trachea was moist and inflamed, there was a large quantity of frothy fluid in the bronchi. The lungs were very much congested and here and there patches of broncho pneumonia.

The cause of death was diphtheria poisoning with septic pneumonia.

It is of course evident the antitoxin would play a very poor part in this case.

18th. Case. Name M.L. Female aged 2 years 7 months.

Admitted to the City Hospital 3rd. March 95.

The patient took ill 5 days prior to admission complained of difficulty in swallowing.

There were marked signs of general acute poisoning. The pulse was small but regular 120 per min. Respirations 46 per min also regular but accompanied with indrawing of the chest wall. Slight cough was present, a few moist sounds were heard at both bases posteriorly? There was no albumin in the urine.
There was a whitish membrane on both tonsils and posterior pharyngeal wall. The uvula and soft palate are congested but no sign of membrane upon either.

The bacteriological examination revealed Loeffler's Bacillus along with micrococci and diplococci.

4th. March. At 2.45 P.M. 15 C.C. of British Institute Antitoxin were injected.

5th. March. Tracheotomy was necessary at 1.30 A.M. At 2 A.M. 10 C.C. of British Institute Antitoxin were injected.

Died at 6.30 P.M. having been convulsed on several occasions during the day.

The cause of death in this case was rather difficult to account for, on the post mortem examination there was no obstruction which would have caused death. The heart was always good in character although at times it showed a tendency to become rather rapid. The Antitoxin appeared to have no effect whatever in improving the patient's condition.

Since examining the particular form of Antitoxin used in this case I am not surprised that it had no beneficial effect, and a fortnight afterwards I found a flocculated deposit in the bottom of a similar tube and various putrefactive organisms in the fluid.
### Table I.

**Ages of cases that have proved fatal under the Antitoxin treatment.**

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two years and younger</td>
<td>8</td>
<td>44.4%</td>
</tr>
<tr>
<td>Between 3 and 5 years</td>
<td>7</td>
<td>38.8%</td>
</tr>
<tr>
<td>Above 6 years</td>
<td>3</td>
<td>16.6%</td>
</tr>
<tr>
<td>Oldest being 14 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sum total</strong></td>
<td><strong>18</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Table II.

**Sex of cases that have proved fatal under the Antitoxin treatment.**

<table>
<thead>
<tr>
<th>Gender</th>
<th>Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>8</td>
<td>44.4%</td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
<td>55.5%</td>
</tr>
<tr>
<td><strong>Sum total</strong></td>
<td><strong>18</strong></td>
<td></td>
</tr>
</tbody>
</table>
### Table III.

Day of disease when the first injection was given of cases that have proved fatal under the Antitoxin treatment.

<table>
<thead>
<tr>
<th>Day of Disease</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>12th. day of disease</td>
<td>1 case</td>
</tr>
<tr>
<td>9th. day of disease</td>
<td>1 case</td>
</tr>
<tr>
<td>6th. day of disease</td>
<td>2 cases</td>
</tr>
<tr>
<td>7th. day of disease</td>
<td>4 cases</td>
</tr>
<tr>
<td>6th. day of disease</td>
<td>1 case</td>
</tr>
<tr>
<td>5th. day of disease</td>
<td>3 cases</td>
</tr>
<tr>
<td>4th. day of disease</td>
<td>2 cases</td>
</tr>
<tr>
<td>3rd. day of disease</td>
<td>2 cases</td>
</tr>
<tr>
<td>2nd. day of disease</td>
<td>2 cases</td>
</tr>
</tbody>
</table>

Sum total: 18 cases

### Table IV.

Number of days in Hospital at time of death of the cases treated with Antitoxin.

<table>
<thead>
<tr>
<th>Number of Days</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>On day of admission</td>
<td>2</td>
</tr>
<tr>
<td>One day</td>
<td>2</td>
</tr>
<tr>
<td>Two days</td>
<td>5</td>
</tr>
<tr>
<td>Three days</td>
<td>3</td>
</tr>
<tr>
<td>Four days</td>
<td>2</td>
</tr>
<tr>
<td>Five days</td>
<td>2</td>
</tr>
<tr>
<td>Six days</td>
<td>1</td>
</tr>
<tr>
<td>Fourteen days</td>
<td>1</td>
</tr>
</tbody>
</table>

Sum total: 18
Table V.

Number of days ill at the time of death in the same number of cases.

<table>
<thead>
<tr>
<th>Number of Days</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 days</td>
<td>2 cases</td>
</tr>
<tr>
<td>4 days</td>
<td>1 case</td>
</tr>
<tr>
<td>5 days</td>
<td>1 case</td>
</tr>
<tr>
<td>6 days</td>
<td>2 cases</td>
</tr>
<tr>
<td>8 days</td>
<td>3 cases</td>
</tr>
<tr>
<td>9 days</td>
<td>4 cases</td>
</tr>
<tr>
<td>10 days</td>
<td>2 cases</td>
</tr>
<tr>
<td>11 days</td>
<td>1 case</td>
</tr>
<tr>
<td>14 days</td>
<td>1 case</td>
</tr>
<tr>
<td>18 days</td>
<td>1 case</td>
</tr>
</tbody>
</table>

*Sum total* 18
The above tables give an idea of the fatal cases which occurred during the seven months of Antitoxin treatment in the City Hospital. Besides these deaths there were 5 cases admitted and died on the day of admission. There were also other three cases which were non-diphtheritic. Taking these cases into account there were 26 deaths occurred in the diphtheria wards. During this same period namely from the 1st. Sept. 1894 to 5th. April 1895, there were 107 cases intimated into the Diphtheria wards as cases of diphtheria, from this one gathers that the actual mortality over all during this period is 24·2%.

But when one examines these intimated cases bacteriologically the following results are obtained.

Those cases where the Klebs Loeffler Bacillus is present - 63

Those cases where the Klebs Loeffler Bacillus is absent - 44

that is to say 58·8% were proved to have the Klebs Loeffler Bacillus present.

Out of these 63 cases there were 23 cases which proved fatal, which gives a mortality of 36·5%.

Out of these 23 fatal cases 5 were admitted moribund and did not receive Antitoxin which gives 18 fatal cases which received Antitoxin.
In table IV. of the fatal cases it is seen that 9 cases died within 48 hours of admission which is 50% of the remaining cases.

We are now reduced to 9 cases which were treated with Antitoxin that proved fatal which gives a mortality of the Antitoxin cases during the past seven months of 13.3%.

From 1st. April 1894 to 1st. Sept 1894 being the six months prior to the Antitoxin treatment being commenced here I had the opportunity of treating 48 cases by other means.

During that period 18 cases died, which gives a mortality of 37.5%. These cases were not bacteriologically examined but merely the intimated cases of diphtheria. Therefore in comparing this result with the result obtained in the following seven months where Antitoxin was used, and putting aside the bacteriological distinction it is 24.2%. Which gives an improvement of 13.3%.

These figures alone speak for themselves that the treatment should be carried on. But it is most particular that the best preparations be used and I am fully convinced that the best results are obtained by means of Dr. Aronson's Antitoxin.

Separation of large masses of membrane only occurred when Aronson's Antitoxin was used. And both the tracheotomies which recovered were treated with this form of Antitoxin.
THE APPENDIX.

The appendix contains the temperature charts, with pulse and respirations, the time and amount of the antitoxin injections.

Each case is numbered and has a corresponding number on its respective chart.

Then follows a series of micro-photographs which are referred to in the Thesis.

After this there is a series of photographs of tracheas which are described in the account of the fatal cases.

And lastly photographs of instruments which I have found specially useful.
Bibliography.

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XIII. Medical Annual 1895.
XIV. Egg's Medicine.
XV. Annual of the Universal Medicinal Sciences.
XVI. Report of the Local Government Board 92. 93. 94.
XVII. Report of the Medical Officer of Privy Council.
XVIII. Journal of Pathology Oct. 93.
XIX. British Medical Journal.
XX. Boston Medical Journal.
XXI. Therapist Etc.
Records of Temperature, Pulse, Respiration, Stools and Urine, from 20th Day of September 1894.

In the case of M. Y. Female. Aged 3. Occupation

<table>
<thead>
<tr>
<th>Day of Month</th>
<th>20</th>
<th>21</th>
<th>22</th>
<th>23</th>
<th>24</th>
<th>25</th>
<th>26</th>
<th>27</th>
<th>28</th>
<th>29</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day of Disease</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
</tbody>
</table>

Pulse: 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140

Respiration: 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18

Stools: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Urine: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Young J. Pentland, Publisher, Edinburgh & London.

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Records of Temperature, Pulse, Respiration, Stools and Urine, from 10th Day of November 1894.

In the case of S. G. Female. Aged 5½. Occupation

<table>
<thead>
<tr>
<th>Day of Month</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day of Disease</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>

Pulse: 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140

Respiration: 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18

Stools: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Urine: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Young J. Pentland, Publisher, Edinburgh & London.

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Records of Temperature, Pulse, Respiration, Stools and Urine, from 20th Day of September 1894.

In the case of S. N. Female. Aged 19. Occupation

<table>
<thead>
<tr>
<th>Day of Month</th>
<th>20</th>
<th>21</th>
<th>22</th>
<th>23</th>
<th>24</th>
<th>25</th>
<th>26</th>
<th>27</th>
<th>28</th>
<th>29</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day of Disease</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
</tr>
</tbody>
</table>

Pulse: 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140

Respiration: 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18

Stools: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Urine: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Young J. Pentland, Publisher, Edinburgh & London.
Records of Temperature, Pulse, Respiration, Stools and Urine, from 8th Day of October 1894

In the case of A. B. Female, Aged 63. Occupation

<table>
<thead>
<tr>
<th>Day of Month</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
<th>21</th>
<th>22</th>
<th>23</th>
<th>24</th>
<th>25</th>
<th>26</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day of Disease</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
</tr>
</tbody>
</table>

| Pulse. | 114 | 110 | 116 | 111 | 113 | 114 | 115 | 112 | 113 | 114 | 115 | 116 |
| Resp. | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 |
| Stools. | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 |
| Urine. | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 |

YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.

Records of Temperature, Pulse, Respiration, Stools and Urine, from 18th Day of October 1894

In the case of Mr. A. C. Female, Aged 5. Occupation

<table>
<thead>
<tr>
<th>Day of Month</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
<th>21</th>
<th>22</th>
<th>23</th>
<th>24</th>
<th>25</th>
<th>26</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day of Disease</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
</tr>
</tbody>
</table>

| Pulse. | 114 | 110 | 116 | 111 | 113 | 114 | 115 | 112 | 113 | 114 | 115 | 116 |
| Resp. | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 |
| Stools. | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 |
| Urine. | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 |

YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.

Records of Temperature, Pulse, Respiration, Stools and Urine, from 19th Day of October 1894

In the case of Mr. A. D. Female, Aged 1. Occupation

<table>
<thead>
<tr>
<th>Day of Month</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
<th>21</th>
<th>22</th>
<th>23</th>
<th>24</th>
<th>25</th>
<th>26</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day of Disease</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
</tr>
</tbody>
</table>

| Pulse. | 114 | 110 | 116 | 111 | 113 | 114 | 115 | 112 | 113 | 114 | 115 | 116 |
| Resp. | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 |
| Stools. | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 |
| Urine. | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 | 2.5 | 3.0 |

YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.
Records of Temperature, Pulse, Respiration, Stools and Urine, from 13th Day of December 1894

In the case of A. J. Female. Aged 12. Occupation

Day of Month: 13 12 11 10 9 8 7 6 5 4 3 2 1
Day of Disease: 1 2 3 4 5 6 7 8 9 10 11 12 13

Pulse

Resp.

Stools

Urine

YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.

Case 16.

Records of Temperature, Pulse, Respiration, Stools and Urine, from 13th Day of December 1894

In the case of A. J. Male. Aged 12. Occupation

Day of Month: 13 12 11 10 9 8 7 6 5 4 3 2 1
Day of Disease: 1 2 3 4 5 6 7 8 9 10 11 12 13

Pulse

Resp.

Stools

Urine

YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.

Case 17.

Records of Temperature, Pulse, Respiration, Stools and Urine, from 13th Day of December 1894

In the case of A. J. Male. Aged 12. Occupation

Day of Month: 13 12 11 10 9 8 7 6 5 4 3 2 1
Day of Disease: 1 2 3 4 5 6 7 8 9 10 11 12 13

Pulse

Resp.

Stools

Urine

YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.
### Case 

**Records of Temperature, Pulse, Respiration, Stools and Urine, from 4th Day of January 1893**

**In the case of L. A.**  
**Female.**  
**Aged 9.**  
**Occupation**

<table>
<thead>
<tr>
<th>Day of Month</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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<th>10</th>
<th>11</th>
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<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day of Disease</td>
<td>1</td>
<td>12</td>
<td>15</td>
<td>16</td>
<td>19</td>
<td>20</td>
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<td>29</td>
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<td>31</td>
<td>32</td>
</tr>
<tr>
<td>Temperature</td>
<td>37.2°</td>
<td>37.3°</td>
<td>37.4°</td>
<td>37.5°</td>
<td>37.6°</td>
<td>37.7°</td>
<td>37.8°</td>
<td>37.9°</td>
<td>38.0°</td>
<td>38.1°</td>
<td>38.2°</td>
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<td>38.4°</td>
<td>38.5°</td>
<td>38.6°</td>
<td>38.7°</td>
<td>38.8°</td>
<td></td>
</tr>
<tr>
<td>Pulse</td>
<td>100</td>
<td>102</td>
<td>104</td>
<td>106</td>
<td>108</td>
<td>110</td>
<td>112</td>
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<td>126</td>
<td>128</td>
<td>130</td>
<td>132</td>
<td></td>
</tr>
<tr>
<td>Resp.</td>
<td>16</td>
<td>18</td>
<td>20</td>
<td>22</td>
<td>24</td>
<td>26</td>
<td>28</td>
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<td>42</td>
<td>44</td>
<td>46</td>
<td>48</td>
<td>50</td>
</tr>
<tr>
<td>Stools</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
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<td>16</td>
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<td>19</td>
</tr>
<tr>
<td>Urine</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

---

### Case 2

**Records of Temperature, Pulse, Respiration, Stools and Urine, from 23rd Day of January 1895**

**In the case of M. A.**  
**Female.**  
**Aged 6.**  
**Occupation**

<table>
<thead>
<tr>
<th>Day of Month</th>
<th>23</th>
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### Case 3

**Records of Temperature, Pulse, Respiration, Stools and Urine, from 1st Day of January 1895**

**In the case of E. A.**  
**Female.**  
**Aged 9.**  
**Occupation**

<table>
<thead>
<tr>
<th>Day of Month</th>
<th>1</th>
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<tbody>
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Records of Temperature, Pulse, Respiration, Stools and Urine, from Day of 18th Day of Month.

<table>
<thead>
<tr>
<th>Day of Month</th>
<th>1</th>
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<table>
<thead>
<tr>
<th>Time</th>
<th>Temperature (°F)</th>
<th>Pulse</th>
<th>Respiration</th>
<th>Stools</th>
<th>Urine</th>
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<tbody>
<tr>
<td>8 AM</td>
<td>96</td>
<td>90</td>
<td>86</td>
<td>82</td>
<td>78</td>
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<tr>
<td>12 PM</td>
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<td>92</td>
<td>88</td>
<td>84</td>
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YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.

Records of Temperature, Pulse, Respiration, Stools and Urine, from Day of 18th Day of Month.

<table>
<thead>
<tr>
<th>Day of Month</th>
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<th>11</th>
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<tbody>
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<table>
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<tr>
<th>Time</th>
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<th>Pulse</th>
<th>Respiration</th>
<th>Stools</th>
<th>Urine</th>
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<tbody>
<tr>
<td>8 AM</td>
<td>96</td>
<td>90</td>
<td>86</td>
<td>82</td>
<td>78</td>
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<tr>
<td>12 PM</td>
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<td>92</td>
<td>88</td>
<td>84</td>
</tr>
</tbody>
</table>

YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.

Records of Temperature, Pulse, Respiration, Stools and Urine, from Day of 18th Day of Month.

<table>
<thead>
<tr>
<th>Day of Month</th>
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<th>2</th>
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<tbody>
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<td>Day of Disease</td>
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<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
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</tbody>
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<table>
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<th>Time</th>
<th>Temperature (°F)</th>
<th>Pulse</th>
<th>Respiration</th>
<th>Stools</th>
<th>Urine</th>
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<tbody>
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<td>8 AM</td>
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<td>90</td>
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<td>82</td>
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<td>92</td>
<td>88</td>
<td>84</td>
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YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.
Records of Temperature, Pulse, Respiration, Stools and Urine, from 9th Day of March 1898

In the case of M. A. E. Aged 22. Occupation  

Day of Month: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Day of Disease:  0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Pulse, Resp., Stools, Urine.

YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.
Records of Temperature, Pulse, Respiration, Stools and Urine, from Day of September 1894
In the case of No. 3, Female, Aged 4, Occupation

<table>
<thead>
<tr>
<th>Day of Month</th>
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<th>10</th>
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<tbody>
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<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
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<td>38.8°C</td>
<td>38.7°C</td>
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<tr>
<td>Pulse</td>
<td>100</td>
<td>101</td>
<td>102</td>
<td>103</td>
<td>104</td>
<td>105</td>
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<tr>
<td>Resp.</td>
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<td>26</td>
<td>26</td>
<td>26</td>
<td>26</td>
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<td>Stools</td>
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<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Urine</td>
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<td>Normal</td>
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Died.

YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.
### Records of Temperature, Pulse, Respiration, Stools and Urine, from 1894 Day of November

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<th>Central Temperature</th>
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<td></td>
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<tr>
<td>22</td>
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<td>36.0° F</td>
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<td>23</td>
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<td>35.5° F</td>
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<td>24</td>
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<td>35.0° F</td>
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<td></td>
<td>32.5° F</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>32.0° F</td>
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</tbody>
</table>

#### Pulse

- Day 19: 80
- Day 20: 90
- Day 21: 100
- Day 22: 110
- Day 23: 120

#### Pulse

- Day 19: 60
- Day 20: 50
- Day 21: 40
- Day 22: 30
- Day 23: 20

#### Stools

- Day 19: Normal
- Day 20: Normal
- Day 21: Diarrhea
- Day 22: Constipation
- Day 23: Normal

#### Urine

- Day 19: Normal
- Day 20: Normal
- Day 21: Cloudy
- Day 22: Normal
- Day 23: Normal
Records of Temperature, Pulse, Respiration, Stools and Urine, from 14th Day of October 1894

In the case of C. S. Female. Aged 71. Occupation

Day of Month: | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31
Day of Disease: | | | | | | | | | | | | | | | | | | | |

Temperature: 38.9° - 39.2°
Pulse: 100 - 120
Resp.: 18 - 22
Stools: 2 - 4
Urine: 

 Died.

Young J. Pentland, Publisher, Edinburgh & London.

Records of Temperature, Pulse, Respiration, Stools and Urine, from 1st Day of November 1894

In the case of A. M. Female. Aged 21. Occupation

Day of Month: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31
Day of Disease: | | | | | | | | | | | | | | | | | | | |

Temperature: 36.8° - 37.2°
Pulse: 60 - 70
Resp.: 12 - 16
Stools: 2 - 3
Urine: 

 Died.

Young J. Pentland, Publisher, Edinburgh & London.

Records of Temperature, Pulse, Respiration, Stools and Urine, from 21st Day of December 1894

In the case of J. R. Female. Aged 41. Occupation

Day of Month: | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31
Day of Disease: | | | | | | | | | | | |

Temperature: 38.9° - 39.2°
Pulse: 100 - 120
Resp.: 18 - 22
Stools: 2 - 4
Urine: 

 Died.

Young J. Pentland, Publisher, Edinburgh & London.
### Records of Temperature, Pulse, Respiration, Stools and Urine, from 9th Day of November 1894

In the case of J. M.

<table>
<thead>
<tr>
<th>Day of Month</th>
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<tbody>
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### Records of Temperature, Pulse, Respiration, Stools and Urine, from 24th Day of December 1894

In the case of J. B.

<table>
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<tbody>
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### Records of Temperature, Pulse, Respiration, Stools and Urine, from 25th Day of December 1894

In the case of J. B.

<table>
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<tbody>
<tr>
<td>Day of Disease</td>
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</tbody>
</table>
Records of Temperature, Pulse, Respiration, Stools and Urine, from 6th Day of January 1896.

In the case of J.R. Male. Aged 35. Occupation.

Day of Month: 6
Day of Disease: 5

Temperature:

- 37.5°C
- 37.2°C
- 36.9°C
- 36.7°C
- 36.5°C
- 36.3°C
- 36.1°C
- 35.9°C
- 35.7°C
- 35.5°C
- 35.3°C
- 35.1°C
- 34.9°C
- 34.7°C
- 34.5°C
- 34.3°C
- 34.1°C
- 33.9°C
- 33.7°C
- 33.5°C
- 33.3°C
- 33.1°C
- 32.9°C
- 32.7°C
- 32.5°C
- 32.3°C
- 32.1°C
- 31.9°C
- 31.7°C
- 31.5°C
- 31.3°C
- 31.1°C
- 30.9°C
- 30.7°C
- 30.5°C
- 30.3°C
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- 28.9°C
- 28.7°C
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- 27.3°C
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- 26.7°C
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- 25.9°C
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- 24.3°C
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- 23.3°C
- 23.1°C
- 22.9°C
- 22.7°C
- 22.5°C
- 22.3°C
- 22.1°C
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- 21.3°C
- 21.1°C
- 20.9°C
- 20.7°C
- 20.5°C
- 20.3°C
- 20.1°C
- 19.9°C
- 19.7°C
- 19.5°C
- 19.3°C
- 19.1°C
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- 18.7°C
- 18.5°C
- 18.3°C
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- 10.9°C
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- 10.3°C
- 10.1°C
- 9.9°C
- 9.7°C
- 9.5°C
- 9.3°C
- 9.1°C
- 8.9°C
- 8.7°C
- 8.5°C
- 8.3°C
- 8.1°C
- 7.9°C
- 7.7°C
- 7.5°C
- 7.3°C
- 7.1°C
- 6.9°C
- 6.7°C
- 6.5°C
- 6.3°C
- 6.1°C
- 5.9°C
- 5.7°C
- 5.5°C
- 5.3°C
- 5.1°C
- 4.9°C
- 4.7°C
- 4.5°C
- 4.3°C
- 4.1°C
- 3.9°C
- 3.7°C
- 3.5°C
- 3.3°C
- 3.1°C
- 2.9°C
- 2.7°C
- 2.5°C
- 2.3°C
- 2.1°C
- 1.9°C
- 1.7°C
- 1.5°C
- 1.3°C
- 1.1°C
- 0.9°C
- 0.7°C
- 0.5°C
- 0.3°C
- 0.1°C

Pulse:

- 110
- 120
- 130
- 140
- 150
- 160
- 170
- 180
- 190
- 200

Resp.:

- 22
- 24
- 26
- 28
- 30
- 32
- 34
- 36
- 38
- 40

Stools:

- 4
- 6
- 8
- 10

Urine:

- 1
- 2
- 3
- 4

YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.
### Tafal Case No. 16.

Records of Temperature, Pulse, Respiration, Stools and Urine, from 16th Day of February 1895

<table>
<thead>
<tr>
<th>Day of Month</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
<th>21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day of Disease</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temperature</th>
<th>37.0</th>
<th>36.5</th>
<th>36.0</th>
<th>35.5</th>
<th>35.0</th>
<th>34.5</th>
<th>34.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse</td>
<td>120</td>
<td>110</td>
<td>100</td>
<td>90</td>
<td>80</td>
<td>70</td>
<td>60</td>
</tr>
<tr>
<td>Resp.</td>
<td>24</td>
<td>22</td>
<td>20</td>
<td>18</td>
<td>16</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>Stools</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Urine</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.

### Tafal Case No. 17.

Records of Temperature, Pulse, Respiration, Stools and Urine, from 1st Day of March 1896

<table>
<thead>
<tr>
<th>Day of Month</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day of Disease</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
<td>26</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Temperature</th>
<th>36.0</th>
<th>35.5</th>
<th>35.0</th>
<th>34.5</th>
<th>34.0</th>
<th>33.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse</td>
<td>120</td>
<td>110</td>
<td>100</td>
<td>90</td>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>Resp.</td>
<td>24</td>
<td>22</td>
<td>20</td>
<td>18</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>Stools</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Urine</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
</tbody>
</table>

Died 3.35 p.m.

YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.

### Tafal Case No. 18.

Records of Temperature, Pulse, Respiration, Stools and Urine, from 3rd Day of March 1896

<table>
<thead>
<tr>
<th>Day of Month</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day of Disease</td>
<td>27</td>
<td>28</td>
<td>29</td>
<td>30</td>
<td>31</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temperature</th>
<th>37.0</th>
<th>36.5</th>
<th>36.0</th>
<th>35.5</th>
<th>35.0</th>
<th>34.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse</td>
<td>120</td>
<td>110</td>
<td>100</td>
<td>90</td>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>Resp.</td>
<td>24</td>
<td>22</td>
<td>20</td>
<td>18</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>Stools</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Urine</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Died 3.30 a.m.

YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.
Microphotograph of Film Preparation directly from a portion of membrane from case 22. Showing the presence of the Klebs Loeffler bacillus (x 1000 diam.)

Microphotograph of a cover glass preparation of a 1st. day culture of Klebs Loeffler bacillus from case 30. (x 1000 diam).
Microphotograph of a cover glass preparation on the second day of culture showing the inoculated forms of Klebs Loeffler bacillus (x 1000 diam.)

Microphotograph of a cover glass preparation on the fifth day of culture showing still more advanced forms of involution (x 1000 diam)
Microphotograph of a third day culture of **Klebs Loeffler Bacillus** showing the granular appearance. *(x 1000 diam.)*

Microphotograph of a fourth day culture of **Klebs Loeffler bacillus** showing still further involution. *(x 1000 diam.)*
Microphotographs of Klebs Loeffler bacillus. (x 1000 diam.)

Microphotograph of a cover glass preparation on the 6th. day of culture showing advanced involution. (x 1000 diam)

Microphotograph of a cover glass preparation of first day culture of a streptococcus. (x 1000 diam)
Photograph of a Cast of Trachea and bronchi expectorated forty hours after first injection of Antitoxin. (exact size), see case 1 of the recoveries.

Photograph of a cast of the Trachea showing fenestra expectorated 7½ hours after first injection of Antitoxin. (exact size), see case 3 of the recoveries.
Photograph of expectorated membrane 19 hours after first injection of Antitoxin, see case 2 of the fatal cases.

Photograph of expectorated membrane after Antitoxin, showing extensive ramifications (half size)
Fatal Case No. 2.
Fatal Case No. 5.
Yalal Case No. 1.
Fatal Case No. 9
Fatal Case No. 15.
Fatal Case No. 16.
Fatal Case No. 17.
Fatal Case No. 18.
The following four photographs of cases of diphtheria which died before the Antitoxin treatment was commenced.
Fatal Case No. 1
A photograph of a vertical section of a trachea, larynx and oesophagus, showing the diphtheritic membrane in situ.
Microphotograph of diphtheritic membrane showing the lumen formed by the membrane. (x 50 diam.)

Microphotograph of diphtheritic membrane stained by Gram's method showing small dots of Loeffler's bacilli towards the surface. (x 360 diam.)
Photograph of the syringe used for injecting the antitoxin, it is easily sterilized and can hold a large quantity.
I. A handy tracheal tube introducer.

II. Parker’s angular tracheotomy tube with moveable collar.

III. A useful pair of forceps for removing membrane from the trachea, through the tracheotomy wound.