Diphtheria—With Cases and Historical and Experimental Notes.

Explanatory Note.
This Thesis had its origin in a collection of notes of cases of diphtheria and other like throat troubles. In time experimental notes were added. In time this was followed by historical points but the whole was found to form such an ill assorted and fragmentary collection that in order to gather up the whole into a succinct essay a review or criticism of some of the disputed points of diphtheria has been written and it now forms the first portion of this Thesis.

The whole is submitted to my University in the hope that it may be deemed worthy the degree of doctor of medicine.

Leeds
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John Gordon Sharp.
# Diphtheria - With Cases and Historical and Experimental Notes

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Diphtheria.

History.
The history of diphtheria has been so fully written up by Blyth and the Committee of the Royal Medical-Chirurgical Society and by Bretonneau and others that almost nothing more can be said on the subject. Although it only within the last sixty years since special attention has been given to the disease, it has been described by English writers of a hundred years ago or more. In Scotland it has been known for over two hundred years.

Names formerly given to the Malady.
These are given by various writers and the list is a very long one and we owe a deep debt to Bretonneau for having suggested the name Diphtheria which since 1826 has been adopted by writers and is now the recognised name for a disease in which a well-marked cases a leathery like membrane is produced. As showing how slowly old names die I knew an old gentleman who in his student days used to the name putrid sore throat often used to of diphtheria by that name. He recognized it as a distinct clinical affection.
Confusion with Other Diseases

The slow growth of knowledge is shown by the confusion that so long existed between diphtheria and— notably secalatina. This is easily accounted for in various ways. (1) Because of the close relationship between the two maladies. Epidemics of each often occur side by side and a soil or surrounding suitable for diphtheria often prove a good breeding ground for secalatina. And a peculiar type of constitution is often suitable for both diseases. One member of a family may have secalatina while another has at the same time or within a short period of time, diphtheria or diphtheria may attack an individual followed by secalatina in a few months or weeks or at some indefinite period of time. I had a patient recently who had a typical attack of diphtheria and who some year or two ago had had secalatina. (2) The throat is often severely affected in secalatina and the rash may escape detection or rather I should say in the past may have escaped notice when men were less on their guard or when prejudice prevailed as I often did. It is easy for us today to distinguish between the two affections for we profit by the mistakes of
our predecessors but these men were many of them unconsciously paving the way for us.

3. Diphtheria being often accompanied by a rash we wonder still at mistakes being made under the circumstances. There is little wonder that whole epidemics (nearly whole) of scarlatina have been described under the name of diphtheria or to be accurate the name by which this affection was then known. If one respects our forefathers deserve the highest credit in that they do not appear to have confused the so-called angina maligna with simple sore throat. I have been especially struck with this. And the older practitioners some of whom I have been privileged to be associated with seemed to have little difficulty in diagnosing true diphtheria by its purely clinical features. I am afraid this is an exercise which is now a days too much neglected.

Relationship to Membranous Croup

The consideration of this aspect of the question involves so much controversy and the consideration of so many points that I have ventured to give it a section to itself (see page 42)
Etymology.

Geographical Distribution

So far as can be gathered from authorities the disease is universally distributed.

The Relationship to Soil and Surroundings

Most writers appear to attach less importance to these points than judging from the nature of the affection one would think. In Ziemsen the writer says poor drainage, bogs, marshes and dwellings level with the ground favour the disease. Fred. Roberts quotes Horne as saying water has no influence but soil may have an influence in the spread of the disease. In another place I have referred to Adam's opinion on the influence of soil. Seaton asserts his belief that (contrary to the doctrine almost universally taught) there are but slender grounds for supposing that diphtheria is influenced favourably or unfavourably by what are generally termed sanitary conditions, and the writer goes on to say that the mortality in England has risen with adoption of water supplies and sewage systems during the past fifteen years. On the other hand we find Chadwick giving as his opinion that the spread of the disease appeared
To have been assisted by such conditions of house
drains and of sewers as had tended to the deposit
and retention in them of offensive and infectious
matters" Wilks 13 speaks of the independence of
diphtheria of bad hygienic conditions had now been
shown to be absolutely true. Sir Geo. Johnson 14 asserts
his belief in the influence of bad hygienic surround-
ings in the spread of diphtheria and he has more
than once stoutly defended his views on this point.
That soil organic in character has an influence
in the spread of diphtheria I have often observed.
In a district of Scotland situated on the borders
of Inverness-shire and Banffshire diphtheria
often breaks out although not so common since
the sanitary conditions have improved. I knew a
part of Inverness-shire near Glenmore where no
horse formerly existed. A gamekeeper's house was
built and in a month or two after diphtheria
attacked the children of the keeper who had just
removed to the new house. On one side the nearest
neighbour was half a mile distant and on the
other side many miles. The soil all around was of
a peaty nature with decayed vegetation and fir
trees. In all appearance the children contracted the
disease in the new house. The fact of disturbing
The organically laden soil may have had an effect in distributing the germs of disease. Diphtheria often breaks out in new middle-class districts where there is no reason to suspect the drains or plumber work. This may be due to dissemination of the organisms contained in the soil and this leads us to the consideration of another point namely why the very poor children often escape while the children of the well to do often suffer. It is perhaps in this as in many other diseases that the tissues of the poor child are barred up against the attack of disease while the tissues of the more favoured child are not so well able to resist disease.

Turning to the question of defective drains and bad hygienic surroundings my experience teaches me that these have a marked effect. In the Domintail district already mentioned diphtheria has disappeared very much since greater attention has been paid to drainage around the huts and since the huts themselves have been better ventilated and otherwise improved from a sanitary point of view. The people of this district are better fed and the earthen floor has given way to wooden flooring.
The peculiarities of soil of the district may account for the outbreaks of the present day. In one district of Leeds, "we occasionally have cases of diphtheria" difficult to account for. The district is dotted over with market gardens and the soil has certain peculiarities which may be conducive to the growth of the organism. Seaton's statement about diphtheria increasing with improved sanitation in towns can be met with another that rural districts where formerly no effort was made at sanitation were the greatest sufferers from diphtheria. To-day I much question if the disease was common in country districts as formerly and certainly within the last ten years there have paid great attention to sanitation. Typhoid fever attacks the well to do in great numbers despite their favoured surroundings and certainly this disease is due to some defect in sanitation as it is no argument to say sanitation has nothing to do with the spread of diphtheria. A defect in our sanitary arrangements in one part of a town may be the means of setting up typhoid fever or diphtheria which may spread to a district practically perfect in its hygiene.
ill we have whole towns and districts provided
with a pure water supply and a good working
sewage system and proper means for the
disposal of refuse of all kinds we cannot say
that diphtheria exists independent of bad
hygiene arrangements. In Australia some
of the worst possible cases of diphtheria are seen
here the people in the bush live in houses
covered with wattle and earthen uneven floors
are common and often the people are dependent
for their water supply on tanks of rain water
into which droppings of cats and other
animals find an entrance. Often times
otherwise the dirty water of all kinds is simply
thrown out of doors where it percolates into the
soil the whole forming a good culture ground
for organisms. To show the effects of drains
I mention three instances (1) In a part of the
Highlands where diphtheria is almost unknown
the water closet system became blocked in the
summer. Three children of the house died of
the disease within one week. The drains were
put in order and no more cases occurred.
(2) In 1874 two families in Leeds brought an
action against the landlord for compensation.
for the death of relatives. The houses had been built over an old open drain in consequence of which both families had been seized with diphtheria.

In a district of Leeds in 1875—a street had all the kitchen sinks trapped inside the house. Several of my patients and several patients of other practitioners contracted diphtheria. Two deaths took place. In the next street all the drains were trapped outside and all the dwellers remained free from diphtheria. Old houses often remain free from the disease while new ones often are the seats of trouble. The same is seen with regard to typhoid fever and one can only account for it by saying that time has freed the soil (on the surface at least) from the germs of the malady.

Season of the Year

"Taking the average of a long series of years this disease has reached its highest prevalence in November and December and the deaths from diphtheria reach above the average from the first September till the first of March. These periods point to the time when the"
soil is most heavily charged with organic refuse in the shape of decayed vegetation.

**Family Susceptibility**

Johnstone of Worcester writing in 1779 makes some valuable observations in this connection. He writes: “Children who have always a relaxed habit and fibres extremely delicate and tender are predisposed to the malignant angina. In the same way too copious evacuations predispose to the disease hence women who have the menstrual discharge in a large quantity are particularly subject to it.” I have seen this illustrated in my own practice. A family consisted of a son aged 23 and four daughters aged respectively 20, 19, 17 and 9 years. The son had diphtheria followed by profound paralysis and finally recovered. The youngest daughter (aged 9) caught the disease and died; the three eldest daughters did not contract the disease. But the family peculiarity is to be found in these three eldest daughters. They all suffer from most profuse menstruation and have to provide themselves with specially prepared napkins.
On the other side we have families who appear to enjoy immunity from the disease. Drusseau failed to inoculate himself and his assistant and I have known membrane coughed into the face and eye of an operator who could not for a second or two free his hands to remove the particles and yet he suffered no after-trouble. The same practitioner on another occasion by mistake used a small napkin to wipe his face which a few minutes before he had employed in wiping the eyes of a patient suffering from very severe purulent gonorrhoeal ophthalmia. A short period of redness of both eyes was all that resulted. He too tells me that although he performs a large number of examinations of the dead body he has never suffered any constitutional disturbance from the various pricks which fall to the lot of the most careful operator. In the same way we can understand and explain why diphtheria may kill one person, affect another with a paralysis which is recovered from and a third with signs and symptoms so trifling as to almost escape detection. I say signs and symptoms
for everyone who knows anything of the disease knows that the mere redness of the throat may be followed by death or severe paralysis.

Relationship to the Lower Animals

Although cows are supposed to have spread the disease I have not seen any cases traceable to them. E. Klein inoculated two cows and they contracted the disease which was attended by symptoms differing much from what one finds in the human subject. Papules appeared on the udders but whether a membrane was present I am unable to make out. One of the cows died and the other was killed. The cows are described as having a cough but this must be a mistake for I was under the impression that cows could not cough.

As to cats I have not seen any of these affected with the disease but I know of an instance in which an affected animal so supposed to have conveyed diphtheria into two families several of the members of whom died. Diphtheria on cows in poultry may be related to diphtheria as it affects the human
being. I know of no case of direct infection. This however is not so likely to take place for hens are not so intimately associated with children and others as cats or even cows. The fact that hens frequently suffer from a disease producing a membrane like diphtheria shows that the organism most likely lives in the soil and we have good reason for believing that the organism of human diphtheria inhabits the soil. Crep like crep is a clinical term and may mean true diphtheria or an inflammation of the air passages. Taken as a whole it is a highly fatal malady.

Morbid Anatomy.
The personal observations which I have to offer under this heading are such as are chiefly confined to the bedside consequently they are better to be considered under the headings Pathology and Diagnosis.

Pathology.
Use the term in its widest acceptation. Assuming that the Klebs–Loeffler
bacillus as the cause of diphtheria we start with the implantation of the organism in some part of the body where it multiplies and gives rise to a chain of symptoms of the most interesting character. Whether the organism merely keeps to the surface and secretes toxins which are absorbed into the general circulation or whether the organism itself enters the tissues is evidently not decided by Sidney Martin only found the organism on the surface; Kanthack found it in the internal organs as well. We may suppose some slight abrasion is necessary before the organism can attach itself to a tissue. However, something more would appear to be often necessary for abrasions of the skin surface are common and yet cutaneous diphtheria so rare. Cutaneous diphtheria was commoner in Bretonneau's time and the French physicians of his day said that in times of epidemics a blister applied to the surface of the body was frequently followed by a diphtheritic membrane over the blistered part. The throat would appear to be the breeding ground for the bacillus and I offer the following suggestions on this point. Starvry food is acted upon
by the salivary secretions and is changed into sugar. Now in the mouth particles of this kind of food are seldom absent from the mouth especially of the young child and for this reason a small quantity of sugar can seldom be absent from the mouth especially around an enlarged tonsil. Here then we have a field for the growth of the organism and with this a suitable temperature. If any abrasion exists then the conditions are still more favourable to the organism.

The bacillus of diphtheria having attached itself to the throat or other part would first seem to act like a strong mechanical or chemical body by destroying the tissues and producing fibrin. This fibrin would appear to be a highly suitable nest for the growth of the organism. The next change is the production of albumose (dentro) from the proteids of the tissues and an organic acid as explained by Sidney Martin who found no base present in this diphtheritic digestion. These two bodies (albumose and organic acid) are absorbed into the circulation and most likely bring about the various changes in the tissues.
albumose appears to differ somewhat in action from the acid being more powerful. Although
Martin's observations so far as I am aware have not been confirmed we may in the main
accept them as correct. If I mistake not no combustion has been made of this acid hence
we know little or nothing of its composition
and constitution. To get organic acids free
from bodies with which they are associated is
often difficult hence we cannot be sure that
the acid found by Martin was quite pure,
and the association of a small amount of
albumose would give an effect very similar
only less powerful than pure albumose. I
mention this because many of not all
bacilli produce fatty acids and the organic
acid of the diphtheria bacillus may be
simpler than at first would appear.
The presence of the acid is of the greatest
significance for an acid medium seems to
be detrimental to the growth of the organism
of diphtheria: hence we have nature's
method of combating the further progress of
the disease.
Whether the disease remains local for a time
or very soon passes into the circulation is a
point of great uncertainty but the fact of
albuminuria appearing on the first or
second day of the disease looks as if diphtheria
was from the first a general and not a local
disease. A mere redness of the throat with or
without membrane may give rise to severe or
fatal paralysis. To my mind this points
to the disease being general from the first.
Returning to the question of albumin in the
urine one finds it present in the great
majority of cases of true diphtheria and in
those cases in which albumin is absent—
we can account for it by saying the kidneys
have not suffered to any great extent or that
they have been equal to the strain of elimina-
ting waste matter.
The products of the organism (or the organism
itself) having been absorbed into the
system blood poisoning results and it is
as such that diphtheria must be regarded.
Sidney Martin\(^2\) has shown that the blood is
profoundly altered and it is to it that the
changes in the other tissues are due. But a
quarter of a century before Martin had proved
this experimentally Thomas Watson \textsuperscript{22} had come
to the same conclusion based on his clinical
observations and we find him writing: "All
these sequelae are significant of blood poison-
ing. We cannot suppose that the nervous
symptoms transient and wandering as
They often are can have their cause in any
grave or material damage in the nervous
centres. They denote I presume disturbed
nutrition of the tissues from imperfect or
altered conditions of its circulating blood."
This places diphtheria in the same category of
diseases with thrush, cholera, peritonitis and
snake-like all of which are blood poisonings
Thrush as affecting babies is a slow but often
purely fatal malady. Peritonitis too is often slow
in its fatality and two of the organisms found
in its course are those often associated with the
bacillus of diphtheria namely staphylococcus
and streptococcus (and if my memory fails
me not Jennison Browne has recorded a fatal case
of sore throat in every way like diphtheria in which
the streptococcus but no staphylococcal
organism was found) Cholera and snake-like
are rapidly fatal and sometimes resembling
the first two and sometimes resembling the last two in its fatality we have *diphtheria*. The changes in the heart muscle necessarily much interest because of the alterations found clinically in the heart beats in patients suffering from diphtheria. These have been especially studied by Martin and recently Greelyan says: "the lesion appeared to be an acute degenerative myocarditis." In a case of slowly dying peritonitis in which I examined the heart muscle, the changes were not unlike those found in cases of diphtheria. In another place I have shown that the products of the organism (Page 146) may have a debilitating action on the heart muscle ("the blood of a patient dying of diphtheria coagulates slowly".)

The symptoms of heart failure are regarded by Osler as due, in a majority of instances, to neuritis of cardiac nerves. But symptoms of heart failure occur even earlier than paralysis of the palatal muscles and certainly earlier than paralysis in other parts. The first indication of heart failure is that the pulse misses a beat or one beat in twelve or twenty does not readily come up to the fingers. Along with this the skin
becomes coarse and dry and the muscles and soft parts waste so rapidly that one can notice a difference in the patient every morning. The whole condition looks as if the blood did not nourish the tissues. For these reasons I believe the heart failure is due to a general weakness dependent upon the altered state of the blood brought about by the absorbed albumen of the organism and its products.

Coming to the changes in nerves Martin says the condition is one of simple degeneration affecting first of all the white substance of Schwann which breaks up and finally disappears, then the axis cylinder which is attenuated and finally ruptured in some fibres so that below this ruptured axis cylinder the fibre undergoes the Wallerian degeneration. Seymour Sharkey makes some valuable observations on the use of the word neuritis and objects to terms denoting inflammation where no inflammation is apparent and suggests the employment of peripheral nerve degeneration where the only change is breaking up of the white sheath of Schwann. Further valuable suggestions are also made.
When we come to consider the point of attack made by the diphtheritic poison we find Tronseau writing: "Thus although it is not very dangerous when it attacks the skin it becomes so when it attacks the mouth, nasal fossae, the vulva or vagina but is most frequently fatal when it attacks the pharynx." Tronseau of course recognised laryngeal diphtheria as secondary to affection of the throat. The fatality increases with the greater facility for absorption of the organism or its products. The two cases of diphtheria affecting the skin surfaces which I have seen were simple and rapidly got well (the secondary affection of the mouth was almost nothing in both cases). The single case of nasal disease died (an infant of six weeks) and all the cases affecting the vulva and vagina have died and without extension to the pharynx or air passages. But it has to be stated the latter cases were in very poor children in insanitary places and in every way under conditions in which they were ill able to resist disease. Still the facts point to increased fatality where the means of absorption are best and the conditions
for growth of the organism most favourable
In discussing diphtheria as it affects the
throat one thinks of the tonsil and the part it
plays. It is only a small Peyer's patch—the same
issue which is marked out for the chief field
of attack in typhoid fever. The diseases
resemble each other in other ways. They are
both treacherous. Both may be so simple as to
pass recognition till suddenly some complica-
tion arises. Both are often difficult to diagnose.
These points of resemblance are of great
pathological importance and by a simultaneous
study of the two diseases throws light on the
obscurities which surround both.

**Diagnosis**

I confine myself chiefly to some of the difficulties
I have experienced in the differential diagnosis of
this disease

**Thrush**

Although this is mentioned in text-books as an
affection which may be confounded with
diphtheria, I have hitherto failed to recognise any
Closeresemblancebetweenthem. Thetongueand
gumsaremoreaffectedthanthethroatandthewhiteoryellowishdotsaredistinct. Iftheydo
reachoneanother,theystillretaintheirdistinct
formation. They aren'tough and leathery but
soft and brittle.

Scarlatina
The whole throat has always appeared to me to be
redder than I have seen in diphtheria and the
membrane to be yellowish different and
not continuous (it is hardly correct to call it
membrane). Ifa continuous covering occurs
I have found it to be composed of the necrosed
epithelial layer which has not undergone
coagulation necrosis. The higher temperature
more rapid pulse and characteristic rash—one
orall are guiding lines.

SphyphiliticSoreThroat
This hardly comes within notice as an acute
affection although I have seen it mentioned in
text-books. The temperature, pulse, manner of
onset and history generally make diagnosis
easy.
Simple Sore Throats

These constitute the great difficulty to the young practitioners and the fact of their being infectious and often epidemic in schools and communities increases the difficulty. This aspect of the question has lately been dwelt upon by Series under the title of Infections Sore Throats. But in sore throats not true diphtheria the membrane is nearly always small in amount and completely disappears in two days at the utmost and never recurs whenever removed. It often yields in twenty-four hours to sodium bicarbonate given in the form of mixture well diluted. I may be over confident but I do not think I have seen a case of simple sore throat with membrane in which I have not been able to trace the membrane to a crypt. The appearance I often see is a crypt blocked by a soft whitish material which spreads itself in a film-like manner over the part of surrounding tonsil and this may join with the extrusion of another crypt and so a continuous membrane is formed. A membrane of true diphtheria on the other hand looks as if it was laid on to the part and quite foreign to it.
The microscopical character of the various membranes I have dealt with in another place (page 122). In all doubtful cases one may have the aid of bacteriology. In all cases where the Klebs–Loeffler bacillus is present however slight the local lesion one must regard the condition as true diphtheria and be guarded against making light of it. It is necessary to make a definition confession of faith on this point for one hears it asked if a case of very simple throat affection with the presence of the bacillus is to be called diphtheria.

Prognosis.

While children stand measles and whooping cough and perhaps scarlatina better than adults one finds it the reverse with diphtheria in which the younger the child the graver the prognosis. This shows that there is something in diphtheria which makes it materially different to say scarlatina. Perhaps the sudden depression of diphtheria (shown by the often rapid fall of temperature) may be more than the young child is able to combat. In no disease with which
we have to deal, must the prognosis be so guarded. The character and extent of membrane gives no guide as to whether the disease will be simple or serious. Individual susceptibility plays so important a part. I think my experience teaches me that the soft flabby child or adult sinks under diphtheria while the wiry child or adult successfully battles with the disease. For example such a patient whose muscles cannot be dried out in an attack of catarhal bronchitis or pneumonia is likely forever from diphtheria. James Begbie reports a case which illustrates the difficulties of prognosis. He says "membrane about the size and shape of a horsebean. It had well defined edges all round and no appearance of ulceration could be detected. The external glands were not affected and only slight difficulty of swallowing was experienced. The pelticle on the tonsil did not extend its boundaries and the general redness and tumefaction of the fauces did not increase. No factor of the breath and no huskiness of the voice attracted notice." A hopeful prognosis was given. Death resulted slowly.
Modes of Death

Extension to Air Passages

Brounneau (who it must be remembered wrote
with a purpose in view) regarded extension of
the disease to the air passages as the commonest
termination of the disease. Although my experi-
ence is too limited to be able to express a
definite opinion on the question yet what
experience I have had leads me to adopt
the view of the great physician of Tours.

Heart Failure. The next commonest I regard
as failure of the heart.

Gradual Failure of Strength. I place gradual
failure of strength third.

Paralysis of Respiration. I have also seen
paralysis of the respiratory centre.

Treatment

Preventive

This I regard as being more important than
appears to be believed by many authorities. The
fact that diphtheria is more prevalent in rural
than in urban districts leads me to ask what
are the differences between these from a sanitary point of view? In the country we find (1) large tracts of ground un-built up, (2) little or no regard paid to disposal of sewage, (3) houses often ill ventilated and often with earthen floors and (4) often the presence of cows, horses, dogs, pigs and hens as near neighbours. We see that the organism of diphtheria may live in the soil and sewage.

Several of the animals just named are suspicious. Errors of ventilation no doubt play an important part. Deep drainage of land the hero would do much to stamp out diphtheria from country districts. Drainage so as to remove sewage from dwelling houses, byres, and stables would also be powerful aids. The substitution of wooden for earthen floors and the removal of byres, stables, pigstyes and hen-coops to a greater distance from the human dwellings and situate them in a proper direction so that there is no leakage of fluids towards dwelling houses are also important. The prevention of animal droppings near the doors by proper fencing.

In towns diphtheria has increased within the past thirty years. This may be because once having become epidemic it is difficult to stamp
out and we must try to educate the laity in matters pertaining to sanitation. Perhaps diphtheria is not now so common in country districts as it was and so great attention is now paid to the laws of health we cannot but account for the beneficial change as due to this. In towns from the fact of people living close together contagious diseases must be more readily spread from person to person and this reason alone accounts for continuous prevalence of diphtheria seeing our system of sanitation is far from being perfect. Twenty-five years of County Council administration in country districts will do much to prove or disprove the part which sanitary surroundings play in relation to diphtheria

Isolation and Treatment at Home

The poor who have few facilities for isolation often place their medical attendant in an awkward position. They in many instances are unwilling to have their children removed and one must respect their feelings. and if they have even one small room to which the patient can be confined and if there be one adult woman who can give a reasonable
amount of attention to the patient I make no
trouble about removal to the hospital. Indeed I do
not know but what with the limited attendance
and house room to be obtained amongst the
sensible working class that what as good results
are got as in fever hospitals. However well
ventilated a hospital may be the fact of a number
of diphtheria patients occupying the same
ward is no better from a sanitary point of
view (if as good) than the room of a cottage
house, all things being equal.

Local Treatment
Children.
I take the case of children first because
local treatment in them gives rise to the
greatest difficulty. I have given up the use
of the tongue depressor or even of the tea-
spoon for pressing down the tongue gives to
many children pain as great discomfort and
I am sure in my earlier cases I did more
harm than good by my efforts in this
direction. When the child sees I have nothing
in my hand it opens its mouth and if it
ones so much the better. I almost never fail to get a good view of the throat without any depressor. The application of nitrate of silver, perchloride of iron or other astringent make the mouth and throat most uncomfortable and do what is our endeavour to avoid namely, nervous irritant. Sprays I avoid for the same reason. Leave the local treatment to be applied by the mother or the nurse at her leisure. This treatment generally consists of a teaspoonful of powdered borax dissolved in a cupful of warm water which is used with a soft piece of rag, the throat and mouth being wiped out two or three times a day. Fresh rag and lotion are used each time. Sometimes I vary the lotion by giving twenty grains of sodium salicylate to be dissolved in the cupful of water instead of the borax or alternating with it.

Adults and Young Persons
I gently swab out the throat and mouth three a day if possible, once with sodium salicylate lotion twice the strength mentioned above and once with chlorine compounds (chlorate of potass...
m powder, strong hydrochloric acid of each
one drachm. Mix and add gradually (cooking
after each addition) three fluid ounces of water.
Then add glycerine one fluid ounce. Between
times on two or three occasions during the twenty
four hours the patient uses the borax lotion
to wash out the mouth and to throw back to the
throat but no gargling is done. Nitrates of silver
and astringents I have given up because they
make the patient uncomfortable and give
rise to a rough darkened surface which hides
everything and they further make injured
areas which are suitable for the further invasions
of the organism. Sprays I have given up
because I have never been able to see any
good from their use. Pepsin and papain I
have never seen used nor have I used them
myself although the book speaks of them.
On theoretical grounds I can only understand
they may add albumose to albumose and so help the work of the microbe and
make the products more easily absorb-
able.

Internal Treatment
I give three grains to a child of two or three and ten to fifteen grains of the to an adult of physiologically pure sodium salicylate every three hours alternating with ten to sixty minims respectively of the chlorine compounds both well diluted. In the case of a child I give the sodium salicylate with glycerine and syrup and in adults with compound infusion of gentian. I believe the salicylate has a local antiseptic and also an internal antiseptic action. The presence of albuminuria shows that the poison of diphtheria is to a great extent eliminated by the urine. Salicylate appears in the urine as salicyluric acid and as such is most likely antiseptic.

On the third or the fourth day I begin with Baxter's syrup and give five to ten minims well sweetened four times a day for a child and a teaspoonful well diluted for adults. If the throat condition by this time shows signs of clearing or has become clean I give the salicylate and chlorine compounds only twice each in the twenty-four hours the borax lotion being continued till the throat becomes healthy. If the heart shows signs of failing I even off the salicylate.
altogether, although I cannot recall a case in which the salt of itself has brought about cardiac depression. In cases of commencing heart failure I gave strophanthus or digitalis but I have not satisfied myself that I have received any benefit from them. They do not seem to strike at the root of the evil. I feel sure I have received more benefit from the administration of digested foods. Alcohol is dealt with under Diet.

**Diet**

I have found an egg beaten up in half a pint of milk which has been boiled and allowed to go nearly cold, the best food for both children and adults. A child can take two or three quantities of this in the 24 hours. Two teaspoonfuls of brandy or half a glass of Port wine may be added to flavour but often a little sweetening is all that is needed. Along with this I gave a child one or two pints of pancretasized mald food divided into four or six or more in the twenty-four hours. Thus I gave in the shape of Benger's Food which contains a certain amount of ferment and being made with milk the whole
in digested. In this way we can get a large amount of peptide (really albumone and very little peptone)thrown rapidly into the circulation and so tissue waste is combated. Children may object to the food at first but they get to like it. I always see that it is carefully prepared. I have found of far more value in failure of the heart in its first stages and of general failure of strength than either alcohol or digitalis. T. Forel at the time says the "gives as much alcohol as the patient can bear." Between giving and assimilating there is a great difference. And we know that very little alcohol is broken up and used in the animal economy and excess given is simply excreted and only serves as a quickly passing off stimulating agent. Peptones both stimulate and build up the tissues and by giving them early in the course of the disease we may do much to prevent future trouble. If we give alcohol it is best to give it well diluted in the shape of Port wine or brandy in milk plain or digested. A teaspoonful of brandy or a tablespoonful of Port wine to half a cupful of milk given in teaspoonful doses every few minutes will do more in grave cases of heart failure than the pouring in of
of large quantities of alcohol. I have known a pint of whisky given to a child of four in twenty four hours and without any effect on the heart failure, the child dying as if nothing had been given but cold water.

Regarding the management of complications and convalescence I have nothing special to offer.

Treatment by Antitoxin Serum.
I have employed this on two occasions. Both were undoubted cases of diphtheria. One case died and the other got well. Certainly in the fatal case it had no appreciable effect on the course of the disease. The amount to be injected is large and I have advocated its application by the bowels and I see it has been so used in Paris by Chantemesse.

Subject to the use of the serum on many grounds. We know nothing of its nature and although it has now been before the profession for a considerable time no analysis of it is forthcoming. Already many people are dubious of it and one must feel sorry if time proves that it is of
no service. The result may be to throw much discredit on our profession. One may well feel doubtful about serum therapy when one reads. In certain cases I have succeeded in curing rabbits of anthrax by injecting minute quantities of peptic or trypsin (Hankin), and I find Louis Bobbett showing that normal horse serum increases definite antitoxic power. Everyone who knows anything of physiology knows that all serum has properties of protecting itself within certain limits against disease, but the injection of an extra once or two of serum can have little or no effect on a disease. If I understand aright the effect of any foreign agent on the blood and other tissues it is that the effect of these tissues is to extrude the foreign body and to get rid of the effects of it. Further the blood and other tissues return to normal or nearly normal and while they may have lost some of their former powers they do not store up ferments or antitoxic bodies to guard against the further attacks of a particular disease. A horse then who has been treated with the contents of a culture tube of a particular disease has probably an altered serum or defective serum but not an antitoxic serum. Every animal
can be made by a gradual process of injection able to resist larger doses of any poison vegetable or animal.
Kings and rulers of former times braced their tissue up against the effects of poisons such as opium
and strychnine by taking gradually increased doses but we would hardly think of injecting the
serum of an opium eater to prevent or to combat poisoning by opium in a patient. But there are
purely theoretical objections and we must test the results.

We find that the death rate at first with antitoxin
was something under five percent but in time it
has gone up to twenty-seven percent. Which
perhaps all in all is not much different from
what one finds under other lines of treatment,
allowing for errors in diagnosis and mild
epidemics. During the year 1875 antitoxin
serum treatment has been universally employed
and yet we find in November 1875, the deaths
exceeded by nearly seventy-five percent the
corrected average for the forty-fifth week of the
years 1883–94. In February 1876 the deaths
were "in excess of the decennial average for the
seventh week of the years 1886–95 by 12" and the
deaths in the three preceding weeks were higher
than this.

Reports of seventy-five cases treated in University College Hospital have been published but as there has been some discussion on the results I refrain from quoting from them. At the time of revising this essay the report of the Metropolitan Asylums Board had been issued and I give the following from the general results. The cases treated in 1894 before the use of antitoxin numbered 3042 and the deaths 902 or 29.6 per cent. We then find (in 1895) that the number of cases was 3529 with 796 deaths or 22.5 per cent.

This gives only a difference of 7.1 per cent which is too small seeing we have a larger number of cases and when we have to take into consideration the fact that greater attention was now paid to diphtheria in every way and necessarily a larger number of favourable cases may be included. If the difference in mortality had been twenty or thirty per cent then we might have said the serum was a distinct gain to our list of therapeutic agents.
Is Membranous Grouph always due to
the Poison of Diphtheria?

The discovery of the specific cause of diphtheria
in the shape of the organism known as the Klein-
Loeffler bacillus reopens this oft hotly
contested question. If the bacillus is found in
the membrane in every case then we shall
have to answer in the affirmative but if on
the other hand membranes exist in which no
organism answering to the specific one
present in pharyngeal diphtheria then the
contention of the Scotch School will be
established as a certainty. If the discovery of
Klein and Loeffler does nothing more than
enable investigators to clear up this difficulty
it will have done a great deal. In the
discussions hitherto on this vexed point
the love of truth has often been lost and
calm reasoning has given place to national
prejudice. Retrornean although he did so
much to advance the knowledge of diphtheria
was the first writer when in the preface
to his great work he wrote: "Francis Home
persuaded himself that he had just met
with an affection which had hitherto escaped the attention of his predecessors; he thought it ought to give its the popular name under which he found it designated in a Scotch province. The novelty of his discovery was widely diffused and the new denomination so fascinated all persons that it prevented them from recognizing a disease observed from the most remote antiquity and which in our days is accompanied by all the symptoms which it has uniformly exhibited.

Brettonneau's statement is a compliment to Hone and the Scotch province and a rebuttal to Hone contemporaries and successors. Although the title of my paper defines the subject I wish to discuss so much confusion has collected around the name croup that I may be permitted to say what I do not mean by the word. I include the affection sometimes known as laryngismus, abidulus and also acute catarrhal laryngitis in which there is no membrane present and which so far as I can gather from writings and personal experience generally results in recovery. I further
exclude all cases of laryngeal membrane due
to destroying agents such as hot steam, hot
water, carbolic acid, ammonia, corrosive
plumbate, the corrosive acids, the caustic
alkalis, or any other agent which destroys the
epithelial covering or deeper parts and so often
forms a part of the windpipe. These act
mechanically in reality but in their destruc-
tion of proteid matter a certain amount
of fibrin is always present. Strong chemical
or mechanical agents act then like the
bacillus of diphtheria. But we exclude all
membranes of this sort for when we know of
the existence of these destroying agents then
we may look for a membrane. I have seen a
membrane covering the whole of the tonsils
and pillars due to corrosive poisoning
which could be stripped away and when
so removed left a bleeding surface. There
was no doubt about the cause for we had
evidence of the poison being taken. If this
takes place in the throat so may it in the
air passages.

This narrows our enquiry down to a mem-
brane in the air passages, in which there is
no distinct symptom of a previous aphthosis of
the pharynx. Valuable as Bretonneau’s
correlations are, they are to be received with
cautions by the men who desire to arrive at the
truth for much that Bretonneau wrote was
written for the purpose of proving the error of
Hone’s observations. The same applies to
Bretonneau’s pupils and followers among whom
we may mention Feneuau, Guerant, Bouchut,
Simpus and Daviot all of whom were more or
less prejudiced against the Scottish observer.
Since Bretonneau’s time opinion has some-
what changed in Great Britain and many
pathologists and clinicians have adopted the
views of the great French physician and his
followers. In 1879 a committee of the Royal
Medical—Chirurgical Society of London
obtained the views of the Fellows on this vexed
question but as far as I have been able to
interpret the replies they leave the question
much as it was. I have read the works of
Hone, Bheyne and others but their views are
so well known and are so fully noted in the
report of the Committee just named that it is
unnecessary to do more than give the names.
I have to state shortly the view of various known authorities and to offer criticisms or comments on various points which may be raised in the quotations.

Ogle's says: "between diphtheritic laryngitis and croup a majority of writers now hold that there is no essential difference." But the point is not so easily settled as Ogle would have us believe. Segmors Taylor in 1871, in discussing diphtheria places after it and within brackets (membranous croup). Hamilton too if I mistake it not in his book regards membraneous croup as diphtheria of the air passages. Senator evidently shares Bretonneau's views for he mentions that Ruppius of Baden was the first to show that the pharynx is the first affected in croup and Bretonneau followed after him. John Abercombie says: "the membrane may either spread to the larynx or the disease may attack that part primarily a condition to which the name croup used to be and is by some few writers still applied." Mr. Squire says: "epidemic croup is entirely diphtheria." But it must be remembered it is of epidemic croup the writer speaks. So much for the dogmatic teaching..."
in favour of the identity of the two so-called conditions and when I cite the opinions on the other side I think it will be agreed to that the verdict is far from being unanimous that croup is always diphtheria as Axсле states. So long ago as 1843 Watson wrote "The croup is not contagious although like cynanche tonsillar and for the same reasons it is found sometimes erupting at the same time in quiet succession in more than one child of the same family". This would rather point to its contagiousness and the statement which follows shows that the malignancy is greater than most observers agree upon for croup as a disease different from diphtheria. Watson says "It is said that four children out of five attacked by it used to die but that now the treatment being better understood than formerly the number of deaths and number of recoveries are nearly equal." Hilton Fagge gives a definite opinion saying "what I regard as a non-infectious malady namely croup". And he makes another statement about which there is no uncertainty: "To sum up it seems clear that no fixed line can be drawn between
membranous croup and the milder forms of the disease in which no false membrane developed except in those cases in which it occurs over and over again with sudden and alarming but very transient symptoms may be separated under a distinct designation for which purpose the name of apopneous croup seems to be the most appropriate." Charteris cautiously puts it "Diphtheria and croup are closely allied."

Norman Moore gets out of the difficulty by saying "Croup is a clinical term and has no precise pathological meaning and may be due to one of three pathological conditions: (1) Laryngitis morbus stridulus (2) Diphtheria affecting the larynx. (3) Acute catarhhal inflammation of the larynx and trachea." This is hardly likely to advance our knowledge for as the result of reading I think most authorities now agree recognize the first condition as distinct and the third is nearly by every one spoken of as false or apopneous croup. One these grounds I take exception to the writer's observations. In the days of Home or Cheyne Moore's definitions might have passed, but to-day the difficulty has been narrowed down. Routes while
recognizing that the great majority of cases of croup affecting the air passages are really cases of diphtheria - go on to say "Looking at the matter from a purely pathological point of view apart from clinical experience it certainly seems possible that other irritants may produce similar results." Payne in discussing this question says "It should however be stated that a croupous membrane is readily produced in the air passages of animals by irritating substances (ammonia, acetic acid &c) and is thought rarely produced in man by simple irritation such as boiling water or steam or even by other irritants possibly cold." Green has the following "Simple mechanical or chemical injuries will produce a typical croupous membrane." Macquoid believes that we have cases not due to diphtheritic poison saying "There remains still a certain proportion of cases of membranous laryngitis which are not due to the action of the diphtheritic poison." Henoch speaks of diphtheritic croup and inflammatory croup and the different mortality in each so he would appear to favour the idea of two distinct diseases. Goodhart in writing of croup says "my own opinion is
that there are grounds sufficient for a belief in the existence of a non-diphtheritic as well as of diphtheritic membranous croup." Fred Taylor gives it that "There can be no doubt that diphtheria sometimes begins in the larynx. But there are other cases of laryngitis with the formation of membrane which are called croup and these by some are supposed to be purely catarrhal or at least not contagious and not due to the diphtheritic poison." Aitken insists boldly: "True croup—the croup—so a different disease—a disease different from diphtheria." He describes the membrane as alkaline. This differs from the membrane of diphtheria which according to Sydney Martin contains an organic acid and one would naturally expect it to be acid in reaction. My own experience is that the membrane in all throat affections diphtheritic and otherwise is acid. Flint says: "Whether diphtheria and membranous croup be distinct diseases. Regarded from a clinical point of view it seems to me clear that this question is to be answered in the affirmative. There is more—over nothing in the pathology of this disease opposed to this view. It is established
both experimentally and clinically that pseudo-membranous inflammations of the throat may be produced by a variety such as inhalations of hot vapour, the swallowing of corrosive poisons &c. &c. " Warburton Reglius 57 in one of his essays makes an observation with which I close this list: I remember as I have observed before in this Society (the Medico-Chirurgical Society of Edinburgh) on the occasion of my first visit seeing cases of croup in the French Hospitals to have been struck by noting the great care exercised in the examination of the mouth and throat of the child and when instances of the disease were described by Ironsean or Giussant I failed to recognize the distinguishing features of the disease as familiar to me in the writings of British physicians."

If we ask ourselves can cold (as suggested by Payne page 40) or any of the febrile affections cause the formation of a membrane in the air passages? we can reason out the question on broad general principles. Cold is denied by many observers to be of itself a cause of disease but speaking broadly cold weakens a tissue
and makes it liable to attack and when cold is suggested we suppose this is what is meant. If we examine the matter more fully and try to learn from the effect of cold on other parts we find that the throat is perhaps more liable to disease than any other part of the body. It is often red and inflamed in cold weather owing to cold air impinging upon it. It is affected more or less in measles, scarlatina, rheumatism, typhoid fever and in almost all febrile affections. It is good culture field for almost every organism. Cold affects the throat or at least in cold weather we have so called "cold" but with this no membrane or at the outside a thin shimmering layer. Scarlatina produces in the throat a collection of yellowish dots chiefly made up of round cells or in the worst cases I have seen the epithelial layer is destroyed. It is not a continuous layer or membrane like diphtheria. Measles produces very little alteration beyond redness and in the worst cases a necrosis of the superficial layers. Rheumatue sore throats are attended with no membrane. Quinsy maybe attended with small necrotic patches but no continuous membrane. Others might be instance but enough has been
said to pave the way for my contention. If these affections then cause no membrane, or almost none in the throat which is their most favourable culture ground I believe we are justified in saying they will fail to produce a membrane in the air passages.

Incline to the view that membranous croup is always (saving under the restrictions already enumerated) due to the poison of diphtheria and answer some of the objections to this view in the following terms. To the objection that croup begins without any affection of the pharynx I answer there is no reason why diphtheria should not first attack the air passages and even never spread beyond this. We may have a catarrhal laryngitis while the parts of the tract above and below are spared or we may have a nasal and pharyngeal catarrh with a bronchial affection the intervening larynx and other parts being passed over. But more we may have a membrane in the windpipe and only the mere inner patch in the throat and yet this patch is diphtheria. It is often difficult to get a good view of the throat in a refractory child and a child may have considerable throat trouble without making any
complaint and diphtheria is not always suspected but as a matter of routine the mouth has been examined. This crop is a disease of early childhood as is met with the answer that so is diphtheria to a large extent, and the tender tissues of the young child are suitable to the growth of the microbe. In crop it was held that boys are more liable than girls while in diphtheria no one sex is especially liable. Before this could be finally settled we would have to eliminate all cases of laryngismus stridulus and other conditions.

Besides in records of cases (published many years ago) boys and girls appear equally liable. Notably as I write I have beside me a description of thirteen cases by Drury Alexander of Halifax in which seven girls and six boys were attacked (See page 33) But supposing it did attack boys more than girls we find a large number of cases of crop (here using the word in its widest meaning) occur during the first year of life and it is an established fact that within this period more boys than girls die. This can only mean that disease attacks baby boys more than baby girls. It is often said that crop is not contagious while diphtheria is highly so and
that in consequence crop may be confined to one member of a large family. In the instances which I have observed personally and which I now purport to cite I hope to meet this objection and others which have been raised in this essay.

Highly contagious diseases may be confined to one member of a large family. A short time ago I attended a girl of 16 in scarletina well marked. Three younger members of the family remained free and yet complete isolation was impossible. A boy of 12 contracted scarletina. Four younger members of the family were not attacked. The boy was confined to one room but in a cottage house one could not prevent a child straying into the sick room. A girl of 10 contracted diphtheria confirmed by bacteriological examination. A brother two years old and two younger children of the same family remained well. This was also in a cottage house. A boy of 7 had diphtheria. An older brother and sister in the same house did not contract the disease and yet they slept in the next bedroom and could not be kept away from the patient and the mother nursed the patient and did all the cooking.
and household work. A girl of 14 had diphtheria
and smallpox and six other children (the
oldest twelve and the youngest at the breast)
occupied the same house. None of them contracted
the disease. Instances could be multiplied
to show that diphtheria may exist and of a
malignant type and yet cause little throat-
trouble. I quote from the practice of a fellow-
medical man. A child became ill with symp-
toms pointing to an affection of the stomach and
although the tongue was examined nothing
pointed to any trouble in the throat. The child
died suddenly and a second child became ill in
the same way and this led to a searching examina-
tion of the child and diphtheria was discovered. In
examination of the body of the first child dis-
covered diphtheria. The second child died. The
next case I give illustrates the relationship of
pharyngeal to laryngeal diphtheria as I have it.
A young man contracted diphtheria and died.
Diphtheria had often broken out in isolated cases
in the neighbourhood. Six months later and
next door to this case a boy became ill on a particular
Sunday afternoon. The throat only pointed to a
catastrophic condition. On Monday the patient became
seriously ill with croupy cough and difficult breathing. Tracheotomy was necessary and was performed but the child died on Tuesday. Membrane was discovered in the air passages. The next cases illustrate how diphtheria may first manifest itself (by serious symptoms) in the air passages and yet have been present in the throat in a mild form. One child ill for some days but not such as to call for attendance became suddenly worse one day, the breathing being difficult and the cough croupy. This increased and the child died in less than forty-eight hours after first seen. No other child of the family became affected. The throat was red and I thought I saw membrane but of this I am not certain. A fortnight later a child living next door became ill in the same way and died in less than twenty-four hours. The throat was in the same condition as in the first case. No other case became affected in the same house. Both families were very poor and although warned of the danger freely intermingled. In next instance I give illustrates how a grave affection may follow a simple throat affection. A man had a
A sore throat mild so slight as not to call for attention. In six weeks he lost all power in his legs. A child may in the same manner have diphtheria of the throat so slight as to escape detection and it may spread to the air passages causing alarming symptoms and death. Paralysis in adults and laryngeal affection in the child would appear to be the complications of diphtheria of the throat.

Within a narrow circle of a densely populated area three cases occurred with some weeks of one another. A boy complained of sore throat. The throat was red but no membrane was seen. In a day or two laryngeal symptoms came on and he died. No other child of the house or next door on either side suffered. Soon after a child in the next street but one and within a hundred yards began with crampy symptoms and died. Soon after this second case an adult man in the street between the two contracted diphtheria of the throat and recovered. No one in the same house or next door on either side suffered. The first case may have been diphtheria of the throat followed by the same disease in the air passages. The second was "croup" and the
There was undoubtedly diphtheria. All may have been diphtheria.

Much more could be written and larger numbers of illustrations drawn from the extensive practice of older men, but I adhere to cases coming under my own observation.
Notes of Cases.

Diphtheria and Some Diseases Resembling it.
Case 1


On 31 March 1894 I was asked to see a man of 24, a plasterer, who while working at Harrogate was exposed to the bad smells from a sink. When first seen he was feverish with a pulse of 110. He complained of sore throat. No rash was to be seen but the throat on examination was found to be red and covered with a grey membrane as follows: On the right side it was as large as a shilling and covered the velum, while on the left side there was a small yellowish-grey patch in the same position. A little of this yellowish patch was scraped off, leaving a bleeding surface, and examined under the microscope after staining with logwood, when there was found a mass of coagulated fibrin with corpuscles difficult to stain and some of them were transparent, masses without nuclei. A culture was made and at the end of 24 hours whitish yellow colonies were observed without liquefaction of the jelly.

The urine was scanty and for the first few days contained albumin. The glands at the
angle of the jaw were not enlarged but the
membrane was shed the day after or the second
day after its complete formation. No heart,
murmurs nor untowards symptoms de-
veloped. The patient was kept in bed for a full
week after the disappearance of the membrane
and in 21 days from the onset he was well saving
for considerable weakness in the legs on
attempting to walk.
The treatment consisted in giving ten grain
doses of sodium salicylate every three hours
until the throat had quite healed. After this the
compound infusion of gentian was prescribed
in two tablespoon doses four times daily. The
throat was ordered to be gargled at frequent
intervals for some days with a teaspoonful of
powdered borax dissolved in a teaspoonful of
tepid water. Milk diet with egg and milk
(one egg beaten in a pint of warm milk) were
continued for a week.
Case 2

On 11 August 1894 a girl of 12 was brought to me complaining of sore throat and immensely swollen glands of the jaw. Both conditions are said to have existed for a week. On examination of the mouth, the tonsils and velum on both sides were found red, swollen, and covered with large patches of grey membrane, which had no relation to the openings of follicles. The child was pale and weak but had been going about. The pulse was only 50 and the urine contained albumin. The membrane disappeared entirely in a day or two and in a week the throat had healed.

The treatment consisted in sending the patient to bed, giving sodium salicylate in fine grain doses every four hours with plenty of liquid food in the shape of broths, beef-tea, boiled milk and warm milk with egg beaten in it. The throat was gargled with borax lotion as in the foregoing case. There was no subsequent trouble beyond weakness.

The child lived in an insanitary neighbourhood but no other cases appeared at that time, although
The disease is seldom long absent from this district of Leeds.

Case 3.

Doubtful Diphtheria. Next door to Diphtheria.
In September 1894 I saw a girl of 15 who complained of sore throat and weakness of the limbs. She lived next door to a child who in two days died of diphtheria. The throat was red and swollen but there was no membrane and as the pulse was normal and no other serious symptoms were present I told her she would soon be well. A simple mixture of small doses of tincture of aconite was prescribed followed in two days by a rhubarb and soda mixture and in four days the patient was well. No membrane ever appeared.

This case is interesting because of the presence of true diphtheria next door. The horses are old of soft stone and poultice chickens roost often present in
neighbouring hen coops.

Case 4.
Tonsillitis with Bronchial Catarrh.
A few days after I had seen Case 3 I was called to a child of 6 - a boy, who lived two doors from another fatal case of diphtheria.
My patient had tonsils red, large and inflamed, but no membrane. There was difficulty in swallowing. The temperature was nearly normal, likewise the pulse. Along with the tonsillar condition the child had some bronchial catarrh, but beyond the difficulty in swallowing the child made no complaint, and it was not an easy matter to keep him in bed. No urgent symptoms ever developed and in one week the child was well.
The treatment was as follows: Five grains of sodium salicylate with one minima of tincture of aconite and three minimis of ipecacuanha wine were ordered every four hours. The medicine
was given in two teaspoonful doses measured with a teaspoon so that in the act of giving local effect might be obtained. All the natural functions were attended to and liquid diet was enforced.
This case is interesting because of the nearness of true diphtheria, and because some eight months later I attended this child and his elder sister in what appeared to be ptoleum poisoning (Diagnosis verified by consultation). Another interesting point is that this elder sister, living in the same house developed scarlet fever some two months after the poisoning and was removed to hospital. The cottage is one of twelve built of brick, and old and of such construction that no sanitary arrangements however complete could make them healthful to live in.
No bacteriological examination was made and although I have called this case simply tonsillitis it may have been a true diphtheria.
Case 5—

Quinsy: (Diphtheria and Sore Throat epidemic)

Some days after I had done with Case 4 I was called in haste to see a woman of 40 living in an old back to back stone house, who thought she had diphtheria. She was the more frightened because she lived not a stone throw from a fatal case of diphtheria and because she herself had lost a child (living in the same house) in diphtheria two years ago. On examination I found the tonsils red and swollen and over the soft palate on the right side there was a swelling which on pressure yielded pus. No membrane was to be seen. The pulse beat 110. There was nothing pointing to diphtheria but everything to a simple quinsy which had suppurred and thus I told the woman. I ordered her to apply hot fomentations outside and to gargle the throat every hour with warm water and I prescribed fifteen grains of sodium salicylate every four hours. The diet was restricted to boiled milk taken warm and to milk and egg. When I saw my patient next morning the quinsy had burst and the throat looked clean and
healthy and in a few days the woman was well.

The case is interesting because it shows the importance of being able to assure patients of the true nature of their complaints when treacherous diseases are epidemic. The simple assurance placed this woman on the highway towards recovery. Hoop prevailed in an hen-coop near this woman's home some months previous to the present illness.

Case 6.
Tonsillitis—Follicular—with Membrane.
Following close on the foregoing (October 1874) was that of a man of 20 I was asked to see. He complained of being hot, uncomfortable and of having sore throat. On examination I found he had a pulse of 100 and a temperature of over 100°F. The tonsils were red and swollen and a grayish white membrane covered them. On careful inspection the membrane was seen to have some relation to the follicles, in fact protruding
from the crypts and extending over a certain part of the tonsillar surface; and a few such joined and formed a large continuous membrane I gave a guarded prognosis, although from the fact of the relationship of membrane to follicles I felt sure the case was one of follicular tonsillitis of non-malignant kind, yet in view of the numerous deaths from diphtheria and on account of the difficulty of diagnosis I thought it wise to report the case unless in 24 hours considerable improvement should take place.

The treatment was the same as in my other cases. In twenty-four hours I saw the patient and found the inflammation in the tonsils had considerably diminished and with this a contraction of them and removal of the membrane, and in points here and there were seen small white masses issuing from the openings in the tonsils. The temperature and pulse had come down and the patient felt more comfortable. There was now no doubt as to the diagnosis and the man got rapidly well. The horse in which this man lived
It is new and of red brick, but it stands within twenty yards of the stream into which refuse from a large tannery is thrown and at times the odour is overpowering as it was at the time of his illness. Diphtheria was or had been prevalent near at hand; and some months previously the man's youngest sister, an infant, had died of diphtheritic rhinitis and in the same house (See case 12).

Case 7
Sore Throat next door to Fatal Diphtheria.
In January 1895 I saw a child of three—a girl—living next door to a fatal case of diphtheria attended by a brother practitioner. The child had redness over the soft palate and tonsils but no membrane. The constitutional symptoms were almost nothing and after the child had taken four or five doses of a mixture containing two grains of sodium salicylate in each dose
the redness passed off and in three days the child was well. No other members of the family suffered at this time (See Case 7). This case is specially interesting for many reasons. The house is one of a street of forty cottages built back to back and the waste pipe from the kitchen sinks generally are trapped inside (They have since all been trapped outside opening into a gally) but at the time of this illness all the waste pipes and the water pipes were frozen in the street, I think without exception. The weather was intensely cold. Two families occupied this cottage of four rooms. The people were poor and the old grandfather suffered from gangrene of the toes of one foot and for which I amputated the great toe some short time before this. Considering this case in the light of subsequent events it may after all have been diphtheria.

Case 8.


On February 6th 1875 I was called to see a
girl of 5 who lived opposite to Case 7. Her brother had died a month previously of diphen-theria after an illness of two days. My patient showed well developed membrane covering the soft palate and tonsils. Albumin was present in the urine and the glands at the angles of the jaws were swollen very little. The temperature never reached above 102°F and there was no urgent symptom. The little patient took food well in the shape of beef-tea, milk and egg, broths, milk and tea with milk. She was kept lying and the parents were informed of the danger. The bowels were regular and urine was passed freely. The throat was not swabbed for the child complained of intense pain when even the back of the tongue was touched even gently, and the parents were adverse to touching the throat, complaining bitterly of the doctor who had swabbed the throat of my patient's brother and had caused him to almost "go into convulsions". My treatment consisted in giving three grain doses of physiological pure sodium salicylate every four hours in two teaspoonful doses to be
swallowed slowly, the mixture being made up with a dilute solution of glycerine. The throat kept sweet and the membrane slowly separated and by the 7th day only a small piece remained on and this on being lifted up revealed a clean healthy surface below, and I prided myself that we were to have a good recovery. No alarming symptoms developed as yet and by continual drumming into the mother I got her to understand in part the importance of rest, quiet and frequent feeding. On the 11th day the skin became dry, hard and coarse to the touch and there was evidence of some grave disturbance of the nutritive processes, and one feared poisoning of the patient's tissue by the albuminoid produced by the organism of diphtheria. The pulse became irregular in rhythm, every twelfth beat being much less forcible as it touched the finger than the other eleven. The child was placed on strong beef essence, large doses of the compound syrup of the hypo-phosphites (one teaspoonful every four hours) and liquid peptones. These he took well although occasionally they returned by
the nose pointing to some paralysis or rather parasympathetic of the muscles of the palate. On the 12th, the patient improved a little and the mother relaxed her efforts and fell asleep and I believe the child did not receive the nourishment as she ought to have done. On the 13th day she changed for the worse becoming pale and pulseless with some difficulty of breathing but no intracting of the chest muscles. After consultation it was agreed to open into the wind-pipe should the difficulty of breathing increase. The difficulty in breathing did increase and assisted by D. W. Ross of this city I opened above the thyroid. Blood and mucus came out with a gush but the difficulty of breathing was little benefitted and the child slowly sank.

I think this child might have been saved had I had more careful nursing for afterwards I learnt that often in the night the little patient had to awake her attendant to obtain a drink or nourishment.

A culture made from the membrane gave the characteristic appearances.

The accompanying chart shows the course of the temperature.
The weather was still very severe and waste and water pipes very frozen. The house is supplied with a closed arrangement but outside and removed some distance from the house.

Case 9. (Sister to Case 7)
Diphtheria.

On 21 February 1895 I saw a child of 4. Sister to Case 7. The sister a month ago suffered from a simple sore throat and it will be remembered that a fatal case of diphtheria occurred next door. The child had a rapid pulse, foul tongue, and a large yellow patch on the left tonsil. This membrane was dark yellow and looked as if a piece of washed leather had been planted on the part. I could liken it to nothing so much as to the membrane covering a large carbuncle.
on the back of an old woman I attended some time previously. There was no swelling of the glands under the jaw. The urine contained albumin. My studies having run done I could not test for the characteristic culture. No other prominent symptoms appeared. The child took plenty liquid food in the shape of milk and egg, milk and water broths, beef tea, tea and milk and light boiled egg. The medicinal treatment consisted of three grains of sodium salicylate well diluted every three hours alternately with ten minims of the following mixture also well diluted:

Chlorate of potassium 1 drachm
Strong hydrochloric acid 1 fluid drachm
Add the acid gradually to the chlorate previously placed in an empty 6 ounce bottle. Shake after each addition, the bottle being corked. Next add,

Water 3 fluid ounces
Shake well together and add
Glycerine one fluid ounce. Mix.
On the third day the membrane spread to the other side, still no serious symptoms came on
By the 8th day the membrane had completely cleared away and after this the child got rapidly well. No paralyis developed. The nursing was good, although the people were poor and the surroundings far from salubrious. The waste and water pipes were still frozen. The dry closet was some distance from the house. Had I desired it local treatment could hardly have been employed on account of the nervousness of the little patient.

Case 10 (Father of Cases 7 and 9)
Doubtful Diphtheritic Pharyngitis

While visiting Case 9 I noticed the father at home at a time when I knew he should have been at work. On asking the reason I was told he had not been so well for two days but he was going to work in the morning. On pressing further I was told he had had sore throat but it was better. On examination I found nothing abnormal with the palate or tonsils but a small clean-looking ulcer occupied the back wall of the pharynx. The tongue was clean and the pulse normal and
The man looked well, and his desire appeared to be taken no notice of. However, I touched the ulcer with nitrate of silver and told his wife to watch if anything happened further and to let me know. I heard no more of it.

Case 11
Diphtheria. Paralysis of Respiratory Centre. Death.

This case I saw in the practice of a brother practitioner hence the notes are scanty.
In April 1893 a young man, a pupil-teacher in a Board School contracted diphtheria presumably at school where a few cases had broken out. He lived in a good middle class neighbourhood and his circumstances were more than ordinarily comfortable. The houses were new and near his house cases of diphtheria kept occurring. The land on which the houses in the neighbourhood are built was formerly pasture land with an—
old house here and there. Open drains were common and houses (at least two) have been built either wilfully or by mistake over these drains and in two houses at least diphtheria has broken out wherein the disease could be traced to such drains; but cases are known where there has been no reason to suspect open drains amongst a class of houses believed to have been built in sound sanitary principles.

When first seen by my friend both tonsils had to all appearances sloughed away but no untoward symptom was present. The lad took food well and in about a fortnight he was able to move about and get out of doors. On the 17th day I saw him because he complained of sore throat. When I examined the throat I saw some little redness generally distributed over the soft palate, and I attributed it to the damp weather to which the patient had exposed himself. There was no constitutional disturbance, and in a day or two all symptoms disappeared and he was able to go about as usual. On the 21st
day he was at the school sports when it began to rain and he got wet and had to run home a distance of less than half a mile. The next day the temperature mounted up to 104°F and the respiratory and pulse rates were elevated. He improved next day but the day following paralysis of accommodation supervened and later the knee jerks were in abeyance; the respiratory centre showed signs of failing and he died on the 35th day after being first seen. The diaphragm did not appear to be affected.

The lateness of the paralysis is instructive and the reappearance of throat trouble on the 17th day would point to the probability of the disease lurking in the follicles when the surface may appear to be healthy. No membrane was seen on the 17th day hence it teaches the importance of the apparently simple cases of sore throat and that one should not minimise the probable risks. From the 17th to the 31st we have 14 days a period sufficiently long to account for paralysis and this paralysis may have been due to the second absorption from the throat.
Case 12.


This was a girl of 14 who when first seen had a whitish-grey patch covering the right tonsil. The temperature was normal but she was pale, weak and unable to eat. She had complained of sore throat for some days and the increasing weakness rather than the sore throat caused anxiety to the parents. I ordered her to bed, but she was most unwilling to submit to this saying she was "not bad enough for bed." As I was unable to distinguish the condition from that of true diphtheria I took a piece of the membrane and inoculated a tube and found in 36 hours at a temperature of 34°C. distinct colonies and I diagnosed diphtheria. The patient was kept in bed for a week and fed on milk and milk and egg at frequent intervals and she was given sodium salicylate in ten grain doses every four hours. The throat became cleaner day by day and in four or five days no membrane was to be seen. No paralysis supervened by a general weakness was evident for some time. This patient comes
of a family subject to sore throat for about six weeks before this time I attended a sister suffering from quinsy and a month later a brother of the same complaint. This girl lived in the same row of old stone houses as Case 3; and she had gone out and in feeding her mother’s hens, great numbers of which had died of scurvy. Indeed scurvy made such havoc amongst all the hens of the immediate district at this time that all the persons had to dispose of the remaining stock and burn the coops and runs disinfected. Something in the soil may be suitable to the spread of scurvy and of diphtheria and may their not be a close relationship between the two diseases?

Case 13 (Brother to Case 6)
Diphtheritic Rhinitis Death.
A male child of three weeks living alongside a mill stream into which there poured the spent saw an organic refuse of a large tannery near at hand began to suffer from a foul discharge from both nostrils. The child cried a great
deal and at times became cyanotic and suffering from difficulty of breathing. On examining the nostrils nothing could be detected save the discharge and a slight reddening of the lining membrane. The fauces were red but no membrane was seen. About the sixth day after the onset strings of yellowish membrane were coughed up and on examination by the microscope it was seen to be made up of fibrin, coagulated, epithelial cells, and round cells. This membrane corresponded to the shape of the nostrils. Breathing was easier for a time but convulsions followed and the child died 48 hours later, that is, on the eighth day.

The family to whom this child belongs is subject to catarrhal conditions of the mucous membrane and the tender membranes of the infant so predisposed when irritated would be a good culture ground for the diphtheria organism.
Case 144

Diphtheritic Group (Diphtheria of the Larynx)

A boy of 14 months was first seen on the 15th December 1898. It was difficult to get a history of the case but it appeared he had been ailing for some days. When first seen the child was much distressed and breathed with the greatest difficulty. The cough was hard, dry and barking and at each inspiration the chest muscles were drawn in. The condition known as Rueckmull's pulse was present and well marked and very rapid in rate so much so that it could not be counted. Injections were applied around the throat and inhalations were employed with opea eucantha wine in twenty minim doses but the little patient died of exhaustion in 48 hours. The throat was red and swollen and I thought a membrane was present but when examination was made the opening at once became filled with yellow mucus. Tracheotomy nor examination of the body could not be obtained.

The house in which this child lived was a very old one and was situated in an insanitary part of Leeds close to a stream into which the washings from the
numerous tanneries situated within a
radius of half a mile. The house stood on a slope
at the bottom of a valley. The family was large
the house small and the food and clothing of
the occupants scanty.

Case 15—(Next Door to Case 14)
Diphtheritic Group (Diphtheria of Larynx)
A fortnight after I saw Case 13 I was called
to see a girl of 6 who was said to have
suffered from "cold and weakness" for a few
days but nothing to cause alarm to the
parents. Suddenly the child became cyanosed
and had the greatest difficulty in breathing.
The patient frequently placed the hand over the
throat and the face had a distressing anxious
appearance. The cough was hard, dry and
crunching. The pulse was rapid being over
150 and at each inspiration was lost to the
touch of the finger. The throat was red and
swollen but I could not sure if membrane
was present. Fomentations were applied around the throat, inhalations were placed near the child and emetics of spearmintka wine were tried, but the child died in 24 hours, the parents refusing tracheotomy. As already mentioned Cases 13 and 14 lived next door to one another and they intermingled freely although warned of the danger. Both families were exposed to the same insanitary conditions and both were poor and dirty. And the houses in which both lived were old and built of brick with small windows. When both cases occurred the weather was damp and cold, snow lying on the ground some part of the day. If Case 15 contracted the disease from Case 14 then the incubation period must be about 14 days, but both may have contracted the disease in the same manner.
Case 16

Diphtheritic Groupl (Diphtheria of Larynx)

Characteristics: Culture, Antitoxic Serum Recovery

In September, 1875, I saw a girl aged 5 who complained of croupy cough and difficulty in breathing. She had been ill for two days. The pulse was 120, the temperature 99.5°, and the respirations 40. One tonsil (the right) was covered with a yellow membrane, a portion of which on being rubbed over a gelatine-peptone-glycerine tube produced colonies in 24 hours. A view of the opening of the wind-pipe could not be obtained because the back of the throat became filled with mucus whenever an examination was made.

When I saw the child in the evening, I injected into the cellular tissue between the shoulder blades 10 c.c. of the antitoxic serum of the British Institute of Preventive Medicine, marked "Sep. 5 Immunity 1" and supplied by Messrs. Reynolds & Branson of this city.ORDER TO CAUSE AS LITTLE ANNOYANCE AND PAIN TO THE CHILD WHO WAS HIGHLY NERVOUS, AN ORDINARY HYPODERMIC SYRINGE WAS EMPLOYED; ONE HAVING A FINE NEEDLE. THE NEEDLE WAS INSERTED AND KEPT IN POSITION BY DR. W. ROSS, WHO ASSISTED ME. THE SYRINGE
was filled, firmly pushed on to the needle-piece and emphied and left for a second or two after which it was removed from the needle-piece again filled and discharged as before. This was repeated till 10 cc had been delivered. The patient complained of a little discomfort in the back at the point of injection. Next morning the throat was cleaner and the breathing easier. The child had taken five grains of sodium salicylate every three hours for twenty-four hours and I have seen as much clearing of a throat take place from the use of this salt alone so in reckoning up the benefits due to antitoxin this fact must not be lost sight of. Two days after the injection the child coughed up "a tube" according to the mother's voluntary statement which may have been a cast of the windpipe. It was thrown away and I did not see. However the statement is the more valuable because of the fact that the mother was not told to expect a look for anything of the nature of a "tube" nor indeed to look for anything. With this the patient showed a marked improvement and on the next day the throat looked
nearly well, the cough had ceased and the breathing natural. The sodium salicylate which was continued till now was stopped and for it was substituted five minims doses of Bacton's syrup well sweetened with glycerine and simple syrup. Palatal paralysis was looked for each morning and each day the knee-jerks were tested. The former was normal but on the 8th day the knee-jerks were much less active and continued so for some days, but by the 12th day they had returned to normal. The urine was examined only on one occasion but no albumin appeared to be present. She was kept in bed for 14 days. No rash appeared.

The following is the daily report:

12th - Antitoxin 10cc. Gummy membrane on tonsils
13th - Breathe easier. Throat cleaner. Pain. Rumbles in chest
14th - Less rambling. Very pale. Heart intermits. Throat clean
15th - Better. Eats well. Has coughed up yesterday.
16th - Improving. Breathing natural.
17th - Improving.

Six weeks afterwards the child suddenly began to swell around the eyes and passed albuminous urine. He was placed on milk.
diet and given a tris of potassium in fine grain doses. I lost sight of her but sometime after the mother told me the little patient got rapidly well. No signs of scarlatinia were seen.

| Records of Temperature, Pulse, Respiration and Stools, from 12 Day of September 1893 |
|-----------------------------------------------|-------------------|
| In the case of                                   | Fever 16 (Child)  |
| Day of Month                                  | 12 13 14 15 16 17 18 19 20 21 22 23 24 |
| Day of Disease                                | 1 2 3 4 5 6 7 8 9 10 11 12 13 |
| COOLANCE                                      | AM PM AM AM AM AM AM AM AM AM AM AM |
| Pulse                                         | 126 130 130 120 110 106 106 106 106 |
| Respiration                                   | 24 22 22 22 22 22 22 22 22 22 22 22 |
| Stools                                        | 14 14 14 14 14 14 14 14 14 14 14 14 |

The house in which this child lived was old and of stone. Since the two last cases of membranous group the Notification Act has been adopted in Leeds and the house in which Case 16 lived was examined by a sanitary inspector. The walls were damp, the kitchen sink was of soft permeable sandstone and filthy from absorption, the waste pipe opened directly into the sewer and emitted a foul smell. Altogether the house was not habitable and the landlord was ordered to make it so by having the waste sink pipe to open outside.
into a gallery and the flooring of the lower flat was taken up and the walls were lined half way up with wood. Herein is shown the value of the Notification Act as far as the floor are concerned. Landlords are able to take care of themselves.

Case 17
Diphtheria Characteristic Culture.
In September 1895 I saw a boy of 6 whose parents said he suffered from vomiting and exhaustion. He had been ill two days. The pulse was 120 and the respirations 24. The urine showed a trace of albumin. The tongue was coated brown, moist and the breath was foul. The reaction of the mouth was highly acid. The tonsils were swollen and covered with a dirty yellow membrane, a portion of which on examination showed a fine fibrinous network with round cells which stained bright red with merocarmine solution. A culture made from this membrane showed greyish yellow colonies in 36 hours.
These colonies did not liquify the jelly. Soda water was given for a few hours till the richness stopped after which milk and soda water were ordered to be given. A mixture of compound infusion of gentian containing five grain doses of sodium salicylate was prescribed to be given every four hours while awake. The child made a good recovery. No paralysis of the muscles of the palate followed but the knee-jerks which were tested daily showed weakness on the 6th day and remained weak till the 9th day when they improved and slowly returned to normal. By the 6th day the membrane had cleared away and now Bactor's syrup in five minia doses was prescribed. The acidity of the mouth in diseases of the throat is a good reason for the employment of sodium salicylate. This salt is readily changed into salicylic acid in the presence of an acid and as such has considerable antiseptic action. Paper painted over with a one in ten solution of the ferrie chloride solution of the Pharmacopoeia and dried, when applied to the palate or tonsils some minutes after a dose of solution of sodium salicylate has been swallowed at once strikes a characteristic purple colour showing that
A salicylate is present: from the fact of its presence after a few minutes we may say it has some local effect.

Records of Temperature, Pulse, Respiration and Stools, from 29 Day of September 1895

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<th>Case 17 (Boy)</th>
<th>Aged 6</th>
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The house in which the child lived was an old stone one and in an outlying district of Leeds. The windows were small and no attempt made at ventilation. The people were well to do working class folks who lived there because of a large garden attached to the property. The sink was an old sandstone one and the waste pipe opened directly into the sewer or rather only part of it for there was a large hole in the pipe for an unknown period it had been leaking and pouring into the foundations of the house. Had there been no notification this might have gone on till the whole house...
hold was carried off.

Case 18.
Cutaneous Diphtheria.
On the 19th November 1895, I saw a male child aged two years suffering from spots on the face, breast, swollen and cracked lips, bleeding in parts and in other parts covered with a membranous looking body. At first I thought the condition one of herpes which had become purulent but on touching the apparent crusts I found they were soft and leathery. I removed a portion and exposed a bleeding surface. A portion stained with procarmine solution and examined was seen to be a glassy membrane which stained badly. One of the tubes issued by the Leeds Sanitary Authority was charged and taken to Prof. Frevley and his Laboratory at the Yorkshire College. His report was "Diphtheria bacilli numerous with staphylococcus aureus." The membrane spread to the mouth and throat but disappeared rapidly after a few doses of sodium salicylate had been taken. The nose was acid in reaction. A patch the size of a florin was present over the top of the sternum. In
the latter position the great part of the affected area was
dark red in appearance with only a piece of membrane
at one side.
The history shows that the child was well supplied
with food. The house is a very old stone through
(not back to back so common in Leeds) house. Traps
and gullies were built in some six months
previously to the present illness. A gully which
had never been cleaned out and which is
described by the sanitary inspector, as being placed
so that it must be dry half the year stands
directly under the front door and receives the rain water
from the roof. A gully receives the waste water
from the kitchen sink and stands close to the back
door and it too has not been cleaned out, but
had the tenant been ever so anxious to empty it
he would have had great difficulty in doing so
because the body of the gully had been flushed so
far past the top that when the grating is removed
only something like three-quarters of a circle is seen.
On inspection of the kitchen sink we found that
it was as shallow as it could possibly be and yet
receive the name. It was of soft sandstone and
the walls against which it was placed were of
a soft conglomerate and were damp and
mitted a foul odour and all the parts around were permeated with the dust of years.

Coming to the history of the present illness the mother says the child had a bad cold for some days and spots appeared on the upper lip and when both lips began to swell she became alarmed. On the first few days after I saw the child the temperature kept above normal but soon came down. On account of the swelling of the lips & the condition of the mouth swallowing was difficult. The secretions of the mouth were intensely acid. Vomiting was present on one or two occasions and the bowels were loose. The glands under the jaws were swollen. The pulse was rapid and the child was irritable. Breathing was not interfered with and there was no evidence of laryngeal trouble. The skin around the patches over the sternum was red but no general rash was seen. (The membrane sent for examination was obtained from the cheek near the angle of the mouth.) The urine was not examined for the reason that the mother could not collect any. No nervous symptoms developed.

Locally the membrane was removed and the parts...
bathed with a one in three thousand solution of mercuric iodide (bin iodide) several times a day. In a week the parts were all clean and showed no signs of healing but on the 9th day a white exudate of membrane the size of a split pea reappeared on the lower lip. It was removed and the lotion vigorously applied and no further trouble arose. In a fortnight the child had practically recovered. In speaking of treatment one must not forget to say, sanitation was not neglected and defects as far as possible were remedied and after recovery the house was disinfected by the sanitary authority.

The black marks showed the position of the membrane.
Case 19 (Brother to Case 18)
Catarrhal Diphtheria

A brother of the foregoing aged 6 had his cheek burnt by a cracker in the early part of November. The wound had never healed up and over it and the lip there spread a membrane similar to that described in the case of Case 18. There was little constitutional disturbance. No internal treatment was prescribed but the parts were attacked with the mercuric iodide lotion as in Case 18 and the membrane once removed did not again appear.

The black marks indicate the position of the membrane.
Case 20.
Acute Catarrh of the Larynx or False Croup

As a contrast to the cases of true croup I give a short account of a case of the above which occurred in a little girl of 12 months. In January 1876 I was called to see M. C., the child of a lady living in the suburbs of Leeds. I found the baby hot and feverish and breathing more rapidly than ordinary and evidently with effort. The face was flushed and the child generally contented and smiling was febrile, restless and clinging to her mother's neck. The skin was dry. On taking the temperature I found it to be 102.5°F in the axilla. There was no dulness in the areas corresponding to the lungs, but the breathing was harsher than ordinary in some places. There was no indrawing of the chest muscles. A slight cough was present and was dry and brassy in character. The bowels were confined. Examining the mouth I found the tongue coated and the tonsils and pharynx red and swollen. The history was that the baby had had a cold
for two days but had got worse in general health on the evening of my visit. Although looking ill the child had not that distressing and anxious appearance which one sees in true croup (diphtheria of the wind-pipe).

The treatment prescribed was (1) a teaspoonful of castor oil. (2) A warm bath. (3) A mixture of milder wine spirit and spearmint wine and simple syrup. The mixture to be given one hour after the dose of castor oil and to be repeated every two hours while awake. (4) The temperature of the room was ordered to be kept at an uniform rate. Next morning the baby was evidently better and the temperature was 99.0° in the armpit. She had slept two or three hours altogether, the skin had acted freely and so had the bowels and food was taken. The cough was still brassy and the lungs were much in the same condition as on the previous evening. The mixture was continued every four hours. On the following day the temperature was normal, the cough less brassy and the lung condition had improved and the bowels and pharynx were better. A simple tonic mixture was
prescribed. The baby was still kept to one room. Day by day improvement took place and in a week the little patient was allowed to go downstairs and was practically well. No sign was ever seen and neither the tonsils nor parts around showed signs of diphtheria. I regard this as a simple case of catarh extending from the tonsils and palate to the windpipe, bronchial tubes and lungs and which speedily resolved.

Very like this last case was the case of a girl of two years whom I saw suffering (in March) from a catarh affecting the air passages. Before I saw the patient the mother, who knew the value of steeped wine and castor oil, had given doses of the former to produce vomiting and of the latter to produce purging, but increase of the laryngeal symptoms caused the mother to send for assistance. I found the child suffering from well-marked catarh of the respiratory tract, the throat being red and acrid but no membrand was seen nor was any seen during the whole
course of the illness. The most alarming symptoms were those attaching to the larynx and for the present only interest us. These were intermittent: sometimes the child breathed quietly and comfortably, while at other times and especially when annoyed at anything she experienced difficulty in breathing and the cough became more crepity.

In a week's time the condition yielded to the usual remedies and the whole character of the malady pointed to that of a catarrh which had affected the throat, larynx, and bronchial tubes: in fact one often sees in children a similar affections only the larynx escapes attack.

Case 21

Laryngiæmæs Hicidulus. Death.

In January I was called to see a female child of ten months living in a poor part of the town. The nurse to whom the child was entrusted said the baby who had hitherto been healthy was choking. When I arrived at the house the baby had got over the seizure but was pale in the face and a cold sweat lay on the brow. The hands were clenched but not tightly and the legs were somewhat rigid.
to me the child looked just as if suffering from fright. I examined the little patient and asked the nurse the necessary questions. She said the child was generally good tempered and quiet. She had no teeth, the bowels were confined. She made no attempt to stand or walk and the nurse thought the back was "weak." The child, although apparently well nourished, was soft and flabby. The skin was soft and glossy. The head was well formed and so was the chest and body, generally but was of the square type. One could not say the epiphyses were large. A dose of castor oil was ordered to be given and a mixture of aperient wine, bromide of potassium and syrup was prescribed.

No more was heard of the child for six weeks when the nurse again called and reported another attack. I went at once and was fortunate enough in seeing the child in the seizure. The face was pale and the brow cold and covered with sweat. The veins in the neck stood out and the head was thrown back and a distressing effort to breathe was made followed by a long pause. The effort and pause were repeated at intervals till in the course of half a minute or perhaps less a great effort was made
and something appeared as if it had "given way" and a long breath was drawn and the child sank back exhausted and slow deep regular breathing followed for sometime. The baby was allowed to lie quiet for sometime when the treatment prescribed after the first attack was repeated. For a day the child was exhausted and apparently desired not to be disturbed.

Some weeks passed and the case escaped from my mind, but one day I was again summoned. When I arrived at the house I found the child dead.

The story of the nurse and a neighbour was that the child had been well between times and was suddenly seized with difficulty in "getting breath." This soon passed off but another followed in which the child died. I tried artificial respiration and put my finger into the mouth and down to the opening of the windpipe but could neither feel nor see any obstruction. The face was pale as in the other seizures on it there was a strained expression.

This was the first case I had seen and some months after I saw another case of laryngismus stridulus which happily was not fatal.
In the course of five years—three of them in very large working-class districts—I have only seen the two. They both occurred in damp districts but probably constitutional peculiarities had more to do with the malady than influence of soil or surroundings. I give the case to show that I clearly distinguish between croup and laryngismus studulosis.

Cases 22, 23, and 24. These three are taken together because they all happened close to one another and within a short period of time.

