



Diphtheria - its Pathology &

Therapeutics as primarily a local disease.

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On looking over the ^{*}history of diphtheria the two who get the prominent place in early days are Aretaeus (commencement of Christian era) and Aetius, (5th century) both of whom refer to a throat affection, occurring chiefly in childhood, which seems to correspond to the above disease.

Galen (2nd century) describes a fatal disease as prevalent at his time in which fragments of membranous tunics are expelled, & says he can determine, whether it comes from the larynx or pharynx, by the manner in which the fragments are expelled.

From the 5th to the 16th century little seems to be known. In Spain under the name of "garrotillo" epidemics occurred about the years 1583-1618, first in Seville. Heredia in 1690 attributes relapses to absorption of morked products tried to prevent the same by cauterization.

In Italy & Portugal it occurred in epidemic form first about 1618.

In Germany it was described by Wedel in 1718.

In France the first reliable accounts date about 1745, at which time the malady was epidemic

*From

¹ Treatise on Diphtheria - Jacobi

² Kirsch's Handbook of Geographical and Historical Pathology - Vol III. New York Soc.

³ Cyclopaedia of the Diseases of children - Keating Vol 5 part II

at Paris and nearly all the other chief towns of that country; at this time, also, it made its first appearance in Holland and England.

According to Hirsch it did not occur in America till about 1752 - he says that in this part of the world inextricable confusion has been brought into the history of diphtheria by confounding it with Scarlet fever. But according to Jacobi we have it about 1643, when two children were said to have been attacked by the "malady of bladders in the windpipe."

From this time on till the end of the 18th century the chief writers seem to have been Home, a Scotchman, 1766, and Bard, an American, 1791, and following them comes Bretonneau. Home looked upon Croup and Angina Maligna as two distinct diseases, and looked for the membrane exclusively in the respiratory tract, but held that there was no connection between it & the false membrane found in the pharynx.

Bard on the other hand saw membranous pharyngitis, membranous laryngitis, & pharyngo-laryngitis; he speaks of the membrane affecting

the skin, of paralysis of the muscles of deglutition & of the larynx, & also of paralysis of the lower extremities as sequelae. He looked upon the morbid process as the same, whichever were the mucous membranes attacked, & made a distinction only according to the localisation of the disease. He then recognised the fact that the various forms of diphtheritic inflammation were identical in their nature, & showers differing in appearance, had the same underlying cause.

* Bretonneau followed up the ideas of Bord asserting, that the degenerative processes of this disease were not peculiar to the mucous membranes of the larynx, trachea, or bronche, but occurred also in the mucous surfaces of the mouth & throat: that membranous laryngitis - croup of some - was identical with angina maligna - garrotello of the Spaniards & stomaceae of the ancients - and showed that the production of a firm exudation on the mucous surface was the characteristic thing. He brought forward the theory that diphtheria was a specific disease.

* Memoirs on Diphtheria - Bretonneau, Foucault &c New-Edin. Soc. 1859.

All authorities agree in thinking diphtheria to be a disease chiefly of childhood, between one and six years, though it may & does occur in young infants & adults, and is said to be less dangerous when it affects the latter.

According to Jacobi the predisposition towards this disease in childhood is explainable to the fact, that the mucous membrane of the mouth & pharynx is then more succulent & softer, & frequently the seat of a congestive & inflammatory process; that the nasal cavities are small & frequently affected by catarrhs; that the buccal cavity is often the seat of catarrh & of stomatitis & insufficient cleanliness leads here to irritation of the mucous membrane; that the tonsils are proportionally large. Again the pharynx is by no means spacious, while the protuberant condition of the tonsils affords a resting place for the disease, the remaining space is so small that it becomes a source of uneasiness to the child, in many instances, every much more than that to the child during diphtheritic tumefaction; the lymphatics are of large size & numerous & can be

more easily injected in the child than in adults,
communicate more freely both with one another,
with the system generally. These circumstances,
he says, have no influence in calling the disease
into existence, yet they assist its development
and add to the severity of the symptoms.

Seasons of the year, climates, altitudes &c
seem to have no influence on the causation, though
some say it occurs more frequently in spring
& winter, when the catarrhal disorders are about,
which seems very probable. Hirsch says that
the circumstances of season & unfavourable weather
associated therewith are without direct influence
on the melody, & that they are of consequence
merely as predisposing causes, in so far as they
increase the susceptibility of the individual, either
by exciting the particular mucous membrane which
the disease is afterwards to attack, namely that
of the throat, or by bringing about an
unfavourable state of the hygienic conditions
amidst which the individual lives.

Individuals as well as families are said to have
a predisposition towards diphtheria in favouring

from one person to another the local manifestations may be entirely altered, & this is said to depend solely upon the diversity in the nature of the tissues in which the morbid action shows itself, also on the idiosyncrasy of the individual or family, or age & on strength. The cause of occurrence in families may be explained to large tonsils & vulnerable mucous membrane of the naso-pharyngeal cavity in all its members. Those who have had diphtheria once are more liable to it again, either through permanent alterations of the mucous membrane & tonsillar tissue, or, as Jacobi thinks, through storage of some virus in a lymph body & auto-infection from that receptacle.

* British Medical Journal 1888.

As regards the influence exerted by sanitary conditions upon the appearance of diphtheria opinion seems to differ. Hart in his essay says - "Zymotic disease is mostly bred of poverty out of uncleanness, & diphtheria follows a general law of what may be called the phylogenesis of zymotic poisons in this respect. It takes up its abode of preference in the hovels of the poor, where the stagnant & putrid air reeks with animal

effluxa, where human beings & domestic animals
pig together; above all - and this is the centre toward
which all sanitary precautions should extend - where
the poisonous cesspool & the unflushed privy taint
the air with subtle effluxa, that seize their
victims of the throat & bring death with their foul
touch. The extreme tendency to limited action,
which marks these epidemics, and which was fully
illustrated in the French epidemics, as it has been
also in the English, indicates the presence of
domestic predisposing causes, amongst which we
rank these obnoxious nuisances as of prime
acidity" (Huxley's Hist. & Geograph. Path. New York. Soc.)

Others again - Rousseau, Jacobi, Gassoles &c -
deny that filth has any influence on the
occurrence of this disease; whilst Huxley seems
to take a middle course thus - "without wishing
to make too little of many observations of this
kind against the zymotic origin, if one may
call it so, I still think that sanitary conditions
are not without importance for its existence
& epidemic diffusion. Only they should not be
looked at too exclusively from the point of view

of the putrefactive theory. We should bear in mind also in forming our opinion, that the prevalence of the disease mostly goes with the cold season of the year, and that is a circumstance which on the one hand sets the putrefactive theory in a still more ambiguous light, while on the other hand it raises the question whether it is not the changed mode of life following the arrival of the cold weather & most of all the artificial heating & keeping warm of rooms, the bad ventilation, & the saturation of the atmosphere with watery vapour, in short the production of an artificial climate - whether it is not all these things acting upon the organism and particularly upon the organism of the child, that go to make the real predisposing cause of the disease. Now these are things that do not touch the poor wretch, not even pre-eminently but concern the well-to-do classes just as much, if not even more." (Hersch. Geograph. & Stat. Path. Vol. III p. 110)

D. Barnes^x says that to his mind the great factor^x in the cause of diphtheria is dampness of soil, caused by want of suitable systems of drainage, combined with fetor in the form of decomposing

^x British Med. Journal July 29, 1888
p. 167.

animal matter; that in some you get a preceding period of an undeloped disease - sore throat - then true diphtheria follows - the points, he thinks, to a person gradually developed of insanitary conditions rather than to a definite specific germ like, bacillus, bacillus, micrococcus or what not. In regard of the final point I prefer to look upon the preceding sore throat as Dr. Byg Smelt does, when he says that genuine diphtheria is often preceded by a non-specific or subacute agria, & that the inflamed mucous crypts, lymph follicles & disquamating epithelium thus prepare a favorable nidus for the reception of the specific virus.

* Lancet, 16th Feb. 1892.

The question then is still involved in doubt; the few cases that I have seen & reported however are all in favour of some kind of insanitary help, & other cases which I have seen in the practices of other medical friends all tended that way.

The great question now is, whether is the diphtheric poison chemical or organic? Opinion seems to be very much divided; but by going carefully over the most of the literature on this point I hope to show

that it is chemical but produced of bacteria; and that hence it must be at first a local disease.

* Hence first included the belief of a contagium animatum. Next comes the early days of Oerthel, who describes a micrococcus as the cause: Rauschf., Eberth, Kibr & Tomasi also describe small oval bodies as a part of the infectious element.

Cohn put this organism, which was soon looked upon as an important element, among the schizophytes & called it the micrococcus diphthericus. Klebs & Bellroth went against this organism as the cause of diphtheria; the latter says that in the fulvous mass of mucous-membrane diphtheria, & in urinary diphtheria micrococci & streptococci can always be found, but these are also found in the coating of the tongue, & in ammoniacal urine &c. & suggest that these organisms may act as carriers of the contagion & ferment.

* This part on first days of the microorganism theory is from Reuter's Cyclopaedia, Jacobi's Traitee & other books.

(Allg. Chem. Path. u. Ther. 8^{te} ed.)
Jacobi
Curtis & Satterthwaite in their report on the Investigation into the Pathology of Diphtheria for the New York Board of Health say that the bacteria of diphtheritic membranes do not differ in optical or chemical behavior from those in putrescent but

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non-diphtheritic animal material. They also found that scraping from the upper surface of a somewhat furrowed tongue from a healthy person caused, when inserted into the cellular tissue of a rabbit, an effect scarcely similar to that produced by inoculation with the diphtheritic membrane. Putrid Cohn's fluid also caused the same result. (Aqueous solution of ammonium carbonate, potassium & calcium phosphates & magnesium sulphate). They found, however, that the foregoing inoculation effects were not due to mere mechanical irritation, because, when they inoculated sand into animals it produced no effect. In the foregoing experiments of "effects produced" they must mean the local effect simply, because, as will be seen later, inoculation of animals with diphtheritic membrane produces well marked or rather almost special effects. They also found that thorough filtration of a proven virulent aqueous infusion of diphtheritic membrane or putrid Cohn's fluid removes the infectious property of the same. Hence in such diphtheritic infusion the poisonous quality probably resides in some particulate thing, from which it is not separable by the action

of cold water; also that thorough treturation of frozen resalant diphtheritic membrane & tongue scrapings with a high per centage of Salicylic acid fails not only to remove, but even markedly to modify the intensity of the infectious quality of those substances. Hence since Salicylic acid in even a minute per centage is capable of permanently suspending the vital activity of bacteria, the inference is that the infectious quality of diphtheritic membrane upon the system of rabbits is not correlated to the vital activity of the bacteria present in such membrane, & therefore, there is no theoretical ground for assuming that preventing the bacteria of a diphtheritic patch from making their way through the underlying mucous membrane will, *per se*, prevent general diphtheritic infection of the system. This shows I think that there exists some kind of poison besides mere bacteria.

Dr. Wood & Formad in 1880 employed of the National Board of Health concluded that the micrococcus diphtheriticus & micrococcus septicus were identical, in as much as they responded in the same manner to optical, chemical & vital tests. They say

that the contagious material of diphtheria seems ready to be of the nature of a septic poison, which is also locally very irritant to the mucous membrane; so that when brought in contact with the mucous membrane of the mouth more it produces an intense inflammation, without absorption, by a local action. Whilst absorption is not necessary for the production of the angina, it is very possible that the poison may act locally after absorption, if being carried in the blood to the mucous membrane - this cannot possibly be as will be seen from later researches. They further state that it is possible that the poison of diphtheria may cause an angina which will remain a purely local disorder, no absorption taking place or simply a local tracheitis produced by exposure to cold or some other non-specific cause may produce the septic material, when absorption will cause blood poisoning, the case ending as one of adynamic diphtheria; and so conclude that it is plain, that the local treatment must largely depend upon whether the angina has or has not been preceded by absorption. At the close they come to the conclusion that at present it seems altogether

improbable that bacteria have any direct function in diphtheria, by that meaning that they enter the system as bacteria & develop as such in the system, & cause the symptoms: but they think that it is possible that they may act upon the exudations of the trachea as the yeast plant acts upon sugar, & cause the production of a septic poison differing from that of ordinary putrefaction & bearing such relations to the system as to when absorbed cause the systematic symptoms of diphtheria, & although these bacteria may be always in the air, they are not in sufficient quantities to set up tracheitis, but when lodged in the membrane are sufficient to set up the peculiar fermentation; whilst during an epidemic they may be sufficiently numerous to incite an inflammation in a previously healthy throat. In 1883 Klebs described a bacillus as constantly being present in the superficial layer of the membranous exudation, & in the following year Loeffler successfully cultivated the same. Before this nearly all observers agreed in thinking that the blood & internal organs of persons dying from diphtheria were usually completely free from micro-organisms, & so concluded that there was

*at least for some years before.

an essentially local process where the action on the whole organism was promoted by the absorption of dissolved & injurious substances produced by the bacteria & that the real bearers of the poison would be found only in the local changes. But here the difficulty resided that here the parts getting diseased were soon flooded with great numbers of these organisms, there finding an excellent medium for settling down; & hence great difficulty was experienced in getting pure cultures. Another difficulty was that the membrane forms so quickly that the specific organism present in the epithelium at the beginning of the attack may easily be absent at a later, other again changes in the organism may occur during the progress of the disease.

* Loeffler described two different micro-organisms as existing in the majority of the parts affected, but he himself did not assert that either was or rather could be positively called the bacillus of diphtheria for reasons given below.

One lot consisted of chain-forming micrococci which were found in long chains. The morbid anatomy in these cases was distinct from the second class of cases. Here the epithelium on the surface of

* From -

¹ Micro-parasites in Disease
Selected essays,
Newbydon Soc. 1886.

also

² Micro-organisms etiology of
the Infective Diseases
D. C. Flügge

Newbydon Soc. 1890

also

³ Frankel on Micro-organisms
1890.

the affected mucous membrane was lost, & there was loss of tissue substance but no false membrane. On the denuded surface of the mucous membrane through its substance long chains of large micrococci were found. These were also found in the lymphatics & thence in every part of the body & in internal organs, as they spread they caused necrosis of the tissues. But these organisms, or at least ones similar to these were also found in other diseases which had lesions of the mucous membranes - typhoid fever, paratyphoid fever & cholera could not be considered specific here in diphtheria; moreover when lower animals, such as dogs &c, were inoculated with them a disease similar to diphtheria was never produced.

In nearly all cases in which a false membrane was present the other class of organisms was found, lying in the superficial part of the membrane beneath the surface covering of micrococci & in the part rich in cells. Beneath was the fibrous zone containing no bacilli. These were also found in the lump & lost but their presence there was considered to be due to post-mortem changes.

They were about the size of the tubercle bacillus but

much thicker; some long ones consisting of several & at the junctions there were slight enlargements.

After injecting guinea-pigs subcutaneously grayish white pseudo-membranous masses formed at the point of injection only. Then general symptoms followed, an extreme hemorrhagic oedema in the subcutaneous cellular tissue at the point of inoculation, & effusion into the pleural cavities, lobular consolidation of the lungs sometimes. When introduced into the opened trachea of chickens, rabbits, & pigeons, they produced pseudo-membranes, also on the superficially injured conjunctiva of rabbits, & the injured raguel of guinea-pigs. In all these cases bloody oedema, hemorrhages into the tissue of the lymph glands, & effusion into the pleural cavities followed these local symptoms. In all these cases the rods were found only in the immediate neighbourhood of the point of injection, while the blood & internal organs were entirely free from micro-organisms as is the case in human diphtheria. Some of the chief reasons against thinking these bacilli to be the specific forms were, firstly, they were not found in all typical cases, & that if they were the specific cause of diphtheria, their absence must be accounted for

of the assumption that they were eliminated before the patient's death. In regard to the absence of bacilli may he not have been wrong in his diagnosis. [†] Reginster in the journal referred to spoke of two types of disease & advocated the bacteriological diagnosis of diphtheria as routine practice. He reported trial on 154 cases, in 118 of which the microbe was got & of these 118, 45 proved fatal. On the other hand 36 cases yielded no bacilli but only cocci & of these only 4 were fatal - one admitted with some paralysis, another complicated with measles & dying of pneumonia, & two developing tubercular empyema - all the rest ended favourably in a few days. From these results he drew the above conclusion about there being two types of disease, indistinguishable in their superficial characters, marked by a deposit of false membrane on the fauces & tonsils, associated with fever, prostration & swelling of the lymphatic glands, that the one was true diphtheria & caused by Loeffler's bacillus & of far greater severity than the other which was excited by staphylococci & streptococci & runs a favourable course & is not contagious. He also found that when Scarlet fever supervened on true bacillary diphtheria

[†] Lancet, March 12. 1892 pg 289.

the growth of the bacilli was replaced by that of cocci, as if the new coagulium had driven the old one out of the field. This latter point may then be another reason for the non-existence of bacilli in some cases of diphtheria.

Secondly, Loeffler found a bacillus, similar to the diphtheritic one, in the stuff adhering to the teeth of a healthy child. This however cannot be looked upon as a very strong objection, because the reliability of the mucous membranes of the child may have been at that time sufficiently healthy to resist their action - no injured points existing or no weak parts.

Thirdly, they were not found in the false membranes developed in animals in the same typical arrangement as was observed in man but were either entirely absent or only present in small numbers, which does not seem to be any great difference.

Fourthly, they could not be inoculated on the healthy mucous membrane of susceptible animals but required the presence of small injuries before they could cause infection. This last objection cannot, either, be taken very seriously for ^{*}Frouseau mentions that Dr. Peter made three punctures in his lower lip with a lancet moistened with semi-fluid diphtheritic secretion.

* Clinical Lectures page 524
New York, N.Y. Vol. II.

1 experienced no derangement of health; he also painted the tonsils, the pillars of the palate & the back of the pharynx by means of a dossil of charpie soaked in dephthritic matter & again got a negative result. Trauseau himself tried without effect to inoculate himself by means of punctures on the arm, tonsils & veil of the palate, made by a lancet moistened by contact with a false membrane removed from a dephthritic sore.

One of the most serious points against this bacillus was that Loeffler, at that time, got no paralytic symptoms in any of the animals which survived the inoculation, but then the number which survived was small & the per centage of human beings who suffer from paralytic symptoms is also very small. Frankel in his recent work says that

Loeffler did get these symptoms, I presume he refers to later experiments. In these cases there is a probable

explanation. ^x Rous & Yersin say that the virulence of the bacilli undergoes modification as the disease advances in its course & that the condition of the patient is modified not only by the absorption in the numbers of bacilli, but also in their

^x Micro-organisms
Frankel 1890

^x British Medical. Sept. 27 1890
page 767

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resilience at different stages. As the disease advances the number of virulent bacilli increases rapidly, whilst as the case approaches cure the bacilli that can be separated do not produce such marked symptoms, when inoculated into animals - it may then have been bacilli of this kind which were inoculated & hence the absence in the earlier experiments of paralytic symptoms. The same observers also found that when dogs were used instead of rodents paralytic symptoms were always present.

Loeffler did not then assert positively that the germ found was specific, but he concluded that it was almost certain that the first serious alterations were produced at the point of entry of the poison - at this place the multiplication of the poison took place - from thence was transmitted upwards & outwards; so that in the matter of treatment the first thing that should be done should be to disinfect the infected parts & remove the morbid products, because even though the bacillus found was not specific there were in the products large numbers of bacteria which produced chemical poisons.

I have in the preceding page given a short resume

of what might be called the first accurate investigations into the germ theory of Diphtheria & though I intend to follow on with more recent & more decisive proofs of their truth, I would like here to give the feelings of these authorities towards them.

* Jacobi's Book was published before this date, but in his more recent writings he seems still to be of the same opinion as he was then, as regards bacteria in this disease. At that time he denied bacilli as the proven cause because they had not been found in the blood; he says that no one has proven that vegetable organisms alone & not other free or fixed parts of the diphtheritic membrane are the vehicles of the infecting elements; that the question has not been decided whether the bacteria met with constitute the cause of the disease or are a part of a process or effects of the poisonous action; whether they are carriers of the poison or entirely indifferent entities. With regard to bacteria now having been found in the blood this will be seen hereafter to be no objection at all. * By Smith says that the presence of microphytes even when constant & pathognomic does not determine the whole character

* Treatise on Diphtheria 1880.

* Lancet, 16 April, 1892.

of a disease, for we have such affections as tetanus where the state of the soil is of greater consequence than the presence of the seed, & that there are bacterial diseases in which the microbe appears not to be distributed over the body but to remain confined to the seat of inoculation, & thence to affect the distant organs by its chemical products.

Hirsch in his Historical & Geographical Pathology infers from the communicability of the disease that the virus is of an organic nature. He regards Loeffler's researches as proving nothing, & thinks that the infection takes place directly from the sick person, or indirectly that is by media which play the part simply as carriers. He thinks the chief part is played by the atmosphere, as regards the distributing of the poison, in which the poison of the disease is suspended, but from the narrow limits of epidemics thinks it cannot be carried far by the air.

* Oehl regards it as a local disease in which there is a direct infection, by the immediate action of the contagium with the epithelium of a mucous membrane, whence the disease spreads in a variable time becomes a general infection or

* Lancet 1888, page 643.

systemic disease. But he is still in doubt about the specific micro-organism having been got yet; he says it may probably be that the virus is due to a micro-organism, or that it may be due to the product of their metabolism. He is against escharotics in the treatment but goes in for disinfectants of a milder form.

Frankel in regard to the result of inoculations with other substances says, that while a number of pathological processes occur with the formation of croupous & diphtheritic changes of the mucous membrane, & with post-mortem appearances similar to the process accompanying diphtheria proper, these may arise from various causes, however, while true diphtheria as a whole in all its course, exhibits so many peculiarities as an entity, that every one must consider it a disease by itself & having as its origin one & the same cause - a specific bacillus; and the purely local occurrence of diphtheritic bacilli & the severe general symptoms caused by them (as above) can only be explained by the supposition that the bacteria germinate a soluble substance which spreads from their

* Book on Micro-organisms
1890.

locality through the body, & thus affects even remote parts. This view will be seen to be the correct one.

* Roux & Yersin's experiments confirmed Loeffler's research & added to them that the phenomena described by him as produced by pure cultures of *B. bacillus* are also produced by the chemical products of its growth, & also that when dogs are used as test animals instead of rodents, the paralytic symptoms, which above all others are pathognomonic of diphtheria, manifest themselves in a characteristic way.

* Medical Medical Journal Sept. 27
1890 Pg. 751

They found that pure cultures of the *Bacillus* inoculated on the excoriated mucous membrane of rabbits, guinea-pigs or pigeons, give rise to characteristic false membranes. Injected under the skin they cause oedema at the point of inoculation & death of the animal takes place. On post-mortem examination there is general increased vascularity & congestion of the vessels of the intestines & kidneys. In guinea-pigs, also congestion of the supra-renal capsule & serous effusion into the pleural cavities. In rabbits none of the effusion but the liver shows fatty degeneration; if death does not take place too rapidly diphtheritic paralysis is usually present. The *Bacillus* is only

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found at the point of inoculation from which it often
disappears during the later stages.

From pure cultures of the diphtheria bacillus a filtrate
has been later, so that no bacilli seen, & this injected
under the skin of animals gave rise to nearly all the
symptoms & lesions of the disease which follows the
inoculation of the bacillus, only there is no false membrane.
In smaller doses it produces typical diphtheritic
paralysis.

The poison when it was injected into the veins of
dogs, in sufficient quantity to make the case acute,
gave rise to general increased vascularity of the organs,
desquamation of the cells from the mucous surfaces,
the urine contained albumen, & the blood was thick &
black. In slower cases the mucous membrane was
yellow, vessels distended, petechial hæmorrhage, urine
albuminous, tubules of kidney showing desquamative
changes, & in the liver, in the interlobular spaces, there was
an increase of young connective tissue corpuscles & leucocytes.
A small dose produced paralysis similar to that found
in the human subject.

They conclude from the experiments that diphtheria is
an intoxication caused by a poison extremely active in

nature, formed by a microbe in or near the point of inoculation, that Klab's or Loeffler's bacillus is specific & that the poison administered in small quantities is capable of producing characteristic diphtheritic paralysis. They think the poison has resemblance to the diphtheria; when heated in sealed tube it gets less & less virulent, so also is the poison got from the spleen & tissues, & so they argue that as heating so also do the animal tissues destroy a great part of the poison.

The most recent researches confirm the above in every respect.

* Dr. Sidney Martin found that tissues of the body & cultures of micro-organisms showed the presence of two classes of substances, which were abnormal to the body; one belonging to the group of digested proteids, namely albumoses, & the other an organic acid. The albumoses cannot be distinguished from peptic digestion or from those of anthrax digestion by chemical means, but their specificity is made evident by their physiological effect. From the injection of albumoses - separated from the tissues - there is produced a paresis of the muscles, which is always general, & progressive, though it may be most marked in one limb; there is also

* British Medical Journal, 26 March 1892.

and affection of the respiration as shown by the rapidity of the breathing or in some cases there is a slowness. This rapidity comes on at the culminating point of the poison, when this comes by the injection of small doses the height is reached & recovery seems to take place afterwards; when it comes by the use of larger doses it means or rather is the mode of death. There is no wasting of the muscles associated with this paresis: with large doses the knee jerk is diminished but not completely lost. When one hind limb was more parietic than the other, the knee jerk on that side was diminished. Loss of body weight & diarrhoea was in proportion to the dose of the albumoses & not to the fever. These albumoses have a prolonged effect - the paresis may be rapid in onset but slow in progress, & the general wasting produced is slow & prolonged. Post-mortem examination showed that the action was due to the albumoses & not to bacilli or organisms, because none such could be found. The blood was found to be slow in coagulating, taking in some cases 10 or 11 days to do so from the time of inoculation, & he thinks this may possibly explain how diphtheritic paralysis can occur in patients some

time after the acute disease is past.

The nerve tissues show simple degeneration of the white substance of Schwann, which breaks up & finally disappears, then the degeneration affects the axis cylinder which is attenuated & finally ruptures in some fibres, so that below this ruptured axis cylinder the fibre undergoes ballerian degeneration & the muscle fibre then becomes fatty. All the fibres which showed degeneration of the white substance did not, however, show ruptured axis cylinder. The small nerve branches of the motor nerves are affected to a varying degree, & the motor nerves are not all in the same degree of degeneration at the same period, & this, he thinks, is the reason why the diphtheritic palsy is not a complete but only a partial paralysis. The spinal ganglia, spinal cord, medulla & brain were in all cases found normal, but all other nerves, whether myelinated or not could be affected, & it was seen that the degeneration affected the terminals of the motor branches & not the main trunk as a rule. It is therefore, he says, a preperipheral reaction. This, he says, is also the case in man as regards diphtheritic palsy, the great argument in favour of this being so, being the fact that sensation is affected

no change have been described in the posterior horns of the cord or in the sensory ganglia. Also if the symptoms were those of an affection of the anterior horns there would be wasting & the reaction of degeneration would be present. The changes described as occurring in the cells of the anterior horns (fatty degeneration, vacuolation etc) he describes as probably phenomena added to the changes in the peripheral nerves, & the poison which produces a change in these nerves may after a time affect the substance of the nerve centres, causing fatty degeneration & the atrophy of the cells. This statement about it being peripheral is still a matter of doubt, but his arguments in favour are very strong.

Injection of the albumoses also produces far more or less nerve.

Injection of the organic acid into the circulation produced fever, & slight nerve degeneration, & fatty degeneration of the heart muscle, but not necrosis well marked as with the albumoses.

The chemical examination of the membrane showed the presence of the following proteids - fibrin of the membrane, large quantities of hepato-albumose, & traces of proto- & deutro-albumose. These latter

two are the first products in the process of digestion of fibrin & so the membrane, he concludes, must be in a process of digestion.

The acid body found in the tissues was found present in very small quantities.

Inoculation with an extract consisting solely of proteid, a mere trace of hetero- & traces of proto- & deuto albumos produced fever etc as in the other experiments, with the same post-mortem change, but the doses here were much smaller & produced the same effects. Hence he concluded that in the diphtheritic membrane there was a poison associated with the proteid, which produced the same result as the albumos found in the blood & spleen of diphtheritic patients. But the poison was much more virulent, because a single dose produced a result which only multiple doses of the albumos could effect; the toxic effect of the extract of diphtheritic membrane cannot therefore be ascribed solely to the small amount of albumos found but there is probably something else which is probably of a ferment nature.

The local action of his extract may produce oedema, (which was also produced of the blood albumos of assed

off without other result) but at the site of inoculation it also produces a necrosis of tissue, a greyish yellow sloughy area being left. He got the same results as all the above by inoculation with the albumen got from cultures of bacillus diphthericus, these transforming alkali-albumen into albumose which give the reaction of proteo- & deuto- albumose, paralyze fatty changes etc when in small doses.

Now Roux & Jersin got the same & concluded that the poison was a ferment not only from its acting in very small doses but from the fact that heating attenuated the poison & boiling destroyed it.

Sidney Smith sums up thus, -

1. The bacillus diphthericus forms from the proteids products of the same chemical nature as those found in the bodies of patients dead from diphtheria, namely albumose & or organic acid.

2. The albumose formed by the bacillus diphthericus in artificial cultures have the same physiological action as those found in cases of diphtheria in man - produce fever, diarrhoea, loss of body weight, progressive paralysis of muscles dependent on a degeneration of the peripheral nerves.

3. The bacillus diphthericus is therefore the primary infective agent in diphtheria.

Roux & Yersin (he goes on today) got a much more virulent poison in their cultures, than in the blood, & he got a much more virulent poison in the membrane than in the blood & hence the primary infective agent in diphtheria must be the bacillus diphthericus, & this elaborates, in the membrane, a ferment, which, when absorbed, digests the products of the body forming albumens & an organic acid, & these digested products are the agents in producing death, or causing peric. The products, he thinks, may not all come from the membrane direct, but may be formed by the action of this ferment, absorbed, on the products in the spleen, because in one of his cases only small flecks of membrane were found in the larynx.

From all this then Diphtheria must be considered a local disease in the first instance; but later the system becomes in a manner poisoned, by means of substances generated at & around the point of inoculation. The specific cause must be bacilli - Roux & Yersin found that injection of a filtrate free from bacilli produced

all the symptoms except false membrane, now this membrane
is the result of the bacilli as they form the poison, &
therefore they must be the primary cause.

Case 7.

Jessie J. 4 years 24 August 1891

House of 2 rooms, 5 persons inhabiting.

No possible source of infection traceable: house clean but without any sanitary conveniences: gutter in front of house which was not properly flushed & which smelt badly: very common to row was in a very filthy condition. The row consisted of 10 houses of similar construction, but no other cases in it & otherwise the health of all good.

The patient complained for 2 days of nothing in particular but seemed generally out of sorts & I suspecting nothing did not examine her throat. On the 7th day on calling the child was breathing badly & a foul smelling discharge was coming away from the nostrils.

Face was flushed & somewhat dusky, pulse quick & full, & ^{she was} slightly feverish. On examining the throat a white patch was seen on both tonsils, extending across the arch of the fauces on to the soft palate & uvula; membrane also was present on the back wall of the pharynx. The glands at the angle of the jaw were somewhat swollen & tender. I have not the least doubt that had I looked membrane would have been got at the beginning of the illness.

Treatment: - Having been advised by a medical friend

to try Sulphur in any case of this kind I did so, by
 insufflation every 3 hours; at the same time brandy,
 a tea spoonful every 3 hours, beef tea & milk were ordered.
 This treatment seemed to get rid of the faeces to some
 degree but had not the least effect on anything else,
 for the child gradually sank or rather was gradually
 asphyxiated.

I may here say that I will now try Sulphur
 again as I regard it as perfectly useless; cases in
 which it has been said to do good must have been
 merely follicular tonsillitis, many men looking upon
 this (even at the present day) as diphtheria. There can
 be no doubt that many cases of diphtheria begin as
 such, thus allowing the bacteria to gain an entrance
 into the parts, but at that stage one is not
 justified in calling the case one of diphtheria
 & therefore in saying that any remedy doing good there
 is a good one in true diphtheria.

Case II Sarah J. - 6 years 4 September 1891
 On the 24 August she & her sister (twins), both healthy
 children, were sent off to Glasgow on account of
 their sister Jessie's illness. On Sept. 3 they were

* Making 10 days in all.

noticed to be feverish & languid but made no complaint of their throats; the mother however seeing something of this kind looked at them & found white patches, & so brought them home next day.

The surface of both tonsils was then covered by a tough white membrane like chamois leather, firmly adherent, could only be removed in fragments & then left a bleeding surface. Otherwise the children seemed in fairly good health.

Treatment consisted of swabbing (swab of cotton wool on curved holder) out the throat with Fig Fern solution. 3 times a day & Iodine & Potash Chlorate was given internally. The membrane did not spread any more but this treatment had to go on for 6 days, twice a day for 2 days & once a day for the remaining 2 days. For the first 6 days although the membrane was pretty thoroughly removed by each application it had almost formed again by the next. On the 7th day it formed again in smaller quantity & was greyer, drier looking & friable. The application of the perchlor. did not cause any excoriation or inflammation of the mucous membrane, & by the 11th day there was a superficial ulcer on each side

of the throat which healed in 4 days. From about 4th to 8th day the glands beneath the angle of jaw were slightly swollen & tender on pressure.

General condition - Nothing notable, but about the 5th day she was very weak & languid, with weak pulse but same was perfectly regular, heart sounds corresponding. She was also ordered small doses of brandy under which the pulse improved. By the 12th day the brandy was not required. Fed well all along on milk, beef tea &c; up till 3rd day was running about the house. During 3rd week strength improved rapidly & by the end of week she was practically well.

Case III. Jennie J. 6 years 14 September 1891

Stronger child than her twin sister Sarah. On above date there was a large white patch on right tonsil & a smaller one on the left. General condition seemed normal. Same treatment, but in her case the patches spread - by the 5th day the whole was covered & the membrane had extended forward on to the soft palate. The local applications had to be continued 2 days longer & on the 6th & 7th

days there was slight discharge from nostrils but without foetid smell. There was but slight glandular irritation in her case. In 2nd week her voice was distinctly nasal & speech difficult, & fluids regurgitated slightly through her nostrils when she drank. No stimulents at any time required; she took food well throughout. No inflammatory reaction in her throat from treatment & after 12th day ulcers healed very rapidly without treatment.

Case iv Barbara S — 6 years 8 November 1891

District fairly good as regards sanitary arrangements. House consisted of 2 apartments, & in all there were 6 occupants. Kitchen was of good size but dark, it being in the shadow of a high stone wall & damp owing to the floor being beneath the level of the road outside. The house was one of a row of 5 houses. No other cases near & no other kind of disease about. There was no history of infection of any kind.

Child who was a fine healthy girl complained of slight sore throat on swallowing on the evening of 7th November but was otherwise quite right. When seen next forenoon there was a white patch on both

tonsils which could be removed only in fragments; & this with difficulty, leaving a raw surface. This membrane extended on to the uvula & soft palate to a slight degree. Throat generally inflamed. Glands at the angle of jaw slightly tender. Otherwise the child was fairly well, pulse being a little quick but in other respects normal.

Treatment consisted of swabbing out the throat with the *ly. form.* as before every 6 hours. Internally she got Potass. Chlorat. & *ly. form. pebb.* After 5 applications the membrane became detached leaving superficial ulcers which healed up in 14 days. Fed well throughout. By the end of 7 days she was practically well.

Case. John B. -

5 years

30 January 1892.

Large roomy house standing in a large square of which the sanitary conditions were fairly good, but immediately under back window of house there was a large very rickety common to a considerable number of houses in next block, the smell from which was so offensive that window could be seldom opened. This house consisted of one apartment,

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occupied by 5 persons. There had been several cases of Diphtheria in this square within a few months previous to this but no communication between houses. No water closets inside & the washbasins of each house communicated freely with some drains but nothing offensive from them.

This patient had been complaining vaguely of cold for several days before seen. On examination he was seen to be somewhat feverish, complained of headache & slight soreness of the throat on swallowing. Slight parotid swelling existed at each side of the neck, glands beneath the angle of the jaw were slightly enlarged, hard & tender. The fauces were, generally, slightly red swollen, large white patch was seen on each tonsil of white soft membrane, which could only be removed in threads, leaving a bleeding surface. For 7 days the throat was swabbed twice a day with hy ferric pellets. Patches did not spread but membrane continued to be reformed: but by 5th 6th day over a smaller area at this time it became darker in colour, more friable, & less abundant. After 7th day did not form again. Ulcers healed rapidly. Redness & swelling of fauces persisted till 5th day & was not increased by treatment.

By 10th or 11th day boy was practically well. Throughout his
+ Ptas. was given intensely. General health was
good all the time with the exception of a few days
on which he was somewhat dull & languid but he
fed well all along.

Case 71. Alexander B — 4 years 30 January 1892

Brother of above.

On 30 January he complained of headache, was slightly feverish
sick but made no complaint of sore throat; there was
no external swelling or tenderness, but on examining his
throat a patch similar to his brother's was found on
the left tonsil.

The treatment consisted of the usual swabbing. On the 2nd day there
was a patch on the left tonsil. On 3rd day a patch of
membrane extended from right tonsil over the arch on to the
uvula. There was also a patch on the back of the pharynx.
Glands by this time were swollen, hard & tender. By 6th day
membrane was found less abundantly after removal & had
become grey & friable - dead looking; - by 8th day had disappeared.
About 4th or 5th day there was bleeding on application of caustic
but after the 8th day parts healed rapidly & by the 12th day was
practically well. General condition good throughout.

Case VII

Louisa M^{rs} - 9 years 8th April 1892

On 8th April 1892 there were whitish gray patches on both tonsils & back of pharynx. She had complained of sore throat on the previous day. Her general condition was all right. On pressure under the angle of jaw she complained of slight pain, but there was no swelling. The throat was swabbed out as usual twice a day for the next 5 days. By second day the membrane had spread on to the uvula, arch of fauces & back of pharynx. By the end of 5th day the membrane was quite dead looking & soon began to desquamate, leaving ulcers which were superficial in nature & healed rapidly. By the end of 12th day the child was practically well.

During that time she was for a day or so dull & languid but her general health was impaired to a very slight degree. Iron & Potas. were given internally as in other cases. She fed well all along.

In this case the child was one of a family of 7. The house consisted of 3 rooms & kitchen was situated in the country; the drains about houses were found to be in a filthy condition & also was the well from which the water was got for general use.

Case VIII.

Polly Meg — 7 years 8th April 1892

This child had been complaining of sore throat for 5 days before seen by me, the mother treating it by rubbing her gorge with Iron & Iodine.

On 8th of April 1892 a small patch of gray membrane was seen on each tonsil. General health otherwise good. Glands at angle of jaw were slightly swollen, hard & tender on pressure.

Treatment as usual means of the swab twice a day. The membrane continued to spread for first 2 days but after that gradually got less & less & by the 10th day the child was considered well. There also color of face & iron were given internally.

This was the only case in which the swabbing with Ely force font. caused any irritation of the parts & in this case there was slight swelling of the tonsils after the first 2 applications but nothing of any consequence.

Case IX.

Margaret C — 5 months 10th Nov 1891

House of 2 apartments occupied by 8 persons. She was a sickly child, the house was filthy & the district without proper sanitary arrangements. There were

no other cases in the neighbourhood.

The child had been ill for several days before seen, was weak & languid & had decided diarrhoea. Breathing was noisy & difficult from obstruction at the back of the throat & rattle but not stridulous or croupy. There was abundant sero-purulent acid, stinking discharge from both nostrils. The glands beneath the jaw were swollen. Examination of the throat was difficult but the fauces were full of tenaceous yellow discharge. Could not see any ulceration or membrane. Treatment here consisted merely of stimulants. Child died the same night.

Case X William R — 16 months 6 March 1899.

Single roomed house in badly drained & thickly populated locality; occupants 8 persons in all. The house was one of about 200 one storied houses, without water closets or drain communication of any kind except open gutters. No other cases of other infectious diseases about.

The child, which was pamy & delicate, was first seen at 11 a.m. on 6th March; he had been quite well, comparatively speaking, up till that morning when his

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parents thought him to be feverish a bit & were annoyed
at the way in which he was breathing: when seen
at 11 he was weak & languid but restless: breathing
was noisy irