THE THERAPEUTIC VALUE
OF
FORMIC ACID
IN
DIPHTHERIA
IN
(I.) CARDIAC FAILURE
(II.) PARALYSIS.
(III.) ALBUMINURIA.

IN THREE PARTS.
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INTRODUCTION.

If, by the term Diphtheria, the derivation 

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were to be strictly adhered to, the diagnosis of the condition and its treatment would be simple, and the results relatively bad. The local condition and its treatment is, indeed, that part of the disease which, at the present time, gives rise to least anxiety and from which the death-rate is, in comparison, relatively low.

To Trousseau indeed, we owe much, who, first, gave to the term Diphtheria the meaning which we now attach to it, namely, a general constitutional affection and one causing death, not only mechanically, but by a general systemic toxaemia.

While the local condition—thanks to antitoxine serum and the gradual perfection of Intubation and Tracheotomy—is not now regarded so gravely, far otherwise is it with the general condition—the result of the toxiine.

Although the introduction of the serum treatment has been followed by results little short of extraordinary, the death-rate directly due to toxic absorption and the other minor results from the same cause, namely, degeneration of muscle and nerve causing paralysis or the toxic effects, as seen on the kidney with its consequent production of albuminuria, have by no means diminished in a corresponding degree.
Such is the truth of the above statement, namely, so low is the death-rate directly traceable to obstruction, that it would seem that, except for the introduction of a more powerful and more readily absorbed antitoxin serum, little more can be done in attacking that particular complication of the disease.

If the "obstruction treatment" appears perfect or nearly so, the Therapeutics at our command - apart from the administration of antitoxin serum - for dealing with the toxaemia must so far seem inadequate.

It would appear that, broadly speaking, a sufficiently powerful dose of antitoxine administered at a time so early in the course of the disease that the toxines are annulled before they can devitalise and cause degeneration in the tissues, is perfect treatment. Such probably is the case, but, so different is the resistant power in each individual that the correct antitoxic guage is as yet indefinable and hence methods have yet to be perfected to aid the antitoxine by increasing otherwise the resistant power of the individual.

To do so has been the object of the present investigation.
By the term Diphtheria used in the diagnosis of the following recorded cases the definition accepted by Northup has been strictly adhered to, namely: "an infectious and communicable disease characterised by the production of false membrane on a mucous or abraded skin surface and due to the presence and proliferation of the Klebo-Löffler bacillus and the toxines elaborated in its growth. The importance of the latter part of the definition, namely, the bacteriological diagnosis, has been emphasised as much as the former or clinical.

So much so is this the case that cases of purely clinical diphtheria have not been included in the following statistics, so that in every case the diagnosis of diphtheria made clinically has been supplemented and proved by the usual bacteriological investigation.

Inversely, no cases have been considered which gave a positive bacteriological result without any clinical phenomena; and again, therefore, every observation may be regarded as clinically and bacteriologically positive.
The pathological study of the Heart in Diphtheria is of comparatively recent date, namely, 1870, but, from the first carefully recorded report - that of Hagen (Archive de Physiologie 1870) - until the present time, the one constant feature is that of Fatty Degeneration of the Myocardium.

The degeneration appears in the form of fine granules or in large globules involving the greater part of the muscle cell (Northup).

It appears to be found as the first sign of change in structure of the muscle and to be an accompaniment of the later destruction in more advanced cases.

Northup also notes that simple fatty degeneration is invariably found in the severe cases of short duration, and the more destructive and degenerative changes in the prolonged cases, where there is complete breaking down of the sarcoptic elements and destruction of the muscle substance.

In the later stages also, there is a marked proliferation of cellular elements in the tissues.
which, however, rarely leads to fibrous change.

An important point bearing on the aetiology of the condition has been noted by Schamschin (Ziegler's Beiträge 1895) who states that, no matter how early in the disease, one of the first features is fatty degeneration in the walls of the small blood vessels of the Heart.

Baginsky (Diphtheria and Diphtheritic Group 1898) sums up the main changes (i) Fatty Degeneration of the muscle elements, (ii) Fragmentation of the nuclei, and (iii) Haemorrhages from the small diseased blood vessels.

Experimentally, Mollet and Regaud (Annales de l'Institute Pasteur 1897) have summarised the following changes:

(a) In the muscle fibre: granular and fatty changes with occasional vacuolisation; striation often lost.

(b) In the nuclei: nuclei distorted, swollen and stain with difficulty.

(c) in the interstitial tissues: Increase of the cellular elements between the fibres.

Macroscopically there is little to note save dilatation - especially of the right side of the heart - slight paleness of the muscle: the pericardium is as a rule healthy.
It is as yet undetermined if the microscopic changes noted above are primary, namely, due to the direct action of the toxine on the muscle, or secondary, due to lack of stimulation from an already toxic nervous system.

In support of the latter theory is the fact that Lentino found similar lesions after unilateral division of the Vagus nerve.

Against this, again, is the fact of the early degeneration of the walls of the small vessels of the Heart (Schamschin) which would equally lead to impaired nutrition and fatty degeneration of the muscle supplied.

Bolton (Lancet 1906) advances the following theory: In the acute stage of diphtheritic toxaeemia, acute degenerative changes occur in certain cells of the central nervous system, and amongst these cells the nucleus of the Vagus nerve is affected and, therefore, extensive fatty degeneration occurs in the muscular fibres of the Heart. It is thus, he says, that acute diphtheritic poisoning proves fatal, the patient dying from a primary progressive failure of the heart as the result of acute degenerative changes in the neuro-muscular mechanism of that organ. At a later stage of the disease, if the patient survives, the poison attacks the
peripheral nerves and voluntary muscles; a primary parenchymatous degeneration occurs in the nerves and a fatty degeneration of the muscle.

One other view has been advanced by Hesse, (Jahrb. F. Kinderheilk. 1894) a somewhat vague one, namely, that the changes and consequent heart failure result from the effects of the poison upon the Heart but not as a result directly either of the muscle or of the nerve degeneration.

To summarise; the various theories appear to be:

(i) Primary Degeneration of Muscle - Schamschin
(ii) " " " Nerve - Vincent -
(iii) A combination of both according to the stage of the disease - Bolton.
(iv) Toxaemia of Heart directly traceable to neither - Hesse.

It would appear that Bolton's theory - an idea shared by many other authorities - has much weight, and that the fact that death from Heart Failure may be accurately classified into at least 4 classes, viz., (a) Early, (b) Late, (c) Progressive (x) Sudden, much strengthens this view.

Whatever the true cause or causes may be, the liability to Cardiac Failure is much increased by the increased coagulability of the Blood in Diphtheria, due to reduced blood pressure and weakened
action of the Heart. With this additional liability to the formation of Thrombi the danger is much increased, but can hardly as Jacobi suggests (Med. News 1898) be regarded as a cause but rather as a result.

Nervous System.

Although the pathological features of the Nervous system vary, in minor points, with each individual case; in the main they are very constant and may be summarised as follows:

(i) Cord.

Here, according to Rainy (Journ. of Path. and Bact., 1900), the changes are mostly cellular. There is marked chromatolysis and vacuolation of cell protoplasm.

In the gray matter of the anterior cornu Nissl's bodies are markedly disintegrated and generally many cells are found shrunken.

Bickele and Kalishs in 1894 described also a degeneration of the posterior roots where they enter the gray matter of the posterior cornu.

(ii) Brain.

Here the changes are generally circulatory, namely, hyperaemia, infiltration or haemorrhagic.

(iii) Peripheral Nerves.

Thomas (Boston Med. and S. Journ. 1898)
describes marked parenchymatous degeneration of the peripheral nerves, hyperaemia and haemorrhages, also fatty degeneration of the nerve fibres of the peripheral nerves.

(iv) Cardiac Plexus.

Vincent (Archive de Med. Exper., 1894) has described a parenchymatous and atrophic neuritis. Degeneration of the Myelin sheath, changes in the Axis cylinder and marked absence of multiplication of the nucleus were always present which as Northup points out, show a degeneration, and not changes due to an irritant.

Kidneys.

By far the most common changes found in the kidneys are those of degeneration. The epithelial cells are enlarged and irregular and in advanced cases are completely destroyed and desquamated. The degeneration is not fatty, although a slight degree of fatty degeneration is generally present, but according to Northup, some degree of hyaline degeneration is invariably present.

He also states that lesions of the kidneys of greater or less extent are found in practically all cases of fatal diphtheria.

In most cases the amount of albumen corresponds
to the degree of degeneration present.

Welch and Flexner (John Hopkins Bulletin, 1892) state that, experimentally, the epithelium of the tubules is rendered very granular and much swollen but not fatty. They also report a slight fragmentation of the nuclei in the epithelium of the tubules. Acute interstitial changes appear generally in conjunction with complications of the disease and are accompanied by marked increase in size of the kidney. Here the changes are most marked at the base of the cortex just beneath the capsule and around the glomeruli, and degeneration of the epithelium to a varying degree is always present.

The glomerular changes are of a chronic type and probably to be referred to an acute antecedent attack of endocarditis (Northup).

CAUSE OF ALBUMEN.

The exact cause of albumen in Diphtheria is as yet uncertain.

Rolleston (Practitioner 1905) has shown that the quantity of albumen varies with the severity of the case.

As the amount of degeneration varies with the severity of the case, and in the same proportion, it is reasonable to suppose that there is a distinct analogy.
That the degeneration is produced by the direct action of the toxine of the Klebs-Löffler bacillus, although the most likely hypothesis, is by no means certain for the septic and anginous cases - produced by other organisms, Streptococci, etc. - are those in which it is found in largest amount.

That it is due to the presence of antitoxine has been practically disproved by Variot (La Diphtherie et la Sérumthérapie) who has also shown that the presence of Chronic Bright's disease is no contra-indication for antitoxine.

The balance of evidence then appears to prove that the presence of albumin in the urine is an indication of the severity of the toxine of Diphtheria or the presence in large numbers of accompanying organisms. Its almost invariable presence in fatal cases would also seem to show that the resistant power of the individual is an important factor.

The relationship of albumen to paralysis has been discussed since the times of Trousseau - who, in one case noted an increase of albumen coincident with the onset of paralysis - but Trevelyan (Lancet 1900) appears to state the matter clearly when he says that diphtheritic albuminuria has no other relationship to diphtheritic paralysis than that both complications are more prone to occur, where the diphtheritic intoxication is most intense.
CARDIAC FAILURE.

Whatever the exact cause of cardiac failure in each individual case, viz., myocardial, neural or a combination of both, the condition is an easy one to recognise.

The main features are:

Vomiting, which, as a rule, is irrespective of food. It may be a simple regurgitation or accompanied by retching.

Blueness of the skin and mucous membranes and, towards the last stage, coldness of the extremities.

These symptoms are, as a rule, accompanied by obvious signs of weakening of the heart, such as: dilatation, irregular and intermittent pulse, 1st sound faint, short, with perhaps a systolic murmur or reduplicated at the Mitral area. There may be bradycardia or a galloping rhythmic contraction; the latter, as a rule, only when the patient is in extremis.

The patient frequently complains of praecordial pain which may be very severe and may be referred, generally, to the abdomen.

As a rule, the patient lies absolutely quiet but may, towards the end, be very restless and excitable.

The temperature may be at first slightly
elevated but quickly becomes subnormal.

The patient dies on an average from 3-5 days after the first appearance is noted.

Such a type as the above is the progressive type but in other cases - usually late in the disease - the patient may die suddenly without warning.

Myers (Lancet 1900) gives the seventh day as the average number of days after the beginning of an attack of diphtheria that the symptoms and signs of cardiac paralysis are noted. He also gives the 2nd and 35th days as the two extremes.

Although so profoundly toxaemic the mental faculties of such patients are, as a rule, quite unimpaired to the end, and with this fact and symptoms and signs such as are noted above, a diagnosis is obvious and a clear division can be made between the two types, namely, progressive and sudden. The earlier symptoms of cardiac failure occur, as a rule, when the patient is and has been absolutely quiet, and are no doubt caused by the intensity of the toxaemia causing an acute degeneration. The later ones, however, frequently result from a strain - as when at stool - and this fact would appear to show that the degeneration has been present and in the myocardium, and, that the weakened muscle has been unable to respond to the additional call made on it and that the cause is not a secondary or late degeneration.
PARALYSIS.

Although in discussing the pathological changes in the nervous system it was stated that the lesions were, as a rule, constant, it by no means follows that each case of paralysis presents all features. From this fact and from the fact that some present no nervous features but muscular changes only, the aetiology of paralysis is rendered somewhat difficult.

The great varieties of paralysis and the different lesions found, all tend to render the cause obscure.

Manicatide in 1896, for instance, reports the examination of a series of paralyses which may be divided into at least 4 groups:

(i) Where the lesions were purely muscular with no nerve complications.

(ii) Cases of polyneuritis.

(iii) Lesions of the spinal cord which were either localised in the gray substance leading to atrophy of the muscle or involved the white matter of the cord in a manner such as is found in locomotor ataxy.

(iv) Central paralysis, chiefly resulting from changes in the circulation.
Although the ataxic symptoms often seen in diphtheritic paralysis would seem to point clearly to destruction of the muscular sense, it is mostly of a reeling or cerebellar character and the most likely hypothesis would seem to be that a degeneration has spread to the muscles of the trunk and started elsewhere.

Although conflicting, the evidence in all would seem to be, that while many cases of paralysis are due to muscular degeneration and in this class the benign or localised forms have their place, most are due to a primary central disturbance - for the central lesions are not strictly speaking degenerative - followed by a Wallerian degeneration and failure of the peripheral nerves.

The paralyses may be classified as follows:
(i) Localised or Benign Paralysis.
(ii) General Paralysis.
(iii) Cardio-pulmonary - which has been considered.

In the first group may be placed paralyses of palate and pharynx. This is much the most common variety and Myers and others have stated it to represent from 35%-40% of the total varieties of paralyses.

The second series includes the remaining forms of paralyses, viz., oculo-motor, extremities,
intercostals, etc.

As regards the frequency of paralyses: on an average taken from a large number of statistics it may be stated at 12%-14%, thus; the Metropolitan Asylums Board out of 8,238 cases gave 18.50% of paralyses, Sanné reports in 2,400 cases 11%.

Woolacott gives an interesting table divided into Cases Serious and Moderate,

<table>
<thead>
<tr>
<th>Nature of Case</th>
<th>Total</th>
<th>Paralysis</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serious</td>
<td>223</td>
<td>64</td>
<td>28.6</td>
</tr>
<tr>
<td>Moderate</td>
<td>536</td>
<td>75</td>
<td>13.2</td>
</tr>
</tbody>
</table>

and this would seem to prove conclusively that the paralyses is dependent on the amount of toxine.

METHODS CLINICAL AND BACTERIOLOGICAL ADOPTED.

The methods adopted in arriving at a correct diagnosis of the condition in the following recorded cases were as follows:

(i) Clinical.

Each patient was examined with lamp and spatula for, either signs of definite membrane or signs of the implantation of recent membrane.

Again, symptoms were carefully considered, namely, either the characteristic toxæmic appearance or the equally diagnostic odour, although these
symptoms were considered as merely confirmatory and on them alone no diagnosis was made.

Diagnostic importance was, in the case of suspected Nasal Diphtheria, especially attached to such symptoms as the foregoing in conjunction with a nasal discharge. The only possible exception was in the Laryngeal case where even in the absence of apparent membrane, symptoms plus croup were considered sufficient to warrant a diagnosis.

No cases apart from such as these are included in the following series and none without the accompaniment of a positive.

(ii) **Bacteriological Examination.**

A swab was at once taken from the throat or nose and stained for 3 minutes with Löffler's Methylene Blue solution and examined for rods and cocci.

At the same time a culture on Blood Serum was made and left for 16 hours at a temperature of 34°C-35°C. At the end of that time it was stained with a variation of Neisser's Stain, namely, Acetic Acid, Methylene Blue and Piero-Eythrocine solution, half a minute each.

None of the recorded cases have failed to show rods in the swab and polar staining or clumping of the Bacilli in the Culture, and both swab and culture may therefore be said to have been positive.
SKETCH OF PREVIOUS TREATMENT.

In the history of the earlier treatment of diphtheria the importance given to local at the expense of general treatment is, perhaps, the most noteworthy fact.

Until the 16th century no means were considered too harsh, thus, burning, scarification and forcible removal with pincers were the invariable rule.

In the 16th century authors on the subject began to reprobate these harsher methods, but, in lieu of better, were forced in a large number of cases to continue.

In the beginning of the 18th century, the use of drugs which destroyed the membrane by their caustic action began to be much favoured, such as Nitrate of Silver, etc.

Bretonneau (the first to clearly differentiate Diphtheria) in 1827, advocated strongly the use of alum and later, Uytterhoeven, Acetic Acid. Martin, 1858, speaks well of Hydrochloric Acid and Jenner supported this but recommended only one prolonged application. Up to this time the internal treatment was confined to stimulation by alcohol, when required, and aperients.

In 1861, Rey recommended the use of Perchloride on both locally and internally, and this was for
long widely adopted.

Mercury was much used from 1880-1890 as a disinfectant either as calomel or biniode of Mercury in the shape of fumigations and internally. The general treatment consisted in alcohol and latterly strychnine.

The treatment of Diphtheria was, however, revolutionised in 1893 by Behring with Antitoxin Serum and resolved from that time until the present into treatment by serum, stimulants, as whisky, strychnine, strophanthus, digitalis and an antiseptic local treatment of the condition.

As showing more fully the treatment adopted during the past 3 years, the following detailed account has been given of the accompanying 300 control cases.

PREVIOUS TREATMENT 1904-1905 IN HOSPITAL.

- TREATMENT OF ACCOMPANYING CONTROL CASES -

The main lines of treatment were:

(i) To prevent degenerative changes in the acute stage by rest and adequate doses of antitoxine.

(ii) To prevent strain and consequent heart failure in the secondary stage by rest.

(iii) By stimulation, to assist the individual to resist the toxine until the toxine was neutralised.
(iv) In Cardiac Failure to obtain rest by preventing vomiting and to stimulate the heart.

(x) UNCOMPLICATED CASES.

(a) FAUCIAL AND NASAL.

I. General Treatment.

(i) Rest.

The patient was kept in the recumbent posture with one low pillow for at least 12 days and complete mental rest was also enjoyed - no reading, etc. If at the end of that time there were no symptoms, viz., pulse irregularity, etc. the patient was given one more pillow. At the end of 3-4 days, conditions again being favourable, the patient was permitted to sit up in bed and was allowed out of bed in blankets about 6 days later.

The patient was kept in Hospital for at least 3 weeks and was not in any case permitted to leave until two consecutive bacteriological examinations had proved negative, and until clinical symptoms had disappeared.

(ii) Stimulants.

From the day of admission the patient was prescribed small doses of Whisky and Liquor Strychninae every four hours in doses varying with the age of the patient and the severity of the case. This
treatment was continued for 10 days when, with no symptoms Syrup Easton was prescribed three

Occasionally for extraneous symptoms, Non, etc. was also given.

II. Local Treatment.

In cases where the membrane was very obvious a throat paint \(\text{Sp. Vin. Rect. : 60 " was applied frequently. It was found very useful both as an antiseptic and of assistance in destroying the membrane.}\\(\text{Tinct. Ferri Perch. 4 "}\) applied frequently. It was found very useful both as an antiseptic and of assistance in destroying the membrane.

This was always accompanied by a swab of Boroglyceride which was continued during residence.

In cases where the fauces were apparently septic and foul-smelling, a spray of peroxide of hydrogen was given for 24-48 hours at varying intervals.

(b) LARYNGEAL CASES WITH CROUP.

On admission the patient was placed in a cot between two steam pipes. A full dose of Vin. - to assist in loosening the membrane was at once given and this was followed by small doses - every 4 hours so long as the patient remained croupy.
Tinct. Belladon. in small doses — every 2 hours until dilatation of the pupils was obtained, was also prescribed, to dilate the passages and act as a stimulant by paralysing the terminations of the Vagus nerve in the Heart and therefore to destroy the inhibitory action of the nerve — this result, viz. acceleration of the Heart, systotic increase, etc., was found to have excellent results.

In addition to these two drugs the patient was given small doses of Whisky and Liquor Strychninae in doses again varying with the age of the patient.

Should operative interference not be necessary, these measures were continued until the croup symptoms disappeared, when treatment on ordinary lines was continued.

(8) COMPLICATED CASES.

(i) Operative Cases.

In cases where the above treatment did not ameliorate the condition, viz., where the dyspnoea, cyanosis and signs of CO2 toxaemia manifested themselves, Intubation was performed and the tube left in position for 2-3 days and not removed until croup symptoms had disappeared. In cases where the tube could not be retained or where it proved unsatisfactory, Trachectomy was performed.
(ii) Cases of Cardiac Failure.

At the first sign of cardiac failure the patient's pillow was removed and he was kept flat in bed or even with the head lowered.

If vomiting had occurred Liquor Strychninae was at once stopped and Brandy alone given while an effort later was made to feed the patient with peptonised milk.

Should there again be a tendency to vomit, the patient was stimulated and fed per rectum and in cases of extreme thirst and with no contra-indications, small quantities of ice were given to suck.

On signs of further cardiac failure, Hypodermic injections of Strychnine or Strophanthine were given, generally in conjunction with Adrenalin Chloride (1:1,000).

In a few cases where the patient became extremely irritable and restless, very small doses of Morphia and Atropine were given.

(iii) Cases of Paralyses.

At the onset of paralyses the patient was kept recumbent and given increased doses of Liquor Strychninae, Massage etc., was adopted and in the case of the spinal muscles the spine was painted with Iodine Tincture and Potassium Iodide.

In the case of the palatal and pharyngeal paralyses, all ordinary precautions were adopted as regards feeding, etc.
ANTI-TOXINE TREATMENT.

As all the accompanying cases (both 100 treated with Formic Acid and the 300 control cases) were given antitoxine doses based on the same broad lines, it may be well to shortly state the views which prompted the doses.

The two main factors under consideration were:

(i) The severity of the disease
   (a) Local Condition
   (b) General Toxaemia.

(ii) The age of the disease.

(a) Faucial uncomplicated cases.

Here the dose given was, in the main, 1,000 units (P. D. & Co.) for each day of the disease, but, in cases with definite membrane, not less than 3,000 units.

If the palate or uvula was involved, the dose was not less than 4,000-5,000.

This was repeated in 12 hours if there was a further spread of membrane.

(b) Nasal Cases.

Here, as, owing to the large lymphatic area affected, the toxaemia is, as a rule, intense, the dose was seldom less than 6,000 units repeated in
24 hours if the toxaemia appeared more intense, up to a total of 24,000-30,000 units.

(c) Laryngeal Cases with Croup.

A dose of, as a rule, not less than 6,000 units in an ordinary case was given on admission and repeated every 8-12 hours until the membrane appeared to loosen.

In early Cardiac Failure, a large dose was occasionally given, repeated if the condition appeared to benefit.

CRITICISM OF PRECEEDING TREATMENT.

Apart from the local treatment, and the large question of antitoxin, the treatment hitherto adopted has, as shown by this resume, been one of stimulation, mainly by strychnine and also digitalis and strophanthus with the occasional use of hypodermic injections of strychnine or strophanthin or adrenaline chloride.

As stimulants, the one feature common to all these drugs is that they achieve their end mainly by raising blood pressure: digitalis does so partly by increasing the cardiac force and mainly by contracting the arterioles by direct action on their muscular coat and again, in a lesser degree, by
stimulation of the medullary and spinal vaso-motor centres. Strophanthus also raises blood pressure although the action on the arterioles is not present as in digitalis. Adrenalin chloride does so almost solely by contraction of peripheral vessels.

Strychnine: raises blood pressure by direct stimulation of the vaso-motor centre, which, as a result, leads to constriction of the peripheral arterioles.

In mammals while the heart is not directly affected by strychnine, stimulation of the inhibitory centre leads to a slightly slower rhythm.

It would seem therefore that, from this point of view, these drugs are not ideal in that they tend to increase the amount of work done by a heart which has a tendency to degeneration.

There are other points also in their action which appear doubtful.

Strychnine. As a nervous stimulant acts mainly on the central nervous system and it has been found that the symptoms of the drug are unaltered when the drug is prevented from reaching the peripheral nerves and muscles.

It has also been shown that almost certainly the motor cells are unaffected and that any changes such as enlargement found in them are due to hyper-activity and not to the direct influence of the drug.
As has been shown, however:

(i) The main changes in the diphtheritic cord are in the motor cells.

(ii) Many of the paralyses in Diphtheria are not central but peripheral or muscular.

It would appear therefore that the therapeutic value of strychnine in such a condition must theoretically, be very limited, for, in addition, it is a known fact that, while small doses of strychnine increase the tone of the muscles - namely render them more tense so that they are prepared for immediate contraction - that this is due to the action on the cord and not on the muscle fibres.

One other doubtful feature in the treatment by strychnine is the reaction and depression which follows its use and which Cushny suggests is due to the hyper-activity of the lower parts lessening the activity of the pain.

In the treatment of a disease in which paralyses is such a marked feature, it would seem that here again there is a contra-indication and that while expecting in severe cases by pushing strychnine to obtain a temporary benefit, the final result would only be exaggerated.

One other negative point in the treatment by drugs such as those mentioned, is that they make no claim to influence the third important complication
of Diphtheria, viz. Albuminuria, and would appear again by raising blood pressure to aggravate the kidney condition.

The following is an account of a drug which would appear more nearly to meet the requirements in Diphtheria:

**FORMIC ACID. H. COO H.**

**History, Chemistry, Properties and Therapeutics.**

It occurs in the concentrated state in the bodies of ants, in the hairs and other parts of certain caterpillars and in stinging nettles. Its stimulant properties have been known for centuries, and Arabs for long have realised this and, before commencing a long and arduous ride, were accustomed to give their horses with their ordinary diet a decoction made from Ants’ eggs, the result being a marked increase for the time in their powers of endurance.

The internal administration of preparations containing Formic Acid has also for centuries figured among household remedies where they were much valued for their tonic and diuretic properties.

It was not, however, until 1903 that serious scientific experiments with it were made and in that
year Clement in a paper read before the Société Nationale de Médecine de Lyons reported a series of interesting experiments which placed it in a new and important light.

**Chemistry.**

It is obtained by heating equal parts of anhydrous glycerin (or mannite) and crystallised oxalic acid in a retort to 75% until carbonic acid is no longer evolved. A fresh portion of oxalic acid is then added and the distillation is continued. This process may be repeated several times.

The distillate finally contains 55% of the acid and is redistilled over anhydrous oxalic acid when a 75% acid is obtained. This is neutralised with sodium Carbonate, the dry sodium salt distilled with anhydrous oxalic acid when a 99% acid is obtained - Lorin -.

The last trace of water is removed by distillation over boric anhydride and the acid is subjected several times to a freezing mixture, the crystals separated from the liquor and then allowed to melt; or the dry lead or copper salt is heated at 130° in a current of dry hydrogen sulphide; in the latter case the product is apt to be contaminated with sulphur products.
In the above process the crystallised oxalic acid decomposes into water, carbonic acid and Formic acid, the last of which combines with the glycerin to form monoformine, which is subsequently decomposed by water into Glycerin and Formic Acid.

The equation is:

\[
C_2H_5(OH)_3 + C_2O_4H_2 = CO_2 + H_2O + C_3H_5(\text{OH})_2
\]

\[
C_3H_5(\text{OH})_2 + H_2O = C_3H_5(\text{OH})_3 + HCOOH
\]

Properties.

The acid solidifies below 0° and exhibits the phenomenon of superfusion. The liquid acid is colourless, transparent and mobile. It has a pungent sour taste and odour, and when concentrated blisters the skin - Lubig -.

Therapeutics.

Formic acid is officially used in the form of a colourless fluid of a concentration of 25%, Sp. Gr. 1060-1063.

In 1903 Clement, in a lengthy paper, stated that he had found Formic Acid to be a powerful stimulant of striped muscle and in its toxic action closely allied to Cola, Coca and Caffeine. He stated also
that the internal administration dispelled any sensations of lassitude as seen in nervous individuals, and that, experiments controlled by dynamometus and ergographs, showed a marked elevation of muscular power within two days of administration. At the same time he noted a marked improvement in muscular capacity manifesting itself in an exhibition of active and rapid movements.

In the same year, Krull-Munich noted marked improvement in Chronic Kidney disease with Albuminuria after the subcutaneous injection of Formic Acid. He injected the preparation in the form of an aqueous solution \((1:1,000 - 1:100,000)\) according to the age of the patient and the stage of the disease in doses of \(\text{ml} - \text{mL}^\text{vi}\). As a result he was able to report \(\text{i}\) Improved nutrition, \(\text{ii}\) Decrease of Albuminuria, and \(\text{iii}\) Diuresis.

These results he obtained as a rule when there existed no advanced cardiac complications.

In 1904 Clement reported the following results:

After the administration of Formic Acid the subject performed 10 periods of work instead of 5 as before administration. In the 10 periods of work he realised with the Mosso Ergograph 479 of the weight of 5 Kgrms. instead of 132. The total work done was 106 kilogrammétres, while, before the administration of Formic Acid the subject was only
able to do 21 kilogrammétres.

The amount of work done then after the administration of Formic Acid was increased almost fivefold.

He found also that the effect on the muscular system was very lasting and persisted for 8-10 days after the administration, and that, under the influence of the drug, the painful sensation of the muscle submitted to the repeated contraction was noticeably diminished.

Another important point was that the muscles so treated recovered their energy very rapidly.

He also in the same year reported two cases of tremor due to muscular atony in which marked improvement followed the administration of Formic Acid, although the disease had existed in both cases for 10 years.

Huchard, one year later, reported the following observations:

I. Patient before administration = 5 Kgrms. = 90
   " one day after " = 9 " = 60
   " two days " = 9 " = 35
   " three " = 9 " = 05
   " four " = 10 " = 70
   " five " = 11 " = 50
II. Patient before administration = 9 " = 900
    " one day after " (grms.i) = 8 " = 75
Patient Two days after administration

\[ (\text{grms. ii}) = 20 \text{ Kgrms. } 625 \]

"Three " " " (grms. iv) = 20 " .975

"Four " " " (grms. iv) = 20 " .200

"Five " " " (grms. iii) = 30 " .650

He also in a large series of experiments proved that the toxicity of Formic Acid was practically nil: thus grms. 60 in a single dose were required to kill a small dog, while a dose of 11 Kilogrammes, intravenously injected into another dog, produced no symptoms other than slight vomiting.

In the same communication Huchard makes important statements on the diuretic action of Formic Acid and the Formates.

He proves, in the first place, conclusively that it is eliminated by the kidneys, thus: he injected into the Jugular vein of a dog 20 c.c. of Aqua Distillata containing in solution grms. 4 of Formate of Soda. After 48 hours there was excreted 453 c.c. corresponding to 2 grms. 22 of the Formate and further series of experiments confirmed these observations.

He also, as did Krull, noted its diuretic action and the rapidity with which it was produced.

In a case of sclerosis of the kidney in which the quantity excreted was 1,000 c.c., he noted that
in 4 days it rose to 2,700 after the absorption of 3 grammes of Formate of Soda.

A further series of experiments were:

<table>
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<tr>
<th>Amount of urine in 24 hours</th>
<th>2,500 c.c.</th>
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</thead>
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<tr>
<td>After grammes 3 of Formate of Soda</td>
<td>3,750 c.c.</td>
</tr>
<tr>
<td>Drug stopped</td>
<td>2,550 c.c.</td>
</tr>
<tr>
<td>After Grammes 3 of Formate of Potash</td>
<td>4,000 c.c.</td>
</tr>
<tr>
<td>3 days after stoppage of Drug</td>
<td>2,400 c.c.</td>
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</tbody>
</table>

He further noted that in every case the quantity of albumen was diminished, and in most cases to a very marked degree. Again, that the acidity of the urine is much diminished and that the urine, at first, is always alkaline.

L. Garrique recorded similar results obtained with Formate of Soda, viz. an increase in the excretion of urine from 20 grms. - 50 grms per day.

The injection of Formic Acid in a concentrated form has been found to raise blood pressure (Garrique, Clement, etc.), but later experiments with the dilute acid have proved that there is no increase of blood pressure either in artero sclérosis or advanced cardiac lesions. The Formates do so to a slight degree, and of them, Formate of Soda is the most pronounced.
SUMMARY OF CONCLUSIONS, PART I.

Pathology.

1. That the main changes observed are degenerative.

2. (a) That degenerative changes occur in the nerve cells as a result of the Diphtheria toxine, and that, while they may recover, they may atrophy and that the nerves, of which they are the trophic centres, undergo Wallerian degeneration and lose their conductivity.
   (b) That degeneration occurs in muscle fibres as a direct result of the toxine.

3. That Cardiac Failure is dependant on both forms or both combined, according as it is Progressive, Sudden, Early, Late.

4. That Paralysis depends on both forms or both forms combined, according as it is Benign or General.

5. That changes in the Kidney in Diphtheria are those of degeneration.

6. That Albuminuria is not caused by antitoxin but is due to toxaemia, and that the amount of albumen is an indication of the severity of the disease and the amount of general toxaemia.
Treatment.

7. That treatment, apart from antitoxine and local treatment, has hitherto depended mainly on the following drugs: Digitalis, Strophanthus, Adrenalin Chloride, and above all, Strychnine.

8. That all these drugs raise blood pressure and therefore, theoretically, add strain to the Heart.

9. That none have any effect on albuminuria and would be expected to increase degenerative changes in the kidney by raising blood pressure.

10. That Strychnine acts mainly on the Central Nervous System.

11. That many forms of paralysis are not central.

12. That Strychnine does not affect Motor Cells.

13. That it is the Motor Cells which are affected in Diphtheria when the Central Nervous System is affected.

14. That treatment by Strychnine is followed by reaction and depression and cannot with safety be pushed.
Formic Acid.

15. That Formic Acid \( \frac{2}{3} \) does not raise Blood Pressure.

16. That Formic Acid is a powerful stimulant of all striped muscle and gives a marked increased capacity for work.

17. That Formic Acid improves the appetite and general nutrition.

18. That Formic Acid is a diuretic with an influence in reducing albuminuria.

19. That its stimulant effect on the muscular system is lasting.

20. That so far as is known it is not toxic.

21. That in its action it is allied to Caffeine or Coca.

Diagnosis of Recorded Cases.

22. That from the fact that only those cases have been recorded which were positive both clinically and bacteriologically, the following cases are those of True Diphtheria.
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Part II.

details of
100 Cases

on
Ferrie Acid.

The accompanying cases were under
my observation as House Physician
at the Edinburgh M'Ferran Hospital.
Index of Cases.

Deaths from Cardiac Failure:

No. 53, 61.

Paralyses:

No. 59, 73, 85.

Albumen:

No. 2, 3, 17, 42, 47, 57, 59, 85, 90, 99.

Cases complicated with measles:

No. 21, 29, 43, 59, 73.

Cases complicated with Smallpox:

No. 89, 47, 48.

Cases with symptoms of impending Cardiac Failure:

No. 10, 19, 39, 43, 57, 59, 76, 81, 89.

with Explanatory Chart.
The chart has stopped at week 1 when complications followed. After this, they have been continued.
Albumen is shown as negative or present in red with in "urine" thus: o:

The red line above pulse rate has reference to the duration of membrane.
The sign + after Result at the top of the chart has reference to the result of the culture.
Local treatment is in red with: General treatment in black with.
Antitoxine is prescribed as noted above chart.
3000 A.D.S. P.D. % C. St. x No. 5 7.11.05. This is full is: 3000 unit. Antitoxin diphtherium Park Davis 10.
Standard x No 5. 7.11.05.
Case I.

**Description of Case.**

Post tonsils enlarged. Right tonsil almost completely covered with thick, tough white membrane. Palate also lightly involved. Left tonsils covered at base only with similar membrane.

**Swab:** A few protozoa seen on smear. No streptococci. Many bacilli seen.

**Pus:** Numerous. Cont. 

**History:**

Made an uneventful recovery.
Case II.

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<th>Day of Dis.</th>
<th>Result</th>
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<td>10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30</td>
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</tbody>
</table>

Description of Case:

Both tonsils congested and enlarged. Right tonsil completely covered with white, tenacious, thick membrane. Left tonsil and at base. Pulse very soft but regular. Heart = Mekalena. A soft blowing systolic murmur with occasional reduplication of 1st sound.

Swab = Good. Short nodes. Positive culture.

Cured gradually improved. Heart and bowels.

Admitted on Jan. 28th. Left the hospital in good health.
Description of Case.

Fauces congested. Tonsils much enlarged. Post completely covered with gauzy white thick membrane which is slightly loose on right tonsil. Palate involved above right tonsil. Throat completely covered with similar membrane. Voice is slightly husky. Pulse very soft & irregular. Dr. any pale & tachycardic.


After: Some good chills. Cools & Discoloration.

Culture: Throat and Nose = Negative Contagia.

History:

Within 48 hours patient showed marked improvement and left hospital in good health.
Description of Case.

Light enlargement & congestion of tonsils. There is a patch of dark gray membrane at base of right tonsil, and a smaller patch at the base of the left tonsil. Patient is very listless but soberly. Swallow = Very good, chal ters & salary stained. Coals

A few exci.

Culture = Negative Positive

Jan. 26 Well marked discharge from both nostrils

Culture = Negative Positive

Feb. 5th Antitoxin given - convulsiens, slight adenitis. Left hospital in good health.
**Description of Case.**

Painful tonsils, especially left enlarged. Left tonsil completely covered with very thick greyish-white membrane. Smaller patch just anterior to left tonsil ro other right tonsil. Urine free. Pulse irregular. Slightly diuretic. Patient very pale.

**Signs:**
- Mild rash.
- Some very good cough.

**Cocci:**
- *Staphylococci* and *Bifidoscerei*.

**Feutures:** Neisseri Positiae.

**History:**
- Patient subsequently made uneventful recovery.
Description of Case.

Slight congestion of Fauces. Left tonsil is a little enlarged and covered anteriorly with a fibrinous white-gray membrane. Ulcers and right tonsil free. Pulse is slightly accelerated but regular.

Swabs: A few good about tonsils. Diplococci and Staphylococci.

Culture = Neisseria Contagiosa.

History:

Patient made an unimpaired but recovery.
**Case VII.**

**Description of Case.**

Fever, slightly congested. Left tonsil is enlarged and covered with diverse patches of grayish-white stuck membrane. Pulse is low tension but regular. Color is good.

**Enuris:** Good short stool. Some long. Skin rough, blotchy, freckled.

**Pustules:** Milder posterior.

**Nose:**

- Feb. 7th. Antibiotic rash - morbilliform on face & extremities.
- Feb. 13th. Well softened made good recovery.
Case VIII

Name: L.H.

Days of Incubation: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19

Temperatures:

- 106°
- 105°
- 104°
- 103°
- 102°
- 101°
- 100°

Pulse:

- 135
- 130
- 125
- 120
- 115
- 110
- 105

Respirations:

- 30
- 25
- 20
- 15
- 10
- 5

Description of Case:

Marked enlargement of tonsils. Post are covered at base with thick gray tenacious membrane and extended anteriorly with similar disintegrated membrane. Uvula & palate unaffected. Face shining pale. Patient has pronounced affinances. Pulse is regular but not rapid.


Culturn: Nasal Positive.

Tentative:
Feb 5th: Pulse is irregular. Vomiting is frequent. Sore of tonsils and uvula lasted 4 days. Feb 9th: Good colour. Pulse regular. Afterward patient made rapid and full recovery.
**Case IX.**

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**Description of Face.**

Base of each tonsil covered with dark gray, thick membrane. These are discontinuities, patches of similar membrane on the anterior aspect of right tonsil. Small patch of similar membrane on the left side of the uvula. Pulse regular.

**Swab:** Many throat swab. Some Polar stained.

**Fluorescein:**

**Purine:** Neisser Positive.

**History:**

Patient made uninterrupted recovery.
Description Case K

On admission: Fauces were very congested. Slight enlargement of right tonsil, left markedly enlarged. Base of right tonsil completely covered with dark gray thick membrane which spread far back for tonsils. Left tonsil covered at base with similar membrane. Uvula and palate free. Patient pale, very fatigued looking. Pulse slightly irregular and volume and force poor.

Curee = Short flexor tained roots. May

Cultiv = Neisser Pencetiae.

History

Jan. 26th: Patient complaining of feeling of pressure and slight precordial pain near mitral area. Pulse is slightly bounding, systolic point and volume poor.

Jan. 30th: Pulse general condition much improved. Pulse is regular. Pain is gone.


Feb. 10th: Throat painful, left tonsil enlarged, right

Feb. 11th: Throat suppurated. Both tonsils. Patient after six months good recovery and left for home well.
Case XI

Date

Day of Dis

Result

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Description of Case


Swab = Good short thick coats, good buds

Cocci and dips coco.

Culture = Negative Contzcan.

Vital Signs

**Case XII**

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**Description of Case:**

Patient had a slight enlargement and fever at base with thick greenish white membrane. Enlargement of right submaxillary gland. Patient was pale. Pulse was irregular. Patient looked sick.

**Swab:** Medium sized round with polar staining, diphlo and white cocce.

**Culture:** Never Contain.

**Notes:**

Case XIII

Description of Case:

First looks normal at base with thick greyish-white membrane which is somewhat shrivelled but not centrally dark grey in colour. Marked enlargement of cervix after about 24 hours. Hypertrophic left ovary. Lordosis. Irregular and uneven volume good.

Erects thick but not well. Delikately becor.

Pauhat = Never Bough.

Patient made gradual recovery. Heart much diminished was still enlarged butistrict but murmur not so obvious. Cough excellent.
Case XIV

Description of Case.

Fever as a littleague, no tonsil enlargement. No definite membrane but patches of filmy membrane above right tonsil. Culture as

Staphylococci and Streptococci.

Cultures = Messsy Normal.

Hxton

Feb. 9th. Sat up in bed felt much better. Pulse irregular.

Feb. 13. Has been taking 91/2 a good color with regular good pulses. Much stronger. Left for home in good health.
Case XV

Description of Case:

Right tonsil at base is completely covered with grayish membrane which is very thin and thick. The left tonsil has a small patch of similar membrane at base. Tonsils palpable free. Child is very pale and poisonous looking. Sauc is slightly chrestic & irregular.


Short Staphylococci. Staph. & Staphylococci.

Pustules = None. Positive.

Headache.

Saw regular & good Feb 11. Made good recovery.
Case XVI

**Description of Case.**

Fonseco congested. Right tonsil very large, left slight. Right tonsil is completely covered with grey loose membrane. Membrane is excessively thick. Left tonsil is covered at base with minute tenacious membrane.


Culture = Mumps Positive.

History:

**Case XVII**

### Description of Case

Right temple completely covered with opaque whitish membrane which is thick, but thin. Left temple also covered but have mild similar membrane. Histological sections at M.R. Pathol. Lab. Prague - negative.

Cultures: Medium palatal swabbed. Staph. aureus.

Cultures: = 

---

Feb. 5th: Pulse very quick. Patient very pale & unconscious. 6th:

Feb. 6th: Pulse improved but still slightly irregular. Drain made on left. No real change.

Feb. 7th: Much improved. Pulse quick but in good volume.仍未


Feb. 9th: Pulse regular & in good volume. CRUS.

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Description of Case:

Febr. 4: Dr. Binns: left side of face cold and the eye completely covered with whitish membrane. Vomiting on left side. Bed covered with similar membrane. Pulse irregular but of normal volume.

Treatment:


Staphylococcus: detected.

Pustules = Neisseri Bacteria.

Feb. 10: Man made to sit up in bed for lecture.
Feb. 11: Man made to sit up on left side in bed.
Feb. 15: Slight movement from left to right.
Feb. 16: Great colostrum. Patient made of much improvement.

Patient made of much improvement.
Description of Case.

Patient an admittance very pale and collapsed. A frequent hard, rapid, and labored. Voice very hoarse. Indrawing of intercostal spaces very marked. All extremity muscles flaccid. Pulse irregular and thin. veins restless and anxious-looking. Fauces injected but free from membrane.

S. was a short poli. Gastric stools
St. h. 
Culture = Contia Neisser

History.

Was at once given & lemon & stimulant, etc.
Description of Case XIX—con.

After half hour of a team as there was no
improvement was administered with No. 4 enema
tube after the two unsuccessful attempts with an
ordinary tube. At 12:20 p.m. held colostomy
and was given Hydrocortisone 1/100, 1/1000
This was made 5 minutes a distinctive improvement.

2 a.m. Enema infused but still very feeble

4:45. Patient became cyanosed & tube very feeble

irregular. Was again given Formalin Elzughe 1/100
Enema 2 colon infused within 10 minutes

Feb 6th; Enema regular. Patient improved. Was

Walking easily. Had bit of a right-side

shift. 12:20 p.m. Colon introduced & Belladonna.

Stopted Feb 7. Enema 2 colon still good

Tube removed 12:30 p.m. 6:45 p.m. Patient

had some pain on finger & collapsed.

Given Formalin Elzughe 1/100 enema at 7:30.

8:45 p.m. Enema regular 1st colon not good.

9:30 p.m. Again given Formalin Elzughe 1/100

17:30 p.m. Enema regular & good volume & force

Pain much improved Feb 8th 12 a.m. 1800 left well

Bowel tone good. Good tube 2 colon. Tube removed

via rectum. Stooled & Acid Formal 25-50% 1 enema at night

Feb 9th. Bowel tone well. Good colon & tube. Enema

Patient made good recovery left perfectly well.
Case XX

Description of Case:

Slight congestion of Fauces. Left tonsil covered at base with tough, tenacious grey membrane. This is a small pocket of irritable membrane on the anterior surface of right tonsil. Mucosa fiery.

Patient is quiet, colour and good regular pulse.

Swab = Mixed cocci, long thin & short rods.

Pulse good. Fever & Diplococci.

Culture = Neisser Pontius

Notes:

Fibrinous membrane spread slightly on the left tonsil. Colour good. Pulse good.

Patient afterwards made an uninterrupted recovery.
**Description of Case**

Left temple convex completely at base with thin dark gray membrane. Soft congestion of temporal bone of right kind slightly affected similar membrane.

**Ears** = Short cord. Paper thin and Clinton.

**Lungs** = Positive Murmur.

**Protein** seen in right sternal Feb 6th. Withered and cyanotic neck are arms.

Feb 20th: Temperature rose 10F. 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd.

**Results**

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**Remarks**

- Transient
- Good recovery
### Description of Case

Right tonsil is a little enlarged, completely covered with thick tenacious, dark gray membrane. The left tonsil is covered at base with some similar membrane. Voice is slightly husky.

Patient is very pale, languid, poisoned looking. Breathing is poor and rhythm irregular.

**Symptoms:** Short, feeble, abandoned cough, short, slight, mucous, slight, and occasional.

**Culture:** Neisseria Pharyngis.

**History:**


Page not legible due to handwriting quality.
### Description of Case

- Occult boils on right enlarged and covered with chinkage with yellowish membrane:
- Naula + palate free. Pulse in show but regular with good volume.
- Swab: Short Colon stained. Sode. Bisi
- Culture = Messer Positive
- History
- Patient made uncomplicated recovery.
Case XXV

### Description of Case

Left tonsil has palate of thick grayish-white membrane at base. Right tonsil has small silky patch at base as fleshy membrane. Uvula + palatofree.

Swab: Good clumps of stout thick rods. Some polar stained rods.

Accessories: Neisseri Gentlie.

History: Patient made an uncomplicated recovery.
Description of Case.

A small patch of greyish membrane which became blanching on pressure removed at base of left tonsil. Ulcers on floor and soft palate.

Case XXVII

Description of Case:

Left trachea has large black gray patch of thick membrane at base. Right trachea sound and free. Pulse is regular and thick full.


Culture: Enteric Bacilli.

History

Patient made an uncomplicated recovery.
Description of Case.


Death = Good short notes.

Hinton = Plastic

Sheer pain on mumps, shivers.

Recovering.
Case XXIX

Description of Case:

Fam.us congested. Brouch sounds enlarged. Breast
swell continues with opaqued red membrane
which appears to be loosening.

Pulse regular & good. Resp. good colour.

Stoma = very good muscle \\

Culture = Neumon Bontius.

Made good recovery but contracted Mumps
on Feb 7th, Recovered & left for home
in good health.
### Case XXX

**Description of Case:**

Most tabic commenced at base with dark erythematous membrane. Throat palpable firm. In the nasopharynx - good.

**Exudate:** A few Bolton stained short roots. *Streptococcus & Staphylococcus.*

**Cultures:** Negative. Routine

**History:**

- Feb 5 & 6 pm. Pulse about 100 bpm. Slight diarrhea.
**Case XXXI**

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<th>Name</th>
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**Temperature (°F)**

- 106°
- 105°
- 104°
- 103°
- 102°
- 101°
- 100°
- 99°
- 98°
- 97°

**Description of Case**

- **Breast:** Bulbs not injected & connect cut-down with yellowish dark membrane. Ulcers and halite free. Pulse is low, tension slightly irregular in time. Heart.Antis 1st round replaced by a soft blinding menace. 2nd occasion undeveloped.
- **Eyes:** Corneal frost, B.H. & Staphylococci.
- **Culture:** Neisseria Bovine.
- **History**

**Feb 17**: Pulse now regular. Tension low. Heart in normal range. Patient left hospital well except for the tension in the cornea area.
### Description of Case

Faeces slightly injected. No peritoneal enlargement.

[Diagram showing temperature and pulse over time.]

**Pulse:**

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**Temperature (Fahrenheit):**

- Feb. 1st: 106°
- Feb. 2nd: 105°
- Feb. 3rd: 104°
- Feb. 4th: 105°
- Feb. 5th: 102°
- Feb. 6th: 101°
- Feb. 7th: 100°

**Pulse Rate:**

- Feb. 1st: 106
- Feb. 2nd: 105
- Feb. 3rd: 104
- Feb. 4th: 105
- Feb. 5th: 102
- Feb. 6th: 101
- Feb. 7th: 100

**Diagnosis:**

- Feb. 1st: Septicemia of the urinary tract.

**Culture:**

- Enterococcus pyogenes

**Note:**

- Feb. 2nd: Patient still very soft and debilitated.
- Feb. 3rd: Patient more comfortable. Good color. Nothing can be eaten. Patient afterwards made unimportant that recovery.
- Feb. 4th: Patient much stronger and better in good color. Nothing can be eaten. Patient afterwards made unimportant that recovery.
## Case XXXIII

**Name:** A.D.  
**Age:** 21  
**Disease:** Tuberculosis

<table>
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<tr>
<th>Date</th>
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<th>Temp.</th>
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<th>Resp.</th>
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**Result:** +

### Description of Case

Small patch of gum membrane with darker centre on tongue surface, slight thrill below.

Small patch on palate of gumma in membrane. Small filmy patch on base of tongue.

Pulse regular & good.

Swab = Good results. Sore that some long, thin epithelium.

Lymph = Normal lymph

Patient made uncomplicated recovery.
**Case XXXV**

**Description of Case:**

Purulent discharge from left nostril. Farcaces not congested. On previous filling gorged palate of membrane have left tonsil. Voice clear to cough. On pulse is regular. Good volume of free. Patient pulse pale & lethargic

Drugs = Some opium Codeine

Drugs = Thrust = Sand short rods. Bileceous

Cultures = Neisseria Catarrhi

History
Patch on left tonsil was present for 7 days. Patient made an uncomplicated recovery.
**Case XXXV**

**Description of Case.**

Fauces are slightly injected. No enlargement of tonsils.

Fibrous grey membrane - old membrane covering base of left tonsil. Right tonsil normal.

Pulse: regular & equal volume & force.

*Exudate:* Soft, yellow, not thick.

*Culture:* Neisseria catarrhalis

*History:* Patient makes an uncomplicated recovery.
### Description of Case

Large patch of dark-gray membrane at base of pharynx. Membrane on left tonsil appears to be loosening. Fauces are congested and soft palate is enlarged. Palatine tonsils pale & friable looking. Pulse is soft and irregular.

**Temperature:**
- 97°
- 98°
- 99°
- 99.5°
- 100°
- 100.5°
- 101°
- 102°
- 103°
- 104°
- 105°
- 106°

**Date**
- 15
- 16
- 17
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- 7

**Pulse**
- 80
- 85
- 90
- 95
- 100
- 105
- 110
- 115
- 120
- 125

**Resp.**
- 20
- 22
- 24
- 26
- 28
- 30
- 32
- 34
- 36
- 38
- 40

**Dyng Intervals**
- 6:00 A.M.
- 9:00 A.M.
- 12:00 A.M.
- 3:00 P.M.
- 6:00 P.M.

**Diagnosis:**
- Diphtheria

**Result:**
- Recovery
**Description of Case.**

The patient, a woman of 37 years, was admitted to the hospital on 15th of November with a diagnosis of pneumonia. She was previously healthy and had no history of illness.

On admission, the patient was found to be febrile, with a temperature of 103°F. The pulse was rapid and the respirations were shallow. The patient was weak and showed signs of dehydration.

Over the course of the treatment, the patient's temperature gradually decreased, reaching normal levels by the 5th day of admission. The pulse also returned to normal, and the patient showed signs of improvement. The patient was discharged on the 8th day of admission, fully recovered.

**Note:**

- The patient's diet was adjusted to provide necessary nutrients for recovery.
- The patient received regular physiotherapy to aid in her recovery.
- The patient was advised to continue with regular follow-up appointments.
**Description of Case.**

Blood stools are completely covered with a thick, dark gray Tenacious membrane. Vesicula right-sides is also covered with a similar membrane. Urine is regular and good volume & force.

**Tests:**
- Blood: Good color, retained solids, good claret.
- Stool: Soft, flocculent.
- Feces: ferry, fecal consistency.

**History:**

On the 15th, after a severe improvement, the patient made an uncomplicated recovery.
Case XXVIII

Description of Case:


Histology = Nonvi. Pneumonia

Patient made an uneventful but slow recovery.
Case XXIX

Description of Case:

Fever rose. Tongue: Brown, gums enlarged. Both tonsils coverd with grayish whitish membrane which appears to be loosening.

Mouth: Palate not much affected. Palate regular & good. No gas odor.

Sweat: Very good mineral salts. Saliva returning. Good appetite, dilloxsin

Culture = Neisseria Contagiosa

Start, made good recovery but contracted Mumps on Feb 19th. Recovered & left for home in good health.
Description of Case

Patient's complaint at time with cholera. Stools, palpable free. Stools regular and good.

Sweat: A few Color changes that restore

Fullness: Melons, Bovine

History:

Feb 9th, 19th: Urine warm, slightly irregular.

Same Feb 9th: Feb 15th: Urine warm, fever. Still slight fever, some return. Color is good. Patient's condition made an uneventful rapid recovery.
Case XXXI

Description of Case

Booth found an injected & congested nose
with yellowish dark membrane. Nucleus and
palate space. Ears is low tension as lightly
irregulars in time. Vent. Anti-stomach replaced
by a soft slowing murmur. T. occasionally reduplicated.

Ears: injected mumps. Drs. 10 8. Staphylococci.

Culture = Neisser Conflue.

History

Feb 17th. Ears in mumps. Jennis low. Heart in
nastic signs. Patient left hospital well
except for the mumps in the ear & his
area.
### Description of Case

**Fauces:** Slightly injected. No tonsillar enlargement.

**Throat:** No white membrane at base of left tonsil. orbs not very regular.

**Swab:** A few short roots. Some long thin roots. Staphylococci bile bacilli

**Culture:** Neisseria catarrhalis

**Urines:**
- Feb 11th: Pus in urine still very soft & tenacious, pale yellow, primrose, looking.
- Feb 12th: Pus has now much stronger & tenacious, good colour, notting consider. Pus heals afterwards made urinuria, felt recovering.
Description of Case:

学霸 crazy.


Pulse irregular. Good volume & free. Patient anxious & delirious.

Swab = Sore equal to the many, large
Debroce = E. H. Debroce.

Swab = Thrust = Sore throat. Debroce.

Cultures = Meyers Porphyri.

Writings

Patient left nostril was present for 4 days. Patient made an uneventful recovery.
**Case xxxv**

Description of Case:

Fauces are slightly injected. No enlargement of tonsils. Fibrous grey membrane; old membrane covering base of left tonsil. Right tonsil normal.

Pulse regular & good volume & force.

**Cough** = sweet short cough. Episodic.

**Culture** = *Meiser Bordetia*

**History**

Patient makes an uneventful & steady recovery.
**Case XXXVI**

**Description of Case.**

Serae petechial of dark-brown membrane at base of throat. Membrane on left side appears to be loosening. Favors are congested about tonsils are enlarged. Catarrh is very pale & personed looking. Pulse is soft and irregular.

**Swab** = Good shot, includes "&" phlegm.

**Further** = Neisseria Contagiosa

February: Pulse regular but still soft. It gradually improved and patient made uncomplicated recovery.
Case XXXVII

Description of Case:

The patient was a man of about 35 years of age, suffering from a chronic illness. The patient had a history of tuberculosis, which had been diagnosed several years ago. The patient was admitted to the hospital in a weak and emaciated condition.

On admission, the patient was pale and anemic, with a temperature of 38°C. The pulse was rapid and weak, and the respiration rate was 24 per minute. The patient complained of a persistent cough and shortness of breath.

Examination:

The patient's general condition was poor, with a marked wasting of the body. The skin was pale and cold to the touch. The patient had a persistent cough, with expectoration of a few small amounts of blood-stained sputum.

Blood examination:

The blood count revealed a marked anemia, with a hemoglobin level of 6 g/dL. The white blood cell count was 5,000/cu mm, with a neutrophilic leukocytosis.

Treatment:

The patient was treated with bed rest, oxygen therapy, and antibiotics. The patient was also given a high-protein diet and vitamins.

Progress:

Over the course of the next few days, the patient's condition gradually improved. The patient's temperature returned to normal, and the cough subsided. The patient was discharged from the hospital after 10 days of treatment.
Description of Case

Both tumours are completely covered with very thick dark grey fibrous membrane.

Vesicle right side is also covered with similar membrane. On the is regular and good volume of juice.

Swab = good pus without necrotic film. Good chitin. 

Fulness = Membranous Purulence.

History

Became ill first on 16th. After six days improved and patient made an uncomplicated recovery.
Case. XXXIX

Description of Case:

Both limbs are convulsive at base with thick, tough dark-gray membrane. The membrane on the right hand is thicker than that on left. Fusses are congested. Nodules and pustules are free from membrane. Patient is very pale and poisonous looking. Urine is regular but very soft.

Swab = Short rods with diplococci and staphylococci.

Culture = Neisseria Vontiue.

History:

Feb. 18: Patient vomited this morning one
Description of Case xxxix con-
and a half hour after food. Slight
cold extremities but pulse regular
and colour good. Heart not enlarged.
Aorta area. 1 st sound faint. Other
rounds closed. Complains of slight
Pain just above costal margin in
middle line. Blot at left upper
stomach a region. Faineis acid urine.
Blebs present in mouth. Milk fever
Feb 17. Again vomited 1 hour after food.
Feel for rection. Pulse remains regular
& good. No good colour & warm.
No pain.
Feb 18 th. Has not again vomited.
March 1 st vomited this morning after
food. No pain. Food Pulse regular
Good colour. Heart not enlarged.
Cannot all over closed.
Patient subsequently made an
uninterrupted recovery.
**Case XL**

Description of Case:

Left gland is enlarged & completely covered with a thick & tenacious, grayish-white membrane. Palate is involved on the same side. Thumbs on left nail and on left is covered with a similar membrane. The voice is very hoarse and there is an occasional short, hard cough. There is very marked enlargement of the cervical glands on the left side of the neck. Patient is pale and pulse is soft and rapid.

Description of Case: 

Staphylococci and paracoccidiococci 

Culturing = Neisser Contam

At night patient was very restless.

Feb 14th: Patient still febrile on pulse and 

irregular. Patient's colour is vastly and 

the pulse is regular and good. Heart not 

enlarged. Mitral area slightly soft 

Delineating myotic murmur.

Feb 15th: Patient des talk in a 

a short time. Good colour. 

regular 

and good volume and force.

Patient afte made an uncomplicated 

recovery.
Description of Case:

Soot, and nose are completely covered with a green membrane which is very thick and tenacious. Throat is inflamed and enlarged. Thymus unaffected. Face is slightly flushed. Pulse is full and regular.

Examiner: [Signature]

Culture: Positive for Bacteriophage

History:

Feb 11: Sore throat, fever, and tonsillitis with extensive nodules on buccal mucosa. Had slight fever next day. Patient felt better on 23rd and 24th. Patient had an uncomplicated recovery.
**Case XIX**

**Description of Case**

Cork tonsils and membra complete removed with many thick dark grey membrane. Child not affected. Voice is clear but there is an occasional short dry cough. Child is very pale and poisoned looking. Pulse is not strong and somewhat irregular. Heart. Slight enlargement left side. A murmur in aortic area is faint but sounds clear.

Swab = Good short rods and bacilli

**Culture = Negative**

**History**

Feb 17th Patient vomited one and a half hou
Description of Case XIII - con-

after food. No very pale and pulse
soft but regular. Eaten Brandy
instead of Whisky, Kept nurse milk etc.
Feb. 19th Vomited last night doesn't.
No
pain. No m orange. Pulse is still soft
but regular. A trace of albumen in urine.
Feb. 21st Pulse much improved. Labour
is also much better. No further sickness.
Patient after meals made an
uncomphletd recovery.
Case XLIII

Description of Case:

Large sore at right cheek cheek, grey membrane over base of right tonsil. Left tonsil has a smaller sore at base of similar membrane.

Patient is in good color and has a good, regular pulse.

Grabs: Good short walks. After 8 hours.

Culture = Meriex Positive

History

Patient eventually contracted measles on an

Train and was then confined to another ward where she made an uneventful recovery from lost

diseases.
Description of Case:

Faines are injected. Right tonsil slightly enlarged.

Several patches of chondrified membrane at the base of each tonsil. Cubes is regular and good. Patient's colour is good.

Swab = Good short rods, Staphlococci, Haemolytic and Diplococci.

Culture = Negative Positive.

History:

Sore for joint pains on Feb 21. Patient made an uncomplicated recovery.
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**Description of Case:**

Fumes are congested right tonsil very slightly enlarged with a fleshy gray patch at base. Ulula 2 palatal tonsils on top. Marked enlargement of right submaxillary gland. Patient is very pale and nictating looking. Pulse is regular but poor in volume and strength.

**Swab:**

Good clusters of family staining rods. Some good rods of *S. pyogenes* and *S. pyocoei*.

**Culture:**

Negative, Positive.
Feb 13th 12.  mom. Has vomited 3 times during past 12 hours irrespective of food. Pulse is very soft & somewhat irregular. Scleritis is very pale. Given Saline, Brandy & Acid Fomnie per rectum. At 5 p.m. given Septonone milk, vomited. No pain but pulse very irregular. 6 p.m. Given Formalte 8yehr 9/100 subcutaneously. 8 p.m. Pulse has much improved. To regular & volume & force better. No further sickness. 12 p.m. Has again vomited. Pulse is still regular. Heart not enlarged. No 1st sound faint. No murmur or gallop. Continued. Feb 15th Has not again vomited. Given Septonone milk. Brandy & Acid Fomnie 1 mouth. Feb 17th No further sickness. Pulse is good. Pulse regular & good. Feb 19th Diarrhea symmetrical & tenesmus with over tone. Patient afterwards made an uninterrupted recovery.
Case XIX

Description of Case

Patient arrived at base with slight dry thick membrane. Throat was at first with similar membrane. Pulse soft and regular.

Swab: Good clusters of black polar stained rods. Stafflococci

Culture = Neisser Pneumonia

Patient developed cellulitis on February 20th but no further complications. Made a good recovery and left hospital well.
Case XLVIII

Description of Case.

Right limb completely covered with thick white membrane which is very tender. Left limb slightly congested. Patient is pale and poisoned looking. Pulse is regular and good volume etc.

Lab. = Faint cock Staphylococci Ovoides

Cultures = Merson Bottles.

History.

Patient's colour much improved by 12th. Urine remained regular & good.

Vomit and stools red and nauseating - on lamb on the 17th. Patient of kidneys made an uninterrupted recovery.
Case XLIX

Description of face.

Favours slightly congested. Right tonsil has a large patch of thick white membrane exuding a yellowish, brownish membrane. Enlarged, but not tender. Count is 4,000,000. Urine is normal. Pulse 90.5, regular and good volume.

Swabs:
- Staphylococcus pyogenes
- Streptococcus pyogenes
- Escherichia coli

Culture: M. catarrhalis

History:

Patient subsequently made an uneventful but slow recovery.
### Description of Case

The tonsils are covered with a thick dark gray-blue exudate membrane. There is slight congestion of the fauces. The tongue is soft and smooth.

**Swab:** A few good short rods of short staphylococci, E. faecalis, and E. faecium.

**Culture:** Gram Positive

**History:**

Patient under large doses of acid from the beginning. The condition improved gradually in regard to swelling and made subsequently an uncomplicated recovery.
**Case II**

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<td>Date</td>
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<td>Respiration</td>
<td>42</td>
</tr>
<tr>
<td>Temperature</td>
<td>39</td>
</tr>
</tbody>
</table>

**Description of Case.**

Slight congestion of fauces. No nasal discharge. Marked from last time. Slight secretion at nostrils. Patient is very pale - very looking - appears very breathless. Pulse is regular but very soft.

*Ear & Nose:* Very good. Tonsil for last several days.

Throat: 8 by 12 inch wounds. Staphylococci

Culture: Neisseria Catarrhalis

Patient improved in colour & fever has already settled. Had a writing desk put in for 3 days on 25th. Made otherwise an uncomplicated recovery.
Description of Case:

Post tonsils connect at base with white plug.

Spatula of membrane and anterior with

Chirnical examination normal. Lumbar free.

Palp=x slightly soft but regular. Bowel good.

Excreta = very good. Stool formed stained

wet. Some meconium. Locci:

Cultive = M. viscosi

History

Right tonsil became enlarged, painful on 4.

Small alme at base burnt an g.t. Patient

otherwise made an uncomplicated recovery.
Case III

Description of Case.

Feces very congealed. Both tonsils enlarged
depth of tonsil completely covered with very
white membrand which is loose
and appears to be of a color standing
over account given. Right tonsil is
cleaned at base with similar membrane.
Marked enlargement of cervical glands.
Patient is extremely pale and very
chilodet looking. Heart. & lightshotten
right side. Aortic it sound almost
impenetrable occasional systolic of
sound at middle area. Pulse is very
Description of Case 111 - con -

Soft and irregular.

Swale = Good soft, which is soft.

Solar stained rocks. Blebcece.

Culture = Never Continue 

Patient on 28th still looked very tannamic and pulse was very soft and irregular.

Membrane spread slightly on right side.

March 1st. Pulse is stronger and more regular. 

Heart sounds replaced by faint systolic murmur. 

March 4th. Patient vomited twice irrespective of food. Pulse very irregular and very soft. At times almost imperceptible. 

March 6th. No change but no further vomiting. 

March 11th. Became more like at 4 p.m. and until 9 p.m. Died at 4 a.m. March 12th.

A case of apparent childless from the start. Although the case is admitted as being admitted on 4th day of illness. 

Subsequent examination of parents proved child to have been ill for at least 2 days. 

Facts which were borne out by appearance on admission.
**Case LIV**

**Description of Case.**

Boat tonsils covered with a thick purulent membrane which, although not entirely disintegrated, was beginning to disintegrate. Patient is a well nourished and pulse regular although slightly soft.

Swab: Good growth of *Streptococcus* and *Pneumococcus* from the tonsil and pharynx.

**Cultures:**

- *Streptococcus* positive
- *Pneumococcus* positive

Patient made an uncomplicated recovery.
**Description of Case.**

**Case IV**

Patient is pale and listless, but pulse regular and good.

Swab - Some greenish yellow mucus. Long, thick coats. Short streaks and clumps of yellow coats.

Culture = Neisseria Catarrhi

History

Patient improved in colour by 20% an afternoons made an uncomplicated recovery.
Description of Case:

But tonsils completely covered with thick white membrane which has a little fever to palate on right side. Urine free. Patient is pale and delirious. Urine regular and good volume. Heart nothing to note.

Swab: Good formalin stained rods.
Diphtheria and staphylococci.

Culture = Neissere Contine

History:
Description of Case:

Right tonsil completely covered with thick dark gray membrane. This is a small patch of similar membrane just posterior to right tonsil. Throat a palate free. Marked enlargement of cervical glands. Pulse is slightly irregular. Good volume. Patient is sweating and is very pale and poisoned looking.

Swab = Good medium. Colon Stained and in clusters staphylococci and diplococci.

Culture = Neisser Coeliics

[Signature]
### Case LVIII

**Name:** J. E.  
**Age:** 11 years  
**Disease:** Diptheria

<table>
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<tr>
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<th>Bowels</th>
<th>Temperature</th>
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**Result:** +

**Diagnosis:** Acute Tonsillitis

**Notes:**
- Patient is alert, responds to stimuli.
- Tonsils are enlarged and covered with tenacious, dark-gray membrane.
- Nasal passage is congested.
- Cough is present.
- Voice is hoarse.
- Patient's appetite is normal.
- Tonsils are soft but irregular.
- **Culture:** N. S. Sipine  
- **History:**
  - Feb. 15th: Patient is very weak. Pulse is irregular.

**Graph:**
- Temperature rises to 105°F on the 24th and 25th.
- Recovery noted on the 30th of the month.
Description of Case LIII - con.

and poor in volume and force. Membrane appears to be de-integrating.

Feb 19. Patient's colour has improved. Do not so bitter and painless to touch.
Urine is now regular although still soft. Local condition has improved.

volume and force.

Feb 27. Improvement continues. Heart
not enlarged. No murmur.

Patient subsequently made an
uncomplicated recovery.
**Case LIX**

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**Description of Case:**

Both tonsils are enlarged. Left tonsil is completely covered with thick white membrane. Pus is abundant. Right tonsil is covered with similar membrane at base. Lymph nodes connected with similar membrane. Great enlargement of cervical glands. Patient is pale and exhausted-looking. Appear very toxicemic. Pulse is soft. Irregular.

**Swab:** Good colonies stained rods. Staphylococci Diphtheriae.

**Culture:** M. N. B. Contagia.
History

Feb 22nd. Membrane spreading on palate.
Fever thick and tension. Heart not enlarged. Right calf swelling.
Skin... not eosin. Other sounds normal. Pulse still irregular.


Patient continued to improve until March 6th when he contracted Measles.

Treatment: Formic Acid was advised and 16 days after the outbreak.
After the disease he developed a slight paralytic paralysis. He subsequently made a good recovery.
Description of Case

Boils: spots at base of tonsils are covered with thick whitish-gray membrane which has commenced to disintegrate. Number is involved at left. Boils free.

Patient's colour is good. Pulse regular and good.

Wound = mixed root. Both roots free.

Culture = Neisseria Catarrhe

Patient made an uncomplicated recovery.
### Case LXXI

**Description of Case:**

Buck tonsils are enlarged and covered at base with thick dark gray membrane. Uvula and palate are unaffected. Pulse is rapid and soft but regular. Heart slightly enlarged left side. Anterior sound is very faint. Soft swelling in left costal margin. Child very pale.

**Culture:**

- Neisseri meningitides
- Pseudomonas aeruginosa
- Staphylococcus aureus

**Final Diagnosis:**

Died from Diphtheria.
Feb 21st. Very pale & ahistorical, severely fevered. Pulse is 80, irregular, very soft.
Feb 22nd. Vomited twice. Anterior sound almost imperceptible. Pulse very irregular.
Feb 25th. Same as 22nd. Gave Formulas of Chod.
Mar 1st. Marked improvement in pulse & color but body now weak.
Feb 25th. Given stimulants & r. c. Amin & Salines. No improvement.
Feb 26th. Died at 9:15 A.M. The end in this case was almost internecine as patient had shown marked improvement in heart, pulse & color for 12 hours previously. It is interesting also to note the absence of albumin which at no time was present although frequently asked for milk. The child was extremely cyanotic from admission.
**Description of Case**


**Swab** - A few short roots. Staphylococci and Diplococci

**Culture** - Neisseria Denticic

**History**
Feb 20th, 4.30 p.m. Breathing has much improved. No marked indrawing of intercostal spaces. Jugular has diminished. Colour good. No abnormal cardiac condition. Pulse regular.

Feb 21st. Breathing has still further improved. Good colour and Pulse is regular with good volume and force. Patient subsequently made an uncomplicated recovery.
### Description of Case

Right tonsil is slightly enlarged and covered at base with thick dark-gray membrane. Mucosa has small patch of similar membrane at right Small patch at base of left tonsil. Pulse is good. Bowel is regular and good volume of stool.

**Sweat** = Good rood. Thick flat rood with coccyx.

**Pus** = Necrose Contine

**Healing**

Patient made an uncomplicated recovery.

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<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Temperature (F)</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Time</th>
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</table>

**Diagnosis:** Diphtheria

**Treatment:** 257 mg x 4 hourly

**Note:** 1st dose of toxoid.

**Result:** Recovery.
**Case LXIV**

**Description of Case.**

Small patch of dark thick-gray sticky membrane at base of left tonsil. Soreness is good. Pulse is regular and good.

Swab: Good coat, thick roots.

Diplococci and Staphylococci.

Pustule = Numera Contini

The temperature rose slightly on March 24th but there was nothing suspicious to account for it. Except for this patient made an uncomplicated recovery.
Case XXV

Description of Case:

Bright tonsillitis present at base with gray membrane. Left tonsil free. Patient is pale. Pulse is regular, good volume. Swab: Good Sulfur stained cells in clumps. Staphylococci

Culture: Neisser's Putrid

Feb 15th: Marked Mark of Amennhea to left tonsil which is almost completely involved Marks - Joint Pain

Subsequently patient made an uncomplicated recovery.
Case LXVI

Description of Case:

Posterior pharynx completely covered with white membrane. It is thin. Throat congested but clear. Pulse is rapid regular and good volume. Patient is a slow crawler which may be natural.


Filter: Neisseria Catarrhalis

History:

Patient subsequently made an uncomplicated recovery.
Description of Case.

Post-mortem case well with skin irregularly yellowish-white thick, tenuous membrane.

Throats and pharynx unaffected. Pulse regular slow and fair volume.

Two to Mixed counts in clots. Pneumonia.

Histology = Ninos Botulism

Analysis:

Stomach and intestines. Patient made uncomplacent recovery.
Case LXXVIII

Description of Case:

Fever rose to 106°. Tongue dry. Sore throat. Cough. Sputum thick and white. Membrane at base of left tonsil. This is a smallish pea-sized membrane at base of left tonsil. Voice is very husky and this is a frequent short croaking cough. The indentation of the uvula is obvious although not very pronounced. No cyanosis. Marked enlargement of cervical glands. Pulse is fast and soft but regular.

| Date | Pulse | Resp | Temp. | Note
|------|-------|------|------|------
| 6    | 105°  | 28   | 94°  | Started Peractum
| 7    | 105°  | 28   | 93°  | Peractum continued
| 8    | 104°  | 28   | 92°  | No change
| 9    | 104°  | 28   | 91°  | No change
| 10   | 103°  | 28   | 90°  | No change
| 11   | 103°  | 28   | 89°  | No change
| 12   | 103°  | 28   | 88°  | No change
| 13   | 103°  | 28   | 87°  | No change
| 14   | 103°  | 28   | 86°  | No change
| 15   | 103°  | 28   | 85°  | No change
| 16   | 103°  | 28   | 84°  | No change
| 17   | 103°  | 28   | 83°  | No change
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| 21   | 103°  | 28   | 79°  | No change
| 22   | 103°  | 28   | 78°  | No change
| 23   | 103°  | 28   | 77°  | No change

Recovery.

March 13, 1873.
Description of Case LXVIII - con-


Culture = Neisser Cothie

History

March 4th 1 a.m. Temperature have been gradually getting more labourious. Intestinal troubles more marked in morning. Very severe diarrhoea cough.

March 5th 11 a.m. Have had good night. To

Sleeping quietly. Lobes is good. Pulse is regular. Good volume & force.

March 6th

Pulse throb. Lobes good. Pulse good.

2 p.m. Parliament while working with a moral staff. Gave Forme 3 3/400 and given mental feeding for 8 hours. Tube removed at 10 p.m.

March 7th. Lobes good. Pulse regular and good volume & force. No cardia abnormality.

March 11th. Temperature more. Given 4000 ADS with.

Patient a friend made an uncomplicated recovery.
**Case LXIX**

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Pulse</th>
<th>Resp</th>
<th>Urine</th>
<th>Bowels</th>
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**Description of Case:**

Boots and hands are convulused at base with white film and patchy old membrane. Patient is good colour. Pulse is regular and good.

*Swab:* Coval short rod with *Staphylococcus* and *Influenza.*

*Culture:* Neisser's positive.

*History:* Patient made an uneventful recovery.
**Description of Case.**

The patient is stiff, cyanosed, and feverish. A membrane is seen at the back of the throat, and there is a frequent dry cough. Respiration is labored and indrawing of intercostal spaces obvious, although not very severe. Tongue is dry and very soft. Right enlargement of right middle of heart. No murmurs.

**Swab:** Sputum, nose, and throat. Staphylococci and diphtheria staphylococci.

**Culture:** Neisseri pneumoniae.

March 2nd. Pulse slightly improved. Irregularity not so marked. Heart in static quo.


March 5th. Pulse is now regular. Sent is soft. Colon is good.

March 14th. Colon is good. Pulse is regular, with good volume. Heat not dilated. No murmurs. Respiration easy. Four hourly medicine started. Patient subsequently made an uninterrupted recovery.
### Description of Case

- Both lungs are enlarged. Both auricles and white thick tenacious membrane. Marked enlargement of auricles of both. Patient is bloated with slight anemic condition. Pulse is slightly irregular over soft.

- Ears: Short thick coals. Middle polar stained with De floccce and Staphylocceci.


- There was running of head slight chills with headache an unexplained test recovery.
### Description of Case

Boar tonsils are completely covered with very thick, white, tough membrane. Slight
respiratory involvement present at first. Patient pale and very poisoned. Nothing else
described. Pupil. Right: small, oblique, irregular, and soft. Heart: Soft, internal
sound faint. Soft blowing mitral systolic murmur.

**Cure** = Good, took no medicine
**Culture** = Neisseri Bouchee

**History**

Medical at St. Paul's but where regular until this.

Medical at Englewood. Puls regular, very smooth.

Patient subsequently made a good recovery.
**Case LXXIII**

<table>
<thead>
<tr>
<th>Date</th>
<th>Day of Obs</th>
<th>Temperature (°F)</th>
<th>Pulse</th>
<th>Resp</th>
<th>Urine</th>
<th>Bowels</th>
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<td>90</td>
<td>20</td>
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</tbody>
</table>

**Description of Case.**

Boots & Linen are enlarged. The left tonsil is completely enclosed at base with thick black granular membrane. Noula free. Patientaac a rapid pulse and pulse is regular and strong.

**Swab =** Mixed stools. Good flora.

**Cultures =** Neisser Positive

Patient made an uncomplicated recovery.
Case XXXI - con -

For three months when mental symptoms appeared he was transferred to another ward. Ariel Forecast at the same time unfortunately was transferred. 18 days after the stoppage of the drug there was an improvement of the hand and a forced grip difficulty in walking. The paralytic symptoms began to wear off in about 14-18 days and patient made a good recovery.
### Description of Case

Patient is very pale and poisoned looking. Both tonsils are covered at base with thin, looking membranes. Throat affected on right not left. Auch soft, breath regular.

**Ears:** Good, short roots. Discharged.

**Culture:** Neisseria Bacteria

**Date:** Dec. 24.

Feb 24: Patient still very pale and wheezing. Soft, although regular. Patient subsequently made uncomplicated fast recovery. On dismissal was good colour with strong pulse. No cardiac abnormality.
Description of Case

Fever preceded onset of localised pain completely covered with a thick white membrane which on lateral view is somewhat loose. Patient's色泽 is fair but Pulse is regular and soft. Soft enlargement left side of heart. Mitral systolic blowing systolic murmur. 1st sound faint.

Swab = Good medium & good thick colony.

Cultures = Negative Outcome

Subsequently.

Urines became regular by March. Subsequently, patient made an uneventful recovery.

Case XXXV
**Case LXXVI**

<table>
<thead>
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<th>Medical Observations</th>
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<td>48</td>
<td>103°</td>
<td>General symptoms</td>
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</tbody>
</table>

**Description of Case:**

Patient was very congested. Nose was completely congested with thick white nasal membrane. Membrane also completely involved. Palatine is involved on right side. There is a marked nasal discharge from both nostrils. Voice is very hoarse. Patient can only speak in a whisper. There is a frequent short croupy cough. Patient is extremely pale and poisoned looking. Driessen. Cheeks is poor in volume and face and is arranged. There is marked
Description of Case LXXVII

enlargement of the cervical glands.

Glands - throat = very good that polar
stained rods in chronicritis and
staphylococi.

Fever = good shortness and
large difficulty.

Cultures = Motile Pusitic

History

Feb. 27th. Breathing still labored. Patient
resists. Pulse irregular. Heart left
side slightly enlarged. 1st sound
Systole. Mental softness of the men
MEM. Membrane has increased 2000 A.D.

4:30 p.m. Inhauing of fluids to no
success made. Large of loose. pulse softer
and more irregular.

11:1. m. Attempted intubation to
relieve heart and for some passage
of coughing. Large piece of thick
white membrane 2½ inches in length
resisted after attempted
introduction of tube which failed
Breathing was much improved.

12:30 p.m. 6000 A.D.

Feb. 25th: Had one severe fit of coughing at 1 p.m.
Description of Case XXXII

Patient still very pale. Respiration, pulse is irregular and very soft. Occasional short coughy cough. Indrawing of intercostal spaces is marked.

March 1st, 12 p.m. Pulse is very soft, irregular, very slow and rapid. Given 10 ftidemic. Formato Stylium at 3 a.m. 10 ftidemic Stylium 1/2 at 12 p.m. no effect. 8 a.m. pulse markedly improved. 12 p.m. given again 10 ftidemic. Formato of 36 ftidemic. Pulse improved. Pulse became slow, soft and breathing also improved much. 5 1/2 a.m. Symptoms of Broncho pneumonia. Respiration very rapid. No symptoms of laryngeal obstruction. Pulse is more regular in volume and still rapid. 8 p.m. Given 10,000 units A.D.S. March 2nd. 10 a.m. Slight improvement. Pulse better. Pulse is regular. Has had Formato 8 a.m. at 9 a.m. and 9 a.m. Given 10,000 units A.D.S. 9 a.m. Has slept well at intervals. Pulse is regular. No swelling cardiac dilatation.
Description of Case LXXVI - con-

March 3rd. Her last good night. Except
respirations reduced and not laboured
Breath regular and good volume and
force. Pulse has much improved.

March 4th. Respiration are rapid (98)

From March 5th the patient gradually
improved and made an uncommonly
and complete recovery. Respiration
were normal by March 10th. The
cardiac enlargement much less decreased.

An interesting point apart from the
great severity of the case is the
fact of the ordinary injections of
Asthma failing to react on March
27th and the great success of the
Formate injections each of which
was followed by marked
improvement.
### Case LXXXVII

**Description of Case.**

Patient: E. C.

- **Age:** 24 years
- **Disease:** Diphtheria

**Chart:***

<table>
<thead>
<tr>
<th>Day of Diphtheria</th>
<th>Results</th>
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</thead>
<tbody>
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</table>

**Symptoms:**

- **Temperature:**
  - **Initial:** 106°F
  - **Recovery:** 98°F

**Pulse Rate:**

- **Initial:** 105
- **Recovery:** 97

**Respirations:**

- **Initial:** 104
- **Recovery:** 98

**Date:**

- **Day:** 25, 26, 27, 28, 1
- **Time:** 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25

**Observations:**

- **Month:**
  - **Day:** 25
  - **Temperature:** 106°F
  - **Pulse:** 105
  - **Respirations:** 104

**Pathology:**

- **Swab:** Color stained that rots.

**Microscopy:**

- **Graei and Diplococci:**
- **Culture:** *N. catarrhalis*.

**History:**

Patient developed a small abscess in connection with scarlet injection, but ultimate result unknown.
Description of case:

left tonsil covered with greyish-white thick membrane. Left congestion of fauces. Blaine is somewhat rebel. Her regular but volume poor.

Swab = Good Dolar material with in clumps. Score:

Culture = Pneumococcus.

History

Patient made a rapid and uncomplicated total recovery.
Case LXXIX

**Description of Case.**

Antiseptic and internal surfaces of throat discoloured with thick white membrane. Large patches also on 1/2 of uvula. Sputum is regular and of good volume. Heart not enlarged. Colour is good.

Swabs: Short rod. Long thin rod.

Staphylococci.

Culture = Neisseria Catarrhi.

Patient at Waverley made an uncomplicated recovery.
Case XXX

**Description of Case.**

Fenauer an engraunt. Breat limbs are completely covered with thick white membrane. Throat & palate free.

Pulse is regular but soft. Heart not enlarged. Soft flowing mucus to thighs.

Other sounds closed.


**History**

March 4-1st, moblasen antecia as he on face a cemintia. Patient made an uncompliated
### Description of Case

Patient on admission very agitated. Vomited twice within 30 minutes of arrival. Indrawing of subternal muscles marked. Voice extremely husky. Short cough, rough which is frequent. Faeces congested, with much mucus. Rhythm completely normal with very thin membrane. Left tonsil congested at base. Pulse is very soft, irregular. Heart, slight enlargement, slight rales. 1st sound very faint—almost inaudible. Best hearing mental was the omen.
Description of Case XXXI—con—

Swab = Red Blood stained note in clitoris

Pusative = Nothing Conspicuous

[Handwritten History]


2 p.m. Tube removed. 1:30 p.m. Child became very cyanosed and pulse almost imperceptible.

Given Hydromine Formate of Elytag 10c. Pulse and others improved markedly in 30 minutes. Breathing also improved.


March 20th. Right side of heart diminished. Sputum is good. Pulse is regular with fair volume and force. No further sickness.

After this except for joint pains which lasted for 2 days, patient made an unexpectedly rapid recovery and left for home. Attendant quite well.
**Case LXXXII**

### Description of Case

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**Symptoms:**
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**Temperature (Fahrenheit):**

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<td>88°</td>
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<td>87°</td>
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**Physical Examination:**

- Nasal: Normal
- Throat: Normal
- Pulmonary: Normal
- Bowels: Normal
- Pulse: Normal
- Respiration: Normal

**Bacterial Test:**
- Negative

**Laboratory Findings:**
- Staphylococcus: Negative
- Streptococcus: Negative

**History:**
- Patient a 10 year old boy
- Well nourished
- Good recovery
- No complications
### Description of Case

Fauces are slightly injected. Tonsils are swollen and covered at base with white, chronicized, thin membranes. Pulse regular. Great volume and force.

Quart - Few short thick pulse.
Stomach weak. Lacrimal:

Cultures: Neisseria Pertusis

Patient subsequently made an uncomplicated recovery.
**Case LXXXIV**

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</table>

**Description of Case.**


**Exams:**
- Mixed colds, stitches, and chesty.
- Marked: Nasal nostrils.

**History:**

March 12, slight patch of similar membrane on left tonsil. March 13: Sore cold still, slight 3000 A.D. Afterwards patient made an uneventful recovery.
Case IXXXV

| Day of Dis. | 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 |
|------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Time       | 106° | 105° | 104° | 103° | 102° | 101° | 100° | 99° | 98° | 97° | 96° | 95° | 94° | 93° | 92° | 91° | 90° | 89° | 88° | 87° | 86° | 85° | 84° | 83° | 82° | 81° | 80° | 79° | 78° |

<table>
<thead>
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<th>Temperature (Centigrade)</th>
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<tr>
<td>35°</td>
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</table>

| Treatment |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

**Description of Case**

Fever continued. Right tonsil enlarged and tonsillitis complete with thick dark grey membrane. Wound connected with a similar membrane. Catarrh about base of left tonsil.

Patient is pale and poisoned looking. Pulse is slightly irregular and volume is poor.

Serum = Baxter (Baltimore) + diluent

Blood culture = Negative

**Culture** = *Neisseria Contica*

History

March 5: Patient had slight paralytic in which eventually ceased off. Otherwise patient made good recovery.

Doctor:
Description of Case.

Boat tonsils slightly enlarged and covered at base with dark gray membrane. Pulse irregular and rapid, but patient very pale & restless.

Swabs: Good mixed cocci and cerei.

Cultures: Neisseria Contagiosa.

Patient developed an abscess in connection with the areas in the cutaneous which caused a temperature for several days. It was incised and did well and except for this patient made an uncompliacated recovery.
Description of Case.

Congested Fauces. Both tonsils are covered at base with dark gray membrane, thick tenacious. Sore is regular and good. Tonsils is good. No candida abnormality.

Gastric culture = negative

History

Patient subsequently recovered without any complications.
**Description of Case.**

Fauces constricted both limbs are slightly enlarged and conical at base with thick opaque white membrane. Good colour and regular hair soft pubis.

*Eurac.* = Medium violet rods. Coeei.

*Staphylococci and Diplococci.*

*Culture.* = Neisseria commens.

*Histories.*

Patient subsequently made an uneventful rapid recovery.
Description of Case.

Patient had at time of onset of sickness been suffering for 3 weeks from Bacille. Both tonsils completely covered with thin black scabby membrane. Throat faucets carried.峡thing slightly infected. Nasal discharge from right nostril. Bulbous lymph nodes in neck. Cure regular.

Wax = Mucous nodules. Polian stained roots. Staphylococci and Diplococci.

Nose = Polian stained roots and cocci.
March 8th. Bowelings which became more
improved with a bit of food. No change
enlargement. Blight oblique. Metal
up to the moment. 1st round Frank
On the regular. 9 soft. Blight pain. MRI Region
March 9th. Brisk improvement to 8 soft and
is slightly irregular. Vomited once
1½ hours after food. Follow very fast.
Acid Famine increased to x 4 hourly
March 10th. 9 a.m. Colon improved of itself
Brisk is slightly irregular but not
so soft. March 15th. 16th Patient
remained much the same. Colon
gradually improved. Was not again
sick. Brisk was varied. Was always
slightly irregular & always changed
in the evening.
After this date the gradually
improved to become quite regular.
Colon was good. No further ordinary
Parched condition in feces and finally
Patient made an uneventful shot
Mercurio
Description of Case.

Furuncles congested. Left tonsil completely covered with thick, white, tenacious membrane. Saliva also largely involved on same side. Right tonsil is covered at base with similar membrane. Ulcers also completely covered. Patient is fair colour with soft, but regular pulse.


Culture: Messue Bouinie

Patient developed on March 5th Pluing with...
Description of Case X - cont -

eventually effusion, fluid was exposed with needle but only clear fluid found. Eventually fluid disappeared but right after illness was suspicious of Otitis. Patient given steam air treatment and subsequently made good recovery. He had albumen but no

symptoms and pulse and colour were good during illness. Left hospital apparently in good health.
## Description of Case

Fauces congested but tonsils are slightly enlarged and covered all over with concreted, dried hypertrophied white thick membrane. Pulse is regular and good.

**Swab:** Good choleraic stools, *Staphylococcus* and *Diplococcus*.

**Culture:** Negative Routine.

**History:**

Patient subsequently made an uncomplicated recovery.
Case XCII

Description of Case:

Patient is a boy, aged 8 years, suffering from Diphtheria.

- Initial Symptoms:
  - Fever
  - Pharyngitis
  - Hoarseness

- Initial Examination:
  - Throat examination
  - Temperature: 39°C

- Treatment:
  - Penicillin
  - Rest

- Progress:
  - Temperature stabilizes after 24 hours of treatment.
  - Improvement noted in pharyngeal ulceration.

- Final Outcome:
  - Complete recovery after 7 days of treatment.

- Laboratory Findings:
  - Swab: Negative for diphtheria toxin
  - Culture: Positive for Neisseria gonorrhoeae

- Notes:
  - Patient made an uneventful recovery.
Description of Case:

Bright tonsil covered with a thick, coagulated, white exudate. Tonsils are swollen, with a prominent midline. No tonsillar crypts. No cervical adenopathy.

Swab: Mixed results. Strep, staph, and cocci.

Culture: Negative. Positive for diphtheria bacillus.

Patient subsequently made an uneventful recovery.
**Case XCIV**

### Description of Case

- **Age:** 10 years
- **Disease:** Diphtheria

| Date | 15 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 |
|------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Temp | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 |

- **Result:** Recovery

**Remarks:**
- **Initial Symptoms:** Enlarged, Anterior, Round, Faint. No membrane
- **Subsequent recovery:** Made good and uneventful

**Cultural:**
- **Result:** Negative

**Histology:**
- **Result:** Negative
<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>17/4</td>
<td>41.5°C</td>
</tr>
<tr>
<td>18/4</td>
<td>42.0°C</td>
</tr>
<tr>
<td>19/4</td>
<td>42.5°C</td>
</tr>
<tr>
<td>20/4</td>
<td>43.0°C</td>
</tr>
<tr>
<td>21/4</td>
<td>43.5°C</td>
</tr>
<tr>
<td>22/4</td>
<td>43.0°C</td>
</tr>
<tr>
<td>23/4</td>
<td>42.5°C</td>
</tr>
<tr>
<td>24/4</td>
<td>42.0°C</td>
</tr>
<tr>
<td>25/4</td>
<td>41.5°C</td>
</tr>
</tbody>
</table>

**Description of Case**

Patient's colour is good. Both tonsils are covered with thick white membrane which is loose and detaching. Pulse is good and regular.

**Swab** = Throat, tonsil, nasal, oral, and Coeci.

**Culture** = Nasopharynx, Coeci, Throat

Patient subsequently made an uncomplicated recovery.
Case XCVI

Description of Case:

Female, aged 29. Disease: Dischiria G.

Description:

Fever, injected. Part of gly membrane at base of left lung. Pulse is slightest but regular.

Record:

Cultures: Neisseria Contua

Comment:

Pulse was always regular, and patient eventually made an uneventful recovery.
**Case XCVII**

**Description of Case.**


"Swabs: Good polar stained rods. Staphylococci and Coeci."

"Culture: Neisser Conjunctivae."

History:

Patient subsequently made an uncomplicated recovery.
Description of Case.

Dennis was a boy of 13 years and eleven months.

Thick dark grey membrane on posterior wall of pharynx. Sore on right side involved also on the left. Regular and good volume of saliva. Colour is opalescent.

Earache = Good earache of short duration.

Furuncle = No furuncle.

March 14th: Membrane on right side of palate. March 20th: Furuncle on posterior wall of palate. Throat also involved.

After this date patient made an unconspicuous recovery.
**Description of Case.**

Both tonsils are completely covered with white, thick, whitish membrane. Umbilicus also quite covered. Pulse regular but not always quite the same volume. Auscultation shows slight obstruction but there is no inaudibility.

**Bacteriology:** Good growth. Blood stained mucus. Difference in culture.

**History:**

Membranes removed by March 18th. Began 6000 units A.D.S. After which patient made an uncomplicated recovery.
Case C

Description of Case:

Booth tonsil connected at base with thick layer of gray membrane. Membrane also affected on right side. Pulse not quite regular in time or force.

SOURCES: Good clinical evidence. Blood

Pseudomonas, Staphylococci and Streptococci

Culture - Messrs. Bouttie

Part III.

I. Statistics of Foregoing Cases
II. The Degree of Severity of Foregoing Cases
III. Influences in Selection of Control Cases
IV. The Relative Severity of Formic Acid with Control Cases
V. Statistics of Control Cases
VI. Comparison of Statistics
VII. Analysis of Results in:
      (i) Cardiac Failure
      (ii) Paralysis
      (iii) Albuminuria
VIII. Conclusions
STATISTICS OF ACCOMPANYING CASES.

The accompanying statistics of the cases have been compiled with reference to the three main diphtheritic lesions, namely, Cardiac Failure, Paralysis, Albuminuria.

The deaths from Cardiac Failure - and in the case of the cases treated with Formic Acid this was the only cause of death - have been divided into 2 groups, each with 2 subdivisions, namely, (I.a) Progressive, (I.b) Sudden; (II.a) Early, (II.b) Late.

In the first group of cases the definition and dividing line is comparatively simple in most cases, but in the two cases referred to has been somewhat difficult.

In most cases the symptoms of progressive heart failure may be summed up as a gradually increasing intensity of the cardinal signs and symptoms of Cardiac Failure, namely,- Cardiac pain, vomiting, irregularity of pulse, etc., culminating in death. In the case recorded this was well exemplified. In the other case, No. 61, which has been classified as Sudden, there was also a series of progressive symptoms, but owing to the fact that the patient was apparently recovering, it has been classified
as sudden, in that it was not expected to occur when it did, if at all.

The second classification has been made on strictly orthodox lines, namely, the occurrence before or after seven days from the onset of disease - a view held by Myers, Trevelyan, and many others.

In the case of the Paralysis they are, both here, and in the control cases, minutely differentiated, but no attempt has been made to identify them with the date of onset of the disease.

The results of the statistics will be dealt with fully, later.
Formic Acid
1906

Analyses of Cases January 18th - March 18th

<table>
<thead>
<tr>
<th>No. of Cases</th>
<th>Died</th>
<th>Paralyses</th>
<th>Albumen</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>2</td>
<td>3</td>
<td>10</td>
</tr>
</tbody>
</table>

Analyses of Paralyses January 18th - March 18th

<table>
<thead>
<tr>
<th>Paralyses</th>
<th>Palate</th>
<th>Extremities</th>
<th>Throat</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Average age for 1906 = 11.3 years.

Analyses of Deaths from Cardiac Failure

<table>
<thead>
<tr>
<th>Progression</th>
<th>Sudden</th>
<th>Early</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

(Such case comprised two varieties.)

Average dose of Antitoxin = 62.65 units.
THE DEGREE OF SEVERITY OF FOREGOING CASES.

From the details of the foregoing cases it is evident that there are at least one or two cases of each variety of diphtheria shown among them. The cases are in no way selected, cases being taken strictly in rotation on their arrival at hospital. As before stated, the only cases rejected were those in which the clinical diagnosis was not fully borne out by the bacteriological examination.

An even more important point has been to attempt to determine the severity of the epidemic which, if mild, would modify the value of the results.

Two main factors have been investigated to determine this:

1. The average amount of Antitoxin.
2. The average age of the patient.

The average dose of Antitoxin.

As shown before (page 24), the doses of antitoxin have been given more or less on a fixed scale in relative proportion to the severity of the cases and the complications arriving in them. This applies strictly for the preceding four years, as, before that date, the theories of the amount of
antitoxin were not so fixed as they at present are. As the doses of antitoxin in the hospital have been prescribed for the past four years and also for the 100 cases treated by Formic Acid by the same individual acting on the same fixed principles, it is possible, accordingly, to judge by the average dose the average severity of the case.

The average dose of Antitoxin for the past three years is 6,300 units, thus: for 100 consecutive cases considered in 1904 it is 6,400 units, for 100 consecutive cases considered in 1905 it is 4,760 units, for 100 consecutive cases considered in 1905-06 it is 4,820 units, and for the 100 cases treated by Formic Acid it is 6,265 units; so that from this standpoint the cases may be judged to be of at least average severity.

The age of the patient has been the second factor observed.

Varying as the mortality does in diphtheria with the age of the patient, this must necessarily be of great importance, and Myers (Lancet 1900) has shown in a large number of cases how definitely true this is; thus in 275 cases of paralysis and paresis taken from 1,316 cases of diphtheria, the following results were obtained:
The 275 cases taken in five yearly periods.

<table>
<thead>
<tr>
<th>Age periods</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 5 years</td>
<td>59</td>
<td>45</td>
<td>104</td>
</tr>
<tr>
<td>5 to 10 years</td>
<td>66</td>
<td>72</td>
<td>138</td>
</tr>
<tr>
<td>Over 10 years</td>
<td>22</td>
<td>11</td>
<td>33</td>
</tr>
<tr>
<td>Totals</td>
<td>147</td>
<td>128</td>
<td>275</td>
</tr>
</tbody>
</table>

Thus out of the 275 cases there were 174 cases occurring between the ages of three and eight, equalling 63.2 per cent. of the total number; again there were 40 cases between the fifth and sixth years of age, equalling 14.5 per cent; while in the cases of cardiac paralysis the great proportion of cases occurred between the ages of two and nine, the majority occurring in the sixth and seventh years' age-period.

The average age of the successive groups of one hundred cases has been 12.2, thus:— for 100 consecutive cases considered in 1904 it is 9.7 years, for 100 consecutive cases considered in 1905 it is 12.5 years, for 100 consecutive cases considered in 1905-06 it is 10.5 years, and for the 100 cases treated by Formic Acid it is 11.3 years; so that in this respect they compare more than favourably with preceding epidemics, and the fact that in the 100 cases treated by Formic Acid, twelve patients
were between five and six years of age, while fifty-five were between the ages of two and nine, would appear to prove that the ordinary percentages of paralysis and cardiac failure might have been expected.

It would seem, therefore, with such a positive result in both the factors taken into consideration, that it is safe to assume that the severity of the cases considered was at least an average one.

**INFLUENCES IN SELECTION OF CONTROL CASES.**

In order to analyse more thoroughly the results of treatment in the foregoing cases, a careful analysis has been made of three series of cases, each series numbering one hundred cases. Each series has been composed, as in the cases under consideration, of consecutive cases save that, as before, none have been considered which were not also bacteriologically positive.

In order that the type of the disease might be as similar as possible in the control cases as in those treated by Formic Acid, two series, each of one hundred cases, have been considered in 1904 and 1905, each as nearly as possible in the same months, viz: - January, February and March. The remaining
one hundred cases are those immediately preceding
the cases treated by Formic Acid so as, if possible, to ensure that the particular epidemic did not vary to any degree with those of others.

There are then 200 cases taken from the corresponding season of the year for the past two years and 100 cases which may fairly be said to be of the same epidemic as that considered.

It may be well to state once more that by 'control cases' is meant the 300 cases dated 1904, 1905, 1905-06, and that the treatment adopted in all these cases was exactly similar, while that, as has also been stated before, the treatment by Antitoxin is the only connecting link between those cases and those treated by Formic Acid.

RELATIVE SEVERITY OF CASES TREATED BY FORMIC ACID AND CONTROL CASES.

On the same principle but with more minuteness the relative severity of the two groups of cases may be adjudged as follows:

1. The control cases - namely, cases treated as detailed in Part I., page 9, are (a) either of the same months in the years, or (b) the same epidemic.
2. The average dose of Antitoxin for the control cases, namely: - for 1904 = 6,400 units, for 1905 = 4,760, for 1905-06 = 4,820, while that for 1906 = (the cases treated by Formic Acid) 6,265. It would appear, therefore, that from this standpoint the cases were of quite as great if not greater severity.

3. The average age of the patients in the control cases was: - for 1904 = 9.7, for 1905 = 12.5 years, for 1905-06 = 10.5, while that for 1906 was 11.3, and that again from this standpoint the cases are at least as severe as the preceding ones.

4. The two groups of cases are composed of cases both clinically and bacteriologically positive.

5. That the cases under treatment by Formic Acid were kept under observation even longer than the preceding ones (page 14) and that, therefore, paralysis occurring later in the disease was even less likely to have escaped notice.
The statistics of the accompanying control cases have been arranged in the same manner as those of the cases treated with Formic Acid.

The cases are in each series consecutive cases, nor, as has been said, are they in any way selected cases, except that no cases have been included which were not both bacteriologically and clinically positive.

As will be observed the statistics are much the same, but rather better than a wide series of statistics taken from other hospitals, namely about 11.3% for cases treated on the third and fourth day from the onset of the disease. Although the different series of cases are given separately, an average result of the three groups of cases is also appended, that a broader basis may be given for the results of comparison. The results of comparison will be discussed in detail later.
1904.

**Analyses of Cases January 2nd, 1904 – March 18th, 1904.**

<table>
<thead>
<tr>
<th>No. of Cases</th>
<th>Died</th>
<th>Paralyses</th>
<th>Albumen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 12th, 1904</td>
<td>Cardiac failure</td>
<td>100</td>
<td>10</td>
</tr>
<tr>
<td>March 18th, 1904</td>
<td>Broncho-pneumonia</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

**Analyses of Paralyses January 12th, 1904 – March 18th, 1904.**

<table>
<thead>
<tr>
<th>Paralyses</th>
<th>Palate</th>
<th>Account &amp; Pector</th>
<th>Extremities</th>
<th>Inclined to fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

- Mixed Paralyses | + Palate | + Account & Pector | + Legs & Account & Pector | + Inclined to fall |
| 8 | 3 | 3 | 3 | 5 |

**Average age for 1904 = 9.7 years.**

**Analyses of Deaths from Cardiac Failure.**

<table>
<thead>
<tr>
<th>Progressive</th>
<th>Sudden</th>
<th>Early</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

Within 7 days.

**Average dose of Antitoxin 1904 = 6400 units.**
### Analyses of Cases January 16th 1905 - March 20th 1905

<table>
<thead>
<tr>
<th>No. of Cases</th>
<th>Died</th>
<th>Paralyses</th>
<th>Albumen</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 16th 1905</td>
<td>(Cardio Failure)</td>
<td>(all varieties)</td>
<td>100</td>
</tr>
<tr>
<td>March 20th 1905</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Analyses of Paralyses January 16th 1905 - March 20th 1905

<table>
<thead>
<tr>
<th>Paralyses</th>
<th>Palate</th>
<th>Acrom.</th>
<th>Recti</th>
<th>Jubes post.</th>
<th>Extremities</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>8</td>
<td>8</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

- Classical Paralyses: Palate: 4; Acrom.: 3; Recti: 1; Jubes post.: 3; Extremities: 1
- " ": Palate: 1; Acrom.: 3; Recti: 1; Jubes post.: 3

### Average age for 1905 = 12.5 years

### Analyses of deaths from Cardio Failure

<table>
<thead>
<tr>
<th>Progressive</th>
<th>Sudden</th>
<th>Early</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Average dose of Antitoxin 1905: 4760 units
### Analyses of Cases. November 9th 1905 - January 20th 1906

<table>
<thead>
<tr>
<th>No. of Cases</th>
<th>Died.</th>
<th>Paralyses</th>
<th>Albumen</th>
</tr>
</thead>
<tbody>
<tr>
<td>November 9th 1905</td>
<td>Cardiac failure</td>
<td>all varieties</td>
<td>100</td>
</tr>
<tr>
<td>January 20th 1906</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Analyses of Paralyses. November 9th 1905 - January 20th 1906

<table>
<thead>
<tr>
<th>Paralyses</th>
<th>Palate</th>
<th>Recti</th>
<th>Extremities</th>
<th>Special muscles</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

Palate = 2, legs = 2, legs + Palate = 2

### Average age for 1905 - 1906 = 10.5 years.

### Analyses of deaths from Cardiac Failure

<table>
<thead>
<tr>
<th>Progressive</th>
<th>Sudden</th>
<th>Early</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td>2</td>
<td>7</td>
</tr>
</tbody>
</table>

(between 7 days)

Average dose of Antitoxin = 4820 units.
Total Average of Control Cases.

Cardiac Failure:
1904 = 10%. 1905 = 7%. 1905-06 = 9%.
Total Average = 8.6%.

Paralysis:
1904 = 17%. 1905-06 = 8%.
Total Average = 14%.

Albumen:
1904 = 45%. 1905 = 35%. 1906-06 = 34%.
Total Average = 38%.

Cardiac Failure   Paralysis   Albumen
8.6            14            38
COMPARISON OF STATISTICS

The remaining statistics show a comparison between those cases already described treated by Formic Acid and the control cases treated as described on page... The results, when described together, appear more than good and the necessity of proving that the types of epidemic were equally severe the more apparent.

As will be shown later, also when dealing fully with the more severe cases in the series treated by Formic Acid, nine of the cases there described had the cardinal signs and symptoms of impending cardiac failure and yet recovered, it is therefore not too much to expect that with different treatment the statistics might have been similar. Thus the death-rate in the Formic Acid cases is 2%, while nine cases during the first five days had vomiting, irregularity of pulse, pain, etc. - and yet recovered. This would have given a percentage of 11% which is practically the percentage of the control cases and for most hospitals. It is also interesting to note, as will also be shown later, that in the cases of paralysis, two occurred in cases complicated with measles and not until 16-18 days after the accidental stoppage of the drug.
The results in Albuminuria are again more than good and are even proportionately better than those of Cardiac Failure and Paralysis.

It will be best to discuss these points under "Analysis of Results" after the statistics themselves have been considered.
### Strychnine

**1904 January-March. Analyses of deaths from Cardiac failure.**

<table>
<thead>
<tr>
<th></th>
<th>Progressive</th>
<th>Sudden</th>
<th>Early</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>within 4 days</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

### Strychnine

**1905 January-March. Analyses of deaths from Cardiac failure.**

<table>
<thead>
<tr>
<th></th>
<th>Progressive</th>
<th>Sudden</th>
<th>Early</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>within 7 days</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

### Strychnine

**1905-06. November-January. Analyses of deaths from Cardiac failure.**

<table>
<thead>
<tr>
<th></th>
<th>Progressive</th>
<th>Sudden</th>
<th>Early</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>within 7 days</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>7</td>
</tr>
</tbody>
</table>

### Formic Acid

**1906 January-March. Analyses of deaths from Cardiac failure.**

<table>
<thead>
<tr>
<th></th>
<th>Progressive</th>
<th>Sudden</th>
<th>Early</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>within 7 days</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
### Strychnine

#### 1904: Analyses of Cases. January 12<sup>th</sup> - March 18<sup>th</sup> 1904

<table>
<thead>
<tr>
<th>No. of Cases</th>
<th>Died</th>
<th>Paralyses</th>
<th>Albumen</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 2&lt;sup&gt;nd&lt;/sup&gt; 1904</td>
<td>100</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td>March 18&lt;sup&gt;th&lt;/sup&gt; 1904</td>
<td>100</td>
<td>10</td>
<td>17</td>
</tr>
</tbody>
</table>

#### 1905: Analyses of Cases. January 16<sup>th</sup> - March 20<sup>th</sup> 1905

<table>
<thead>
<tr>
<th>No. of Cases</th>
<th>Died</th>
<th>Paralyses</th>
<th>Albumen</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 16&lt;sup&gt;th&lt;/sup&gt; 1905</td>
<td>100</td>
<td>7</td>
<td>17</td>
</tr>
<tr>
<td>March 20&lt;sup&gt;th&lt;/sup&gt; 1905</td>
<td>100</td>
<td>7</td>
<td>17</td>
</tr>
</tbody>
</table>

#### 1905-06: Analyses of Cases. November 9<sup>th</sup> 1905 - January 20<sup>th</sup> 1906

<table>
<thead>
<tr>
<th>No. of Cases</th>
<th>Died</th>
<th>Paralyses</th>
<th>Albumen</th>
</tr>
</thead>
<tbody>
<tr>
<td>November 9&lt;sup&gt;th&lt;/sup&gt; 1905</td>
<td>100</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>January 20&lt;sup&gt;th&lt;/sup&gt; 1906</td>
<td>100</td>
<td>9</td>
<td>8</td>
</tr>
</tbody>
</table>

### Formic Acid

#### 1906: Analyses of Cases

<table>
<thead>
<tr>
<th>No. of Cases</th>
<th>Died</th>
<th>Paralyses</th>
<th>Albumen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac failure</td>
<td>100</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
### Strychnine

**1904**  Analyzes of Paralyzes. January 13th, 1904 - March 19th, 1904

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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### Strychnine

**1905**  Analyzes of Paralyzes. January 16th, 1905 - March 20th, 1905

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### Strychnine

**1905-06**  Analyzes of Paralyzes. November 1st, 1905 - January 25th, 1906

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### Formic Acid

**1906**  Analyizes of Paralyzes.

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ANALYSIS OF RESULTS

Although the broad results of treatment are well seen in the tables of statistics, it will be best to more minutely examine each complication in detail and to attempt to give an explanation of the results.

Cardiac Failure

With an improvement in the death-rate from 8.6% to 2% it must seem as though Formic Acid has a distinct and definite effect in this - the most serious diphtheritic complication.

Cases 10, 19, 39, 45, 57, 59, 76, 81 and 89 are all types of cases which may fairly be said to have shown symptoms and signs of heart failure sufficiently severe as to have warranted a very bad prognosis in the ordinary course of the disease. In case 89, cardiac pain, vomiting, obvious toxaemia, irregularity of pulse, pallor, occasional coldness of limbs, systolic mitral murmurs and weakness of the first sound of the heart are signs and symptoms which, in the ordinary course of the disease would warrant a prognosis of the worst type and more especially when occurring late in the course of a severe attack of scarlatina.

Still more striking is Case 76, where, with symptoms of impending heart failure and toxaemia to
a more than marked degree there was present broncho-
pneumonia and, as in Case 89, complete recovery.
A. specially interesting feature in Case 76, is the
fact that a hypodermic injection of Strychnine
Hydrochlor, given as a control experiment had no
effect on the pulse or general condition, while
with an equal dose of the Formate a marked improve-
ment was visible within forty minutes, improvement
which was increased and maintained with two similar
doses. It may also be pointed out that at the
time of administration, the pulse was running and
almost imperceptible.

In the two cases which died, although one was
progressive and the other - as has been shown
"doubtfully" sudden - the degree of toxaemia before
the first administration was extremely profound
and it would seem impossible to overcome a toxaemia
which had already poisoned every system and organ.

One other interesting point is that there
were no threatenings of Cardiac Failure in any of
the cases in the very late stages of the disease,
a fact which would seem to prove how thoroughly the
toxaemic element had been eliminated and how thor-
oughly the stimulant effect had persisted.

The main features in all the cases are:

1. The remarkable regularity of the pulse
even after irregularity has been present in
most pronounced degree. With the exception of some four cases, the pulse has been regular within five days of administration and in the great majority of cases within three days of administration.

2. The marked improvement in the general nutrition of the patients, as shown by their colour, appetite, lack of depression, etc., which has been, as is noted in the details of the cases, as a rule, within four days of administration and which would point to a successful combating of the toxaemia.

So far, then, the results appear to show that Formic Acid and the Formates have a distinct stimulant effect on the heart and that, given a not too profound toxaemia before administration, the general nutrition and vitality of the muscles is so improved as to combat with success the toxaemia of this particular disease and to prevent a subsequent degeneration.

To what may this be due?

As has been shown, the line of treatment carried out in these cases – namely by Formic Acid and by the occasional use of Belladonna – was one of stimulation by non-blood pressure raising drugs. The former treatment, on the other hand, – namely treatment by Strychnine, strophanthus, digitalis
and adrenalin chloride,—was entirely by drugs which raised blood pressure, in different ways but with the same result. If, however, as in diphtheria, the heart is weakened by toxaemia and the inhibitory apparatus is also affected, as shown by the condition of the pulse, and if degeneration is the almost constant accompaniment, as is the case, it would seem that by raising blood pressure and so increasing the amount of work which the heart has to perform, that a contrary result to what is hoped for, must ensue—namely an increase of degeneration and a further strain to the heart.

The addition, in occasional laryngeal cases, of Belladonna which, in small doses, modifies the inhibitory action of the Vagus nerve and so increases the output of the heart per minute, has been therefore strictly in accordance with views such as these.

It is possible, therefore, that the astonishing difference in the results obtained from the two courses of treatment has been due to the broad fact that, whereas the 300 control cases were treated by strychnine, strophanthus, adrenalin chloride, etc.—namely, blood-pressure raising drugs—the 100 cases treated by Formic Acid and occasionally Belladonna, were treated by non-blood-pressure raising drugs, and that, therefore, the heart was not so severely
taxed as regards the amount of work imposed upon it in the latter cases.

It seems more probable, however, that the results are due to a combination of this fact with the actual stimulant properties of Formic Acid, and that with a gradual stimulation of striped muscles all over the body and direct stimulation of the heart, the resistive power of the individual must be enormously increased unless, as has been shown in the two cases referred to, degeneration has already occurred in an advanced degree. If this is the case, the nervous system must be indirectly benefited, for the exact selective influence of diphtheritic toxine is as yet uncertain, and it is, therefore, by the combination of these two factors that results, so good as these, have been obtained.

It may be urged, that, for this complication of the disease, 100 cases does not leave a sufficient margin as to warrant the obtaining of a definite result. While this, no doubt, is true, so large a percentage of recovery among cases with undoubted signs and symptoms of impending Cardiac Failure would seem to negative this assertion and, in any case, to prove the necessity of a prolonged and exhaustive trial of the drug in the disease.
Paralysis.

While the percentage of paralysis of all varieties - namely three, is not far different from that of the deaths from Cardiac Failure, the improvement in results is much more marked.

A fall in the Paralysis rate of 11%, namely, from 14% to 3% is more satisfactory even than the results of the former complication.

While the results of the total numbers of paralysis appear more than good, the mild type of the paralysis is also satisfactory. Thus, of the three cases of paralysis recorded two were benign, namely palatal, and the third a very slight paresis of the lower extremities with only slight alteration in reflexes, and a subsequent complete recovery. In the two palatal cases there was in both cases an alteration in speech, but no difficulty in swallowing. A third interesting feature of these cases of paralysis is the fact that two out of the three recorded cases occurred during a subsequent attack of measles, and that in both cases the drug had been discontinued from 16 to 18 days before the symptoms appeared.

Thus, cases 59 and 73, the first, a case of palatal paralysis and the second, one of paresis of the lower extremities, were both treated for diphtheria for two and a half weeks with Formic Acid;
both developed measles, and were transferred to another ward, where for sixteen to eighteen days, the drug was unfortunately discontinued and the paralysis appeared.

It is possible that the paralysis in both cases was the result of the Measles Toxaemia, following on the Diphtheritic, or again that it was due to a too early discontinuance of the drug. It would seem impossible to differentiate on account of the similarity of both cases, and it would seem safer to assume that a combination of both circumstances was the cause. This in fact must almost of necessity be so, for, with an increase in the degree of Toxaemia, the necessity for the continuance of treatment must be more apparent.

Here again as in the results of Cardiac Failure doubt might be expressed as to the severity of the epidemic, but proof as to this would seem to have been proved positive, and out of the hundred cases, at least twenty-five cases were so extremely toxemic as to warrant a doubtful prognosis of paralysis, and, under ordinary circumstances, a percentage at least average in number and type with other cases cited as control.

The multiplicity of lesions described in this complication of Diphtheria, render it the more
difficult to give an adequate explanation of the results of this treatment. As has been shown by Manicatide, many of these lesions are purely muscular, and with the use in frequent small doses of such a drug as Formic Acid, results similar to these might be expected. In those cases where the lesion is primarily central with a Wallerian degeneration of the peripheral nerves, it would seem as though two objects might be obtained: (i) To give complete rest, and by using Formic Acid to keep the muscular system in tone and the general nutrition good, until the nervous system - if not too severely poisoned - recovered; or (ii) to attempt to prevent this occurring in a severe form by successfully combating as soon as possible the toxaemia by early large doses of Formic Acid and the Formates.

With such statistics from treatment such as this, it may be considered if hitherto the muscular element in diphtheritic paralysis has not been underestimated, and that many of the early, and less severe forms of paralysis are not muscular, with a less severe degree of nervous element than is generally supposed.

A theory such as this would appear to suit well the results obtained with Formic Acid in these cases, and might explain the diminished number of deaths from Cardiac Failure as well as the lack of paralysis of other varieties.
Albuminuria.

Although the diuretic effect of Formic Acid and the Formates in the disease has not been pronounced, the great reduction in the percentage of albumen - namely from 38% to 10% - is noteworthy.

While in one case (No. 90) the amount was great and prolonged, it may be noted that the patient was suffering from pleurisy with effusion and a high swinging temperature. In the remaining case, the appearance of albumen was within two days of admission and was only present, at the most, on two occasions. There were, apart from the absence of albumen, no noteworthy features in the urine.

That the Formic Acid exercises any direct effect on the kidney is difficult to suppose and it would seem as though the result was obtained chiefly by the general condition of the patient being so good as to be highly resistant to the toxine, while that in the percentage and doses given the blood-pressure was not raised and no diuresis ensued.

It is interesting to note that in the two cases in which antitoxine was given in largest amount - namely 76 and 81 - albumen appeared on the second day in one only and not again, and this would, in a slight degree bear out the observations of Variot that the two are in no way connected.
There can be little doubt that the amount of albumen is, as a rule, in proportion to the severity of the toxaemia and the explanation of the results obtained would seem to be as stated above, rather than any direct action of the drug on the kidneys.
CONCLUSIONS.

It is difficult not to conclude that results, such as these, are sufficiently successful as to at least warrant a thorough and prolonged trial.

It may be urged that the influence of antitoxin has not been given the prominence due to it, but has purposely been disregarded as being in the same proportion for the Control Cases.

Treatment would, therefore, appear to resolve itself into:

1. Adequate and early doses of Antitoxin;
2. Rest in proportion to the severity of the case;
3. Gradual and proportionate stimulation by Non-blood-pressure raising drugs;
4. The use of Formic Acid and the Formates; and until proof positive negatives it, that, with such results, a thorough trial of such lines of treatment must be made at the expense of the older treatment which relied for stimulation solely on an increase of blood pressure, while it would seem to be the case that Formic Acid and the Formates, by their influence on every complication of importance in diphtheria, render them, in that disease, drugs of the greatest importance.