Case 22. Pharyngeal Cataract. Laryngeal Symptoms. Death (Diphtheria) In May a boy of 10 living in an insanitary neighborhood and densely populated complained of sore throat in the beginning of the week. The throat was red but no membrane could be seen. His condition was phrenic but he was a highly nervous child. On Friday difficulty of breathing was experienced. On Saturday the laryngeal symptoms increased and he died the same evening. Operation was refused and no examination of the body allowed. No membrane was ever seen.

Case 23. Diphtheritic Croup. Death About six weeks after the foregoing child died a
girl of 25 years began to suffer from severe laryngeal symptoms with brassy cough. She had been ailing in a blustering way for a day or two. All efforts failed to relieve the child and tracheostomy was put before the parents but stoutly refused and the child gradually sank in 48 hours after being first attacked. I should say the soft palate and tonsils were red and I fancy I saw membrane but of this I cannot be absolutely certain for the child could only be imperfectly imperfectly examined on account of the frantic struggling at the sight of the teaspoon.

Case 24. Diphtheria of the Throat. Recovery. A week or two after the death of the last child another man living near came complaining of severe sore throat. On examination the glands of the jaw were swollen and the soft palate and tonsils on both sides were covered with a dirty yellow membrane and the case looked as if it would be serious but by gargling with borax lotion and the use of sodium salicylate it cleared up in a day or two and no paralysis followed. The clinical features were those of diphtheria and although all serious symptoms passed off in the course of a day or
So we know that this malady is not so serious in adults.

Case 22 was an only child but on all sides were young children yet none contracted the disease save Case 23 and that some weeks after. Case 23 was one of several young children yet none of them contracted "croup". Case 24 was a married man and had several young children yet none of them became ill and none of the neighbours. After this no more cases occurred.

We may say with certainty Case 24 was diphtheria and Case 23 most likely yet none in the very immediate neighbourhood caught the disease. Severo isolated case may then occur without being the means of spreading the disease and that with only ordinary means being taken to prevent this.
A Contribution to the History of Diphtheria and Croup.

The work of Breightoti and the Committee of the Royal Medical-Chirurgical Society well embody all that has ever been written about diphtheria and croup and their relationship to other diseases. I have read both the histories mentioned and most of the works quoted by Breightoti and the Committee. One or two authors have impressed me and as they are either not mentioned or if mentioned are not largely quoted I give extracts which I think are of importance as throwing light on the subject under discussion.

Robert Saunders of Banff (1778) who wrote a pamphlet on the sore throat raging in the North of Scotland evidently mistakes scarlatina for he had three hundred cases with only three deaths and the throat condition seems to have been a small fact in his cases. There is no mention of asthmia, paralysis or croupy cough or of dyspnoea. He says it raged with great violence amongst the lower class of people which I imputed to their great uncleanness, bad vitals and frequent exposure to great extremes of heat and cold.
Drury Alexander (1794) who practised at Halifax has written a pamphlet which I purport quoting from for it shows that the writer has given under the name of croup diseases which we now call laryngeal croup, stridulous croup (or false croup) and a disease of the windpipe with distinct premonitory symptoms of pharyngeal trachea or what some call diphtherite croup (diphtheria of the larynx). Halifax under croup he groups three distinct affections. Halifax is a hilly district and having a water supply and under other conditions suitable for the manufacture of cloth it was early seized by the Flemings for the carrying on of the woollen industry. In its geographical features it is very like Galashiels in the Scottish Border where a similar industry has long flourished. Galashiels was in the years 1847 to 1852 at least often visited by "croup" of a spasmodie nature for when the writer served his apprenticeship as a druggist in this town the sale of spearmain wine was extraordinary during the the winter and spring months for the treatment of what the lady called croup sudden in its seizure of young children. I heard of almost no death from the malady although it was a common
thing to be rung up at night to supply ifeacran wine or other antispasmody. Dr. Weir who more than forty years ago attained local fame in the treatment of so-called croup employed an acaeous syrup of ifeacranha. After his death this syrup was patented and it was sold in large quantities and vaunted as superior to the pharmacopoeial wine. Weir has thus anticipated the compilers of the British Pharmacopoeia by forty years. Spasmody (false) croup appears then to have been common in Weir's time. After reading Alexander's (of Halifax) cases I cannot but think they resemble what I was in the habit of hearing described by the people of Salsile. Alexander says in his preface that the disease frequently occurred during the winter months of 1792 and 1793 and his cases belonged to those times. His descriptions illustrate the state of knowledge on the subject a century ago.

Case 1. A child of 9 months. It does not pay if the seizure was sudden. But the child "made no complaint except an apparent dulness in his eyes and a loss of that vivacity." There was evidently some throat trouble although
this is not stated for "she could swallow not more than a heaspoonful of fluid at a time." Difficulty of breathing was great. Despite very bold treatment in the shape of ipecacuan wine, laxatives and leeches on the throat the baby died in 24 hours. (This may have been a true diphtheria which had extended to the air passages)

Case 2. A girl 18 months old. The onset was sudden. She had a giddily cough. She vomited "green coloured matter" with tough phlegm. Blister, leeches to the throat and antimonial emetic were employed.

The difficulty of breathing left her but returned on a later date and antimonial powders given made her sick and then better next morning. Recovery. (This would point to spasmodic cough.)

The cases 3 to 4 are contributed by Dr. W. Shaw.

Case 3. A boy of 22 years. Attacked while at play with great difficulty of breathing. Six leeches applied and tartarated antimony (dose not stated) given every half hour. Breathing easier. Three days after he is again seized. Leeches and antimony again employed. Vomiting follows and he is relieved. Laxative medicines and antimonial powders are prescribed and the disease disappears but we do not wonder that he has
never since perfectly recovered either his strength or his spirits.

Case 4. A girl of 2. Seizure sudden, abating during the day and returning at night for several nights but eventually she got well after being treated by leeches, antimony and laxatives (It would almost appear as if when thoroughly exhausted all tendency to spasm was undone)

Case 5. A boy of 6 months. No preceding symptoms sudden onset. Antispasmodics applied and well in ten days. In three months exposure to cold brings about another seizure and is combated by the same means (This looks as if it was a catarrhal laryngitis)

Case 6. A girl of eight years. "Prepared for a day or two with a cough and pain in her throat" Seized suddenly with a violent shortness of breathing and that peculiar croaking noise in inspiration which distinguishes this from all other diseases. The usual remedies were applied by she died ashen in 24 hours. (This seems a doubtful case of diphtheria - most likely diphtheria)

Case 7. A girl of ten months "began to breathe with great difficulty" Leeches, calomel and zeneca employed followed later by antimony and nitre. She
recovered. Seven months later a second attack came on and from this she recovered. The following spring she had a third seizure and recovered. To show that these were spasmodic in character I quote the writer's own words: "It is worthy of remark that in each of these attacks a copious discharge from the periparturient vessels came on before the child was relieved and in proportion as this took place the flushings in the face and feverish heat abated."

Case 8. A boy of 3 years. Well in two days being treated in the usual way.

Case 9. In a boy of 4 years. Onset sudden. Well in a few days.

Case 10. A girl of 12 months. This would appear to be a case of laryngismus stridulus for she was sometimes free from complaint for six or seven hours when the symptoms again recurred as violent as ever. Now and then they seemed to be relieved by opium. She never discharged any phlegm and was seldom hotter than usual even during the paroxysm. She continued better and worse for the space of ten days when a strong convulsive fit suddenly seized her ... and in a few minutes deprived her of a miserable existence."
Case 11. A girl between 9 and 10 years old lay in a dying state for want of breath. Six ounces of blood were removed from the arm and vomiting given. Next day she was as well as usual except that she felt herself weak. (For want of a better name one might call this laryngismus styloides for a child suffering from a febrile disease could hardly be as well as usual the following day)

Case 12. A boy of five months. Well in two or three days. (Presents no special features)

Case 13. A boy of 17 years. Got wet. Well in two or three days. (No special features)

This completes Alexander's cases and I now turn to a part of Scotland which had had a reputation as a field in which diphtheria was often epidemic and even now I understand makes its appearance. I mean Torintipl and district, a stretch of country in Banffshire but on the borders of the counties of Aberdeenshire, Inverness and Moray and close to the Ben Macdhui and Braingorum Mountains. This district is distant many miles from a railway and from the fact of it standing high and being off the highway to important centres has not much communication with the outside world and in
earlier years intercourse must have been less.

Regarding the earlier epidemics reliable information is wanting but last year was able to get the following information which is valuable as it contains suggestions concerning the relationship of diphtheria to sanitation. I give the writer's own words:

"Some twenty-five years or more diphtheria was very prevalent about Ballindalloch Glenlivet and Tomintoul. It appeared for several years in succession. Few families escaped its visitation and it was not confined to children. I began to look upon it as an epidemic, then as an endemic. I concluded that wet seasons, damp soils, damp houses with their turf walls and turf roofs had some connection with the deadly disease and suited the vitality of the germ. You know the old cottars' houses were often green with fungi far up the walls. The four glass panes in the window were no aids to ventilation and admitted of no air to the room and the old close beds were so many 'black holes of Bactria' in miniature. Diphtheria has often appeared at Ballindalloch, Glenlivet, Tomintoul and I also think at Rothiemurchus."
and Nethybridge (that is since the earlier epidemics spoken of) from whatever cause diphtheria is not now so common as it once was. Drainage (by this must be meant drainage around the dwelling houses for no general system of drainage appears to be employed) and sanitation are doubtless factors in the case. I personally knew Dr Cooper of Achraeahan Glenlivet who was successful in the treatment of diphtheria. Dr Cooper's treatment in part at least consisted of iodide of potassium internally and injection of perchloride of iron and nitrate of silver applied to the throat. All in the house, seek and we'll get the iodide. I need hardly add that the epidemics just mentioned were highly fatal so there is no doubt as to their true nature.

My informant goes on to add: "I think the disease has been known in Scotland for at least two hundred years. Grantown on Spey is so like Inverness in many ways that one wonders what it is free and has been free from the ravages of diphtheria. The modes of living are very similar too. My friend goes on to say:"
"For upwards of thirty years (the period of his residence) I have known of no case of diphtheria in Grantown and conclude that the deep deposit of gravel and open subsoil which absorbs all moisture leaving our roads and building sites so dry has something to do with our immunity from the terrible disease. Three deaths—all children—occurred in 1893 (within a week) caused by a defective and choked drain. . . . The disease went no further."

A photograph taken in Inverness-shire in 1894 and in some measure resembles the dace of cottage described in the letter of my correspondent."
In the long list of writers on the subject of diphtheria, I think sufficient credit is not given to Starr of Lostheart in Cornwall (1750) who in describing the epidemics he witnessed was one of the first, if not the first, to clearly distinguish between diphtheria and scarlatina, in which the throat trouble was prominent. He also speaks of the laryngeal and pharyngeal varieties of diphtheria and also mentions what other writers of his and later dates omit or pass over lightly, namely the immediate cause of death in fatal cases. He writes: "They died suddenly (heart failure or syncope of today) or sank away gradually (our aesthenia)."
Observations on the Naked Eye and Microscopic Characters of the Membrane in Diphtheria 

In 1847 Virchow laid down certain distinguishing features for catarhal, crumpl and diphtherie inflammations of the mucous membranes. And Heubner regarded both the naked eye and microscopic characters of scarlatinal diphtheria as different from diphtheria, although later he had modified his views. Now-a-days opinion has changed and we pay less attention to both the naked eye and the simple microscopic appearances of inflammations of the throat and we rely rather on the bacteriological examination. In many respects this is a matter for regret for although it can hardly be doubted that the Klebs-Loeffler bacillus is the cause of diphtheria, the descriptions of the organism included many shapes and sizes giving one the idea of great indefiniteness, thus arousing suspicion in the sceptical mind. It is said to occur in pairs or arranged in groups or so as to resemble the letters V.M.N.Y.X and so on, or in chains. It is also spoken of as long, short, medium, and as thick and thin. Likewise
the medium in which it is cultivated is said to determine the size and property of staining well or otherwise. A description of this sort then leaves much room for errors in the detection of the organism. Besides this we know that careful clinical observers have not often difficulty in saying whether a case is one of genuine diphtheria or no. Time will clear up all discrepancies but at present there is a danger of clinical observation being left in the background and laboratory observation made to take its place. This is a bad training for the young practitioner.

In the following cases observations were made at the bedside and a piece of the membrane was removed and examined both by high and low powers after being stained with mircocarmine solution and mounted in Farrants solution. Afterwards a microphotograph was made and is here in each case reproduced.

The membrane is taken from a case of diphtheria of the tonsils which extended to the wind-pipe. Confirmed by bacteriological examination. It was tough and leathery and was found to be made up of fibrin in coagula-
2. Diphtheria in an adult man. The membrane covered first the left tonsil and soft palate and in a day or two extended to the other side. Twice a day the throat was swabbed with sodium salicylate solution one time and solution of the chlorine compounds the next and it was as rapidly reproduced. The membrane from which the photograph was made was removed from the throat one week after the onset of the disorder. It was composed chiefly of fibrin with cells and organisms and epithelium in its meshes. No bacteriological examination was made but the disease was to characterize it to leave no doubt as to its identity.
3. **Diphtheria**

From the membrane covering the cheek in a child of two years. Confirmed by bacteriological examination by Prof. Trevelyan. The field had a fleshy appearance and could scarcely be photographed. Numerous failures took place before anything like a presentable picture could be obtained and even at the best is far from giving a very good idea of the condition.

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4. From a case of diphtheria of the nostrils in an infant. The child died some days after the...
membrane was coughed up. It is almost wholly composed of coagulated fibrin in the meshes of which are cells of various kind.

Fig. 4. Nasal Diphtheria

Mass of fibrin in layers with epithelium and small round cells and cocci.

In all the cases of diphtheria it will be seen that fibrin is a constituent of the membrane; if it be allowed that the glaicy membrane is made up of coagulated (membrane) fibrin. Several cases of the membrane in scarlatina were examined and the following notes were made. "Solid when removed - on the seventh day - but liquid on standing. Epithelial cells of various shapes. Round nucleated cells: clusters of organism: broken down tissue but no meshed membrane." The next case reads: "A bluish shimmering membrane - removed on the third day - covers the pillars of the fauces and the underlying
surface only bleeds when very forcibly rubbed. A thick yellow membrane is found in dots on the tonsils and no bleeding occurs when it is detached. It is a soft yellowish membrane and when dropped into alcohol it falls into small grains differing from the membrane in diphtheria which coagulates into a tough continuous string when placed in spirit. The membrane does not cover an extensive area but only appears in dots and does not reappear on being removed. The whole throat is very bright red and angry. In another case of scarlatina the notes run: "The same description of the membrane might do for this one" (That is the second case is so like the third.) These notes were made at the bedside and are copied word for word from an old book.

The photograph shows that the membrane in this case of scarlatina is almost wholly composed of round cells. In this case the membrane although of a yellow colour had features about it which made it plain that it was not diphtheria. The clinical conditions too were scarlatinal.
6. A case of simple sore throat showing that the membrane is composed of round cells. The tonsil was red and inflamed on the right side especially and a yellowish patch occupied a small part of the tonsil. It had no relation to a crypt. It was soft and readily disintegrated. Under sodium salicylate the condition rapidly got well.
7. This photograph is taken a case of a baby with a membrane covering the gums, tongue and throat. It was a dirty yellow membrane and had persisted in reappearing after the continuous application of mercuric iodide solution. The child died of a gradual loss of power and the whole clinical history pointed to a case of thrush. The thrush organism was found on examination but the greater part of the membrane is made up of epithelial cells and shown by the photograph.

Fig 7. (Thrush in a Baby)
A mass of epithelium
The lower part of the photograph has been cut off owing to a stain having been on it and I had not the time to print another one.)
The accompanying photograph is taken from the case of a horseman who came complaining of sore throat and pain in the back and limbs. On examination the uvula was covered with a bluish-white exuding membrane on the removal of which a red angry surface was exposed. The tonsils and soft palate were red but had no membrane. The microscope revealed the two conditions shown. In one part could be seen a ramifying membrane of chains of a bacillus like the hay bacillus but when the slide was photographed next day the organism could only be seen in round masses as seen in the figure. The next part of the membrane was seen to be composed of a mass of epithelium.

Fig 8
(See throat)

Epithelium in the left hand figure: bacilli to the right.
9. This is only introduced as a contrast to the foregoing. A patient came with a throat ulcerated and covered in almost its entirety with a grayish white membrane, the removal of which left bleeding points. The membrane was largely made up of coagulated fibrin but in its meshes were nests of round cells well seen in the photograph of a picrocarmine stained section. The history and other symptoms left no doubt as to the condition being one of syphilis. The throat was well swabbed with the standard solution of mercuric chloride and the false membrane thoroughly removed. It however returned in several reactions during the next four or five weeks. One could hardly mistake this for diphtheria still on first sight the throat so like this disease that I think the subject worth mentioning.

Fig 9 (Syphilitic Membrane)
Irregular masses of fibrin in the meshes of which are cell nests.
My contention then is that it is worth while paying more attention to the simple microscopic appearances of false membranes found in the throat than the tendency of the present time teaches. And I further contend that the organism of diphtheria initiates growth and in its destruction of the part it attacks produces fibrin more readily than any of the other organisms which are to be found in the mouth and throat.
Analyses of Soils and their Relationship to Diphtheria
Soil Microphotographs

Microphotograph of a culture tube from soil. The tube was placed under a low power and a part photographed. The separate colonies are well seen.

Fig 1 = a coloured microphotograph from soil.
Fig 2 = Same uncoloured. Fig 3 = Same as 2 but lighter.
Fig 4 = A gelatine film coloured red to be held up to the light.
In the foregoing table the soils examined were obtained during a dry period, and each specimen was taken from a place removed some distance from a human dwelling or building in which any animal was kept. Animal contamination was thus so far avoided.

General Characters of the Soils &c.

1. This soil was from a part of Inverness-shire where diphtheria has often appeared most unexpectedly. The soil is boggy and peaty and Scotch fir is abundant—a remnant of the old Caledonian Forest is to be seen in the neighbourhood. The depth of the top soil was found to be ten nine inches. I have known of epidemics of scarlatina. Artificial drainage is almost unknown.

R. Ashton-under-Lyne, in Lancashire and really a suburb of Manchester is partly built on a moss. The celeri grown on this moss has a reputation for excellent flavour. The moss in all parts is well drained. The people are well housed and well fed. The soil is a black loam and one has to dig down many inches before a hard foundation is reached. Nearly two and
a half-years' residence in a large practice enables me to speak of the prevalent diseases. Searlatina appeared from time to time but not in great numbers. I only saw one case of diphtheria and a practitioner who had resided in the town for twenty years tells me the disease has never been epidemic and he has seen very few cases of it.

G. Castleford in the West Riding of Yorkshire is built on the banks of the river Aire and Calder. The district is damp and rheumatism is common. Drainage is good. I practised here for twelve months in a very large general practice. The people in general are comfortable. Searlatina appeared now and again but I never saw a case of diphtheria and the practitioner whom I assisted and who had been in the town for forty years told me the disease had never been epidemic and he had not seen many cases. The soil is a clayey sort, with a sandy soil a few inches below.

B A sample of soil from Grantown-on-Spey, Morayshire. The surface soil is ten inches deep below which is a porous sub-
soil. There is no system of drainage. Scarlatina has been epidemic at times but diphtheria never, at least in the past thirty-five years. A sample of a peaty soil from the village of Grantown. The depth of peat is about six feet under which very porous soil.

E. Tomintoul, Banffshire. One of the highest inhabited villages in Great Britain. A very bleak district. Peat abounds all around the village. The soil is rich in iron, manganese and other ores. Diphtheria once very common fatal and even now epidemics occur. The depth of peat at the spot from which the soil was taken (the Grantown side) was three and a half feet. The subsoil is hard and for this reason water must lie on the surface or only a little below.

G. Tomintoul on the Glenlivet side. Depth of moss at the spot from which the soil was taken one foot. Peaty and subsoil as in E. No artificial drainage.

F. Boat of Garten, Inverness-shire five miles from Nethy Bridge. Scarlatina hardly known.
and diphtheria never. Drainage natural.

Depth of top soil ten inches, organic but not

peaty. Subsoil very porous sand.

A. Another sample from another part of

Boat of Garten on the borders of a peat moor

(The moor about one mile distant.) The river

(they separates F and A.) Diphtheria has

once broken out in A neighbourhood twenty

two years ago - but I think it could be traced

to bad sanitary arrangements in the one

farm horse to which it was confined.

Soil much the same as in F.

In the Meanwood district of Leeds

diphtheria has within some years back

evened. Roof in hens is often

epidemic. Scarletina and typhoid fever

have also been epidemic. A large tannery

lies on one side and a small tannery on the

other. A small beck receiving the organic

foul of the large tannery runs through

the centre of the district. Numerous market

gardens are dotted over the village (See p. 14)
Deductions from Analyses of Soils.

As to percentage of water. Organic soils contain much water where the subsoil is hard. The soils of the diphtheria infected regions contained much moisture. One soil (Grantown D) contained a high percentage. Here diphtheria is uncommon or hardly known but the sample was taken from a peat moss. The soils from districts exempt from diphtheria as a rule contained less water than infected regions.

Absorption of water. Nothing can be learnt from this I think.

Power of holding water. This likewise teaches little.

Substances taken up by water. Organic matter was present in both infected and non-infected regions. In two of the peaty soils (one infected and one not) nitric acid was detected. This would show that a peat moss may be a source of danger. In a non-infected region (where diphtheria is practically unknown) nitric acid was found but the subsoil was highly porous. In the other case the subsoil was hard and contained much more.

Substances removed by hydrochloric acid. This teaches nothing of importance to us here.
Percentage of air absorbed. In all the infected regions little air could be displaced from the fresh soils. They all contained much organic matter capable of removal by incineration at red heat with the addition of ammonium carbonate. In soils appeared to form a compact mass through which air had difficulty in percolating. This would appear to point to the important part which air plays in the decomposition of organic matter in soils.

Organic Matters. In all the parts where diphtheria was often present, organic matter was largely present. (Exception: Grantown D which was from a peat moss and over a porous subsoil. As already mentioned diphtheria is not known there.)

Gelatin-peptone-glucose jelly culture. By the naked eye little could be learnt. A second and then a third culture was made from the soils E and G where diphtheria was common. A portion of the jelly was stained with alkaline methylene blue, treated with half per cent acetic acid, dehydrated, clarified and mounted in Canada balsam.
and examined by the microscope. Bacilli not to be distinguished from the organism of diphtheria were seen. To confirm or otherwise a specimen was sent to an eminent bacteriologist and the report was that "the bacillus of diphtheria" is present. This confirms the statement of Mr. W. A. Adams of Maidstone—"He believed that the organism of diphtheria inhabited organically polluted soils (surface) and was liable to displacement into the superincumbent air." See photographs and explanations on pages 1367-136.

Since the foregoing was written I have had opportunity of examining a tract of ground in the Meanwood district of Leeds where scarlatina, diphtheria and typhoid fever (see p. 14) are often present. The piece of ground in question had lain waste for many years and was being reclaimed by a market gardener. The soil is characteristic of the district. The surface soil is clayey in some parts and in others consists of a sandy blackish loam and in still other parts it is distinctly sandy. One foot and in many
places less than this below the surface hard rock is reached (sandstone) or in many parts the under soil is found to be of a peaty nature and deeper down a wet bog is found. These varieties of under soil have a wonderful effect upon the growth and rearing of the market gardens produce and the man related to me his experiences in this direction. When the soil is first reclaimed he tells me plants have no hold on the soil but in a season or two the soil becomes closer and "holds" the plant, the working of course breaking up the soil into finer particles. Secondly the man tells me he has no need to water his plants such as he has had to do in other gardens which he rented in another town. Even if the surface was dry at mid-day in summer, a few inches down it was quite moist, and the driest summer almost failed to remove the underlying moisture! In the first case the rain water lies on the hard rock and in the second if it does get down to the bog, it there lies and is an almost inexhaustible reservoir and rises as vapour, passing through the plant.
and porous top soil. In summer, the ground in the morning is always found to be quite damp, differing much from what the gardener has found in other places.

We have here then in the district under discussion a soil which is largely composed of organic material some little distance below the surface and in which the organisms of disease could readily grow or at least remain dormant and in a condition in which they could readily be thrown on the surface and scattered by the wind or other agency. Roup in hens has already (p. 14) been mentioned as breaking out in this district. Allowing that the organism causing roup is different from that of the organism of diphtheria this soil must also be favourable to the growth and spread of the microbe just named.

Noldé says: "The disease is propagated by infection rather than by contagion; it is caused by the exhalations which escaped from the soil after the earthquake of 1616. During the first year these exhalations occasioned an epidemic disease affecting first the lower animals because they kept their muzzles nearest to the earth in the following year children were attacked and lady adults."
I was led to further investigate the question of the relationship of soil and the organism of diphtheria for the reason that when I made a third culture the tube presented the appearance very similar to what one sees in tubes prepared from the swabblings of a diphtheritic membrane. Each colony was at first separate and the jelly was not liquefied after 48 hours or there. So plain was this that when I placed a tube under the low power I was able to reproduce a photograph. I next prepared a slide and the bacillus was so like the organism of diphtheria that had the opinion of a specialist who agreed with me. Of course one may be deceived that the staining peculiarities and others are like the Flebo-Loeffler bacillus. I have been unable to find any reference to the actual finding of the organism in the soil. To dwell they exist but I must plead ignorance of them.
The Action of the Products of the Organism of Diphtheria on the Heart of the Frog (Rana Temporaria)

In the following research an endeavour is made to ascertain if the products of the organism of diphtheria have any action directly on the heart muscle. Cases of diphtheria often die suddenly and although this may be due in many instances to paralysis of the vital centres there may be cases where the poisonous products circulating in the blood have a debilitating action on the heart muscle itself, just in the same manner as the vegetable alkaloids and glucosides act.

I
25 October 1876 - Temp. 65°F.

A female frog, healthy and well nourished was pithed, a cannula inserted in the ventricle, the septum being divided and the pericardial vein tied. The cannula was tied in, the heart removed from the body, inserted in saline solution and attached to a perfusion
apparatus. Normal saline solution was then passed through the heart and kept up at a nearly constant pressure for half an hour, during which time the beats were regular and strong in character.

At the end of half an hour saline containing air solution the contents of a culture tube from a case of true diphtheria was then turned on. The pressure was kept constant.

For the first fifteen minutes the ventricle beats stronger.

During the next fifteen minutes diastole becomes prolonged.

Next fifteen minutes are marked by cycles of one regular systolic beat and one diastolic beat.

The next fifteen minutes show systole less complete and diastole as prolonged as in the last long beat.

The heart is evidently getting weaker and saline is now turned on and continued for three quarters of an hour, but the heart stops in diastole. Saline still continued. In half an hour the heart recovers a little and weak systolic and diastolic efforts are made but
...there is never a strong beat and soon the organ stops in full diastole. Thus the passage of the products of diphtheria through the heart would appear to paralyse that organ.

I should add that the heart was suspended in the same kind of fluid as was passed through so that the organ was surrounded by the poison.

II 7 March 1896, Temp. 68° F.

A female frog was prepared as in I and saline and saline with products passed through the heart in the same way as detailed under I.

So saline only feeble systole and diastolic efforts were made. This was probably due to the heart being in an atonic state. Saline was continued for fifteen minutes and then the heart was allowed to rest. Saline was again turned on but systole and diastole were no stronger. The poisonous saline was now turned on and in for a few minutes the beats were much as already mentioned. In a short
time (say fifteen minutes) the heart showed prolonged diastole. Saline was turned on again on the first indication of failing power in the heart muscle. When this had passed through the heart for a minute, diastole became less prolonged and slowly the organ returned to weak regular systole and diastole as when saline was first passed through. The poison was again turned on and revealed a condition similar to that already mentioned. This was continued for fifteen minutes.

Saline again passed through and again the heart recovered but took longer time on this occasion. Continued fifteen minutes. Poison once more tried and produced the same results as before. The heart is getting weaker and finally stops in diastole. Saline again tried but the heart muscle fails to respond even when the fluid is continued for half an hour.

From these two experiments it would appear as if the products of the organism of diphtheria acted directly on the heart muscle.
Composition of Antitoxicin Serum (British Institute of Preventive Medicine)

The serum is slightly alkaline in reaction and smells of camphor. Of a bright red colour at first, in the course of three months it loses its brightness and becomes dull brown in appearance. Its composition must vary according to the age of the serum. A serum recently prepared will contain less albumose than one which has been in bottle for some weeks, hence the analysis can only be held to be approximately correct.

The Proteids.

Magnesium sulphate added so as to make a saturated solution and allowed to stand for two days gives a bulky precipitate of Globulin.

The globulin being filtered off the filtrate is neutralised and a precipitate of Alkali-albumin comes down slowly. This precipitate is filtered off and to the filtrate a drop of dilute nitric acid is added giving a white cloud of Albumoses (proteases)
This white cloud disappears on heating and returns on cooling confirming the presence of albumoses. To a fresh portion of the solution (from which alkali-albumin has been removed) a drop of nitric acid (dilute) is added and the lower proteoses filtered off. The filtrate is treated with excess of sodium chloride when at the junction a dense white ring appears of Deutero-albumoses.

Another portion of this solution on being treated with excess of sodium chloride after acidifying with acetic acid throws down a precipitate of Proto- and Hetero-albumoses.

and the filtrate treated with excess of ammonium sulphate gives a small amount of precipitate which is Deutero-albumose

and confirms the foregoing. After filtering off the deutero-albumose the filtrate fails to give the pink-biuret reaction and no precipitate is obtained with hydrochloric acid solution of phospho-tungstic acid showing absence of true Peptone.

The precipitate of proto-albumose and
hetero-albumose just mentioned is dissolved by adding water and the solution dialyzed through
parchment paper for 36 hours when almost no
hetero-albumose
was thrown, showing that the bulk of the precipitate
consists of
Proto-albumose.
We find then globulin, much alkali-albumen, much
proto-albumose, hetero-albumose (almost none) dextrin
albumose (a trace). Peptone is absent.

The Extractives.
Some of the serum dried and treated for 20 hours
with rectified ethyllic alcohol and filtered again
and again and examined by the microscope
showed no characteristic crystals, and the
solution treated with the ordinary reagents gave
no sign of the presence of alkaloids. Strong
sulphuric acid nor ferric chloride give no reaction.
Compared with other forms of digestion the
above is interesting. Some years ago the author
carried out some experiments on the digestion
produced by papain and by the ordinary
pulperactive agents found in the air. The bodies
acted upon being egg and serum-albumino
Papain gives with egg or serum-albumin
1. Globulin and Unaltered Albumin
2. Proto-albumose
3. Hetero-albumose
4. Deutero-albumose (abundance)
5. Dysalbumose (and undigested)
   No peptone.
6. Leucine and tyrosine

Autofactive digestion gives
1. Globulin
2. Unaltered albumin
3. Alkali-albumin
4. Proto-albumose
5. Hetero-albumose (much)
6. Deutero-albumose (little)
7. Alkaloid and crystals
   No peptone.

The Active Agent in Antitoxin Serum.
Guérin and Maé tried serum with alcohol precipitating the albumose and then acted on the coagulated matter with distilled water and got a soluble substance which they believed to be a ferment.

The objection to this is that distilled water would
re-dissolve the albumoses to some extent and the soluble substance of Guérin and Macé may be nothing more or less than proteoses. However they were not able to arrive at any definite conclusion. Hankaïn said immune animals owed their efficacy to certain defensive proteids, but so far as I am aware he does not state any experiments in support of the views expressed (See p. 39). Thus it would appear as if the generally accepted view was that antitoxin serum contained as its active agent something of the nature of a ferment. The following experiments were undertaken for the purpose of ascertaining if any such body could be demonstrated as being present.

Reasoning by analogy one would expect the ferment to be of the nature of a sugar-forming or diastatic body for these occur in blood, chyle, the liver and so on.

1. Tried serum with amygdalin at ordinary temperature. Tested for hydrocyanic acid but none found; and no smell of oil of bitter almonds to be detected. 11 Oct. 1875.

Another sample of amygdalin was tried at a temperature of 26° C. with a similar result.

14 Oct. 1875.—Trymine left with amygdalin at
ordinary temperature produced a smell of oil of bitter almonds and showed hydrocyanic acid after a day or two 15 Oct. 1878—

Two portions of the same sample of amygdalin were treated: one with zymine, the other with antitoxin serum. Both were left undisturbed for five days at a temperature of 19° C. The zymine preparation gave the oil of bitter almonds odor showing that the amygdalin had been split up into oil of bitter almonds, hydrocyanic acid and glucose. The antitoxin preparation gave no odor showing that no ferment of the nature of zymine to be present. 22 Oct. 1878—

Cane sugar was left in contact with antitoxin serum for 12 hours. No reduction of Fehling's solution on boiling for a few seconds while a drop of solution of glucose added to the same reduced the Fehling's solution without further boiling. Hence the serum contains no ferment of the nature of invertin which converts saccharose into invert sugar. 26 Oct. 1878—

Ferments like zymine increase the oxidation of solutions of resins (acting like haemoglobin) in the presence of hydrogen peroxide (and resin
of guaiacum). Serum antitoxin was treated with rectified spirit for some days so as to bring down all the proteids and ferment (if any). The whole was thrown on a filter and repeatedly washed for some days with rectified alcohol. A portion of the coagulated mass of the filter was dried day by day with hydrogen peroxide and guaiacum resin. At first the resin was rendered blue no doubt owing to the agency of haemoglobin or some such body but when the washings had been continued for a day or two a stage was reached when no oxidation took place, while half a drop of blood at once struck a decided bluish-green colour. I could not have been that the alcohol had washed the ferment through the filter paper for we know all ferments are precipitated and rendered insoluble by alcohol. We can only conclude that no ferment is present or at least none which gives the ordinary reaction. 26 Oct. 1875.

Amylopsin or diastatic ferments converts starch into maltose and this latter body although not so active as dextrose (as 66 is to 100) yet readily reduces Fehling's solution. The liver and chyle contain ferments of the kind mentioned and if a ferment does exist in
The serum one might not be expecting too much to look for it as one of this class. The following trial was made. Starch paste was prepared and allowed to cool to 31°C. When some antitoxin serum was added, the whole well stirred and set aside for fifteen minutes and then added to freshly prepared Fehling's solution when no reduction resulted. 11 Nov. 1896.

Further experiments were tried as follows:

One ounce of milk, 1 grain sodium bicarbonate, one ounce warm water and 12 cc. antitoxin serum left at 31°C. for six hours produced no digestion of the milk and a drop of the mixture put on a slide and covered glass and set aside for 14 hours revealed no crystals of leucine or tyrosine such as a solution of zymine would have shown. A drop of the serum itself after standing on a slide for 14 hours was found to contain no leucine or tyrosine.

The suprarenal gland contains a physiologically active agent which has been studied by B. Moore and in case there might be in antitoxin serum a body somewhat similar the experiments which follow were tried, the results in the case of
with ammonium sulfate and followed by

Ammonium nitrate and halitium fulminate

Fuming

Hydrogen Peroxide

Yellow

Yellow

No change

No change

No change

No change

No change

practically the same

as ordinary temperature

of the room.
portion of the filtrate still readily dissolved
boiled starch 11 Oct. 1895. (See page 164)
Zymase in solution of 1/50 sodium bicarbonate
solution was saturated with ammonium
sulphate. The filtrate mixed with stiff starch
make things it in a few minutes. Thus
ammonium sulphate does not wholly (at least)
precipitate diastatic ferments and as we
have shown it is to this class we should expect
the ferment of antitoxin serum to belong.
12 Oct. 1895. (See Note p 168)
One might be allowed to add the note:
Care must be exercised in using proteids with
amygdalin for almost all dead tissues and
organic fluids during decomposition act
diastatically. In the foregoing effort has been made to make every
Each experiment has at least been repeated
tice and many of them three and four times.
Dates have been added as they appear in the
note-book from rough notes made at the time
of some of the experiments.
It is almost unnecessary to mention that blood
in every case contains a ferment but it is the
fibrin-ferment or the cell-globulin B of Halli-
lunston. The point contended is that no ferment
capable of reducing Fehling's solution or of
splitting up glucosides or of digesting proteids
can be demonstrated as being present. In this
connection we may mention that Halliburton
found albumoses in cerebro-spinal fluid
removed either during life or immediately after
death (not in all samples but in a very large
proportion) and yet he could find no digestive
ferment to account for this change. But it has
been shown by Turner and it can be readily
proved that cerebro-spinal fluid reduces
Fehling's solution. Thus a ferment may be present
although the only reaction pointing to this is
to be found in that it reduces Fehling's
solution readily. In the case of antitoxin
diphtheria serum such evidence is wanting.
Prolonged boiling as in the case of all proteids
would bring about some reduction. The very
small amount of sugar present in normal
serum fails to reduce Fehling's solution of
ordinary strength.

Additional Exercises for Separating
the Proteids.

On account of the difficulty of separating the
proteid bodies errors are apt to occur to the
most careful worker and to confirm or disprove the foregoing results the following methods were employed.
The antitoxin serum was diluted with water to double the volume. This was saturated with magnesium sulphate and the reaction which before was faintly but distinctly alkaline was now neutral or just to the acid side. The precipitate was filtered off and more magnesium sulphate added when a further precipitate of Globulin came down. The operation was repeated till no further precipitate appeared. This difficulty of getting rid of the last trace of globulin may be due to the fact of horse’s serum containing a larger proportion of serum—globulin than of serum—albumin. However one finds something of the same with other sulphates and when a solution of protoids is treated with ammonium sulphate to great excess, the filtrate often brings down a further cloudiness, and this has led some observers to believe that a reconversion from the protoid to the albumin state has resulted.
The filtrate freed from globulin was diluted
and added to a previously prepared super-
saturated solution of sodium sulphate
(sodie) The supersaturated solution was
employed in the hope of obviating the diffi-
culty of having to saturate again and
again. This double solution of sodium and
magnesium sulphates brought down
Serum - albumin.

The precipitate was filtered off into a glass
containing crystals of sodium sulphate
and no further separation of albumin
took place. The solution containing the
proteoses and peptone (if any) was diluted
and a drop of dilute nitric acid added.
A very faint opacity was the result
This pointed to

Albumose.

Sodium chloride was next added and
the presence of albumose revealed but
it must have been present in small amount.
Excess of sodium chloride showed rather
more opacity when allowed to stand for
a considerable time pointing a probable
presence of a trace of

Deutero-albumose.
A fresh portion of the serum from which the globulin and albumin had been removed as detailed was treated with excess of ammonium sulphate and allowed to stand for some hours. Albumose was then to be present in very small amount, yet its presence was evident.

It would be interesting to know if serum when newly drawn from the horse contains albumose. One would hardly think so for the injection of so-called peptone (really albumose) when injected into the circulation causes much constitutional disturbance. Whence the traces of albumose then? We know that serum changes colour and we know that oxyhaemoglobin in the presence of alkalis is changed into haemo chromogen and to this substance the changed colour may be due. Serum-albumin is readily acted upon by dilute acids, alkalis, temperature and pressure and it may be that prolonged contact of the faint alkaline fluid has changed a small quantity of albumin into albumose even at a low temperature.

Mr. Huxley's own words are: "It would lead me too
for me to attempt to detail the theoretical considerations that led me to suspect that a particular ferment-like protein known as cell-globulin was the substance in question. At any rate I tested its reaction on anthrax bacilli and found that it possesses the power of destroying these microbes. But if this be the same as the substance described by Halliburton it is present in normal blood and in which case then the blood of any animal is antitoxic.

**Note.** The experiments with malt extract and zymine (pages 158-169) were introduced for the purpose of showing that no serious objection can be brought against the case of ammonium sulphate in dealing with antitoxin serum for the sulphate appears not to precipitate ferments.
Roup in Poultry.
The name roup is given to a disease common among poultry especially those kept in towns and in overcrowded, damp and badly ventilated hen or poultry runs. So far as I am aware very little has been written on the subject from a scientific standpoint, although almost every hen keeper possesses a specific for the treatment of the disease. Lemon Browne quoting an authority says the disease is not identical with diphtheria. The name of the disorder would appear to be given because of the peculiar sound which the bird emits. But my observations lead me to the opinion that this sound only appears in the cases in which the disease especially affects the windpipe and it is due to the air passing over the fibrinous exudation. Where the membrane occupies the mouth only or the mouth and alimentary tract no such sound is heard. The sound is a rough rasping one and the name Roup described it very faithfully. The laity describe a dry roup and a wet roup. The former is less
fatal in its effects: the latter highly malignant. The former is more common in old birds, the latter in young ones, and as in diphtheria in the human being,roup more readily attacks the young and tender tissue. Roup resembles diphtheria so far as it may kill with great suddenness. Dixon, an authority on poultry, says the whole head appears to suppurate while others say the disease in its later stage resembles glanders. As in the case of diphtheria epidemics differ in severity and malignancy. One time we find the disease breaks out in a coop and attacks ducks, hens and pigeons, perhaps only two or three of each and the number of deaths may be confined to two or three, while no hen-coop in the neighbourhood beyond this one is marked out for attack. The next epidemic may be as severe as the former was mild and all save the old birds of a run may be cleared out in the course of a week, and the disease may spread to the whole district and be equally fatal. Roup is most common in autumn and spring although one finds it prevalent at other seasons more particularly if the weather be mild.
and moist

I was led to investigate this apparently insignificant disease because in a certain district of Leeds in which part of my practice lies diphtheria is common (Sept. 14) and in this same district also we have had frequent outbreaks of whooping cough among chickens and I have been able to obtain the following facts and figures.

In June 1849 whooping cough broke out in this district and cleared out one hen-coop but did not spread perhaps owing to the fact that this run is shut off from neighbouring ones by one or more fields. Curiously enough about this time diphtheria became epidemic near this, in fact in the nearest houses but the Notification Act had not then been adopted and one is unable to
ascertain how many cases occurred.

In June 1895 there cleared out fifty-seven hens and chickens from one yard, twenty-seven from another, fifteen a third, and fifteen from a fourth, besides large numbers from others, but as I am not sure of the facts I do not state them. These farms were within half a mile of one another and the disease started at the foot of a rising ground and slowly spread upwards. How far the disease might have spread is impossible to say had it been left to itself, but the various proprietors wisely disposed of the remaining healthy birds and had their coops carefully whitewashed and did not renew their stocks for some weeks. In one of the families at least at the time of the outbreaks severe sore throat occurred and as the condition cleared up under sodium salicylate and as no paralysis followed, no further action was taken. Be this as it may in the beginning of the following September two cases of diphtheria in children appeared in the
immediate vicinity both confirmed by bacteriological examination (see note on page 148).
I had arranged to examine the carcases of the chickens mentioned but owing to a mistake of one of the proprietors they were destroyed without my knowledge. However in the beginning of 1896 I had the opportunity of examining the fowls of two coops in which the disease broke out. From them I give the descriptions which follow.

This coop was situated in the busiest part of Leeds. About twenty fowls were owned by a man who told me he had several young birds which died during the past two months and I saw several affected with rough. One bantam hen I examined carefully. The mouth was red, swollen and inflamed and at the angle on one side was a piece of sloughing tissue which I removed and part of which I placed under the microscope after staining with picric carmine solution and mounting in a mixture of equal parts of clarified mucilage of gum acacia and glycerine. I had the appearance of epithelium
Healthy in parts and in other parts it showed a granular disintegration. Large cells with one, two or three nuclei were also seen in the field and some of these cells showed nuclei almost extruded. In another part of the field a fine membrane was seen which will be described presently. The animal had an unhealthy appearance. Almost no rosy noise was emitted. I learnt that the disease had spread to the next yard (divided by a high brick wall) but I failed to get any examination of the fowl of this runs. Another portion of this tissue was taken squeezed between glasses and stained with alkaline methyl-blue decolorised in half per cent. acetic acid, clarified and mounted in artists' copal varnish. A description will be found further on.

II. This coop was situated in the suburbs but in the same direction as I. The fowls were well cared for and had a wide field in which to run about. Some months previously several hens had died chiefly young ones
Some had a discharge from the beak, some had not. Some had died after twenty-four hours' illness while in others the end had not come so suddenly. I examined one young hen which had a very raucous noise. The mouth was very red and slightly sticky and the entrance to the windpipe was red and congested. In the same coop were numbers of pigeons and several had died. I examined two of the dead pigeons. One, a cock, two years old was thin, emaciated with sunken eyes and dull opaque conjunctiva. The mouth was red, congested and contained a whitish grey tough membrane with rather disagreeable odour. The second pigeon was a first year's bird which I dissected. It was not sunken probably because of it being ill for only one day. The mouth, gullet, top of windpipe and parts around showed inflammatory injected and contained a yellowish-white tough membrane. Some of this membrane was stained as mentioned under I and from the accompanying photograph it will be seen that it is not unlike what one finds in many cases of diphtheria of the human subject.
The membranes from both I and II were then stained in various ways and examined for micro-organisms.

From I

Alkaline Methyl-Blue.
Numerous cocci occupy the field, but besides these large numbers of bacilli are seen which are rather larger than the tubercle bacilli. They often stain deeper at one end, and they arrange themselves at angles, assuming various shapes. They hardly form chains and do not often form groups. Some are straight and many are curved and some look bulbous at one end.

From II

Part of the membrane was kept in a moist...
Chamber at a moderate temperature for two days and then stained and examined.

Gibbes' Double Stain and mounted in Copal. Numerous cocci, also an organism present in very large numbers, singly, double or grouped and at angles and stained beautifully much brighter than the cocci. The staining is nearly uniform, no part of the organism more stained then another. Some are straight, others slightly curved. (See photograph on page 177)

Murdock Brown's Stain Mounted in Copal. Cocci numerous. Large numbers of an organism about same size as tubercle bacilli. One end stains deeply while other end not so deep. Forms rods, single or end to end, straight or curved and variously arranged not unlike the organism of diphtheria.

Ziehl-Neelsen Stain. Mounted as above. The cocci stain brighter than the organism referred to above which in fact is so faint
as to be scarcely perceptible

Indeed hardly say that in each instance a
decolorizing agent was employed (half per-
cent acetic acid).

In roup then an organism would appear to
be present which in many respects resembles
the diphtheria organism. It may or may
not be identical but the two disease are not
unlike each other in many ways. It may be
that the disease runs a different course in
man and in fowl. To settle the question one
would require more time and opportunity
than I have at my disposal. One might
try if true diphtheria of the human subject
did produce roup in the fowl but here
one would contravene the Vivisection Act
and to even apply for a licence would
ruin a general practitioners of medicine.
The organism of roup (for at least we may
safely say it is due to such) most likely lives
in the soil and from the fact that poultry
are continually pecking in earth, one cannot
wonder that the disease is common. Probably
pigeons have more to do with the trans-
mission of the disease than is generally credited to them.

Roup in poultry and croup in children (using here only the word in a clinical sense) resemble each other in a very important point, that is in their varying results. Fanciers tell me that sometimes the birds recover, often they die; and at one time only an odd one may die and the malady disappears without affecting many animals, while at another time almost every bird in the coop is cut off.

Dr. Murdoch Brown used to show to his clinical class a beautifully stained specimen of the tubercle bacillus which had been prepared for him by a former student and Dr. Brown was kind enough to send me the formula for the stain

(1) 10 cc. Saturated alcoholic solution of magenta
10 cc. absolute alcohol. 100 cc. aniline water, made by shaking a little aniline oil in water and filtering. Mix these and preserve in a stoppered bottle.

(2) Saturated solution of methylene blue in water and filter.

(3) Dilute nitric acid.

Float in (1) and heat till steam rises. Nearly decolorize in (3). Wash and place in (2).

Decolorize in (3) wash, dry and mount in balsam.

Microphotograph from Lübbe's Double Stain. In the various areas covered by the letters A the microbes are seen (indistinctly). Want of time prevented further trials.
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Franklin one of the most skilled and expert in the district and who had been in Granton for over 30 years and who has known all the medical men within a radius of many miles.

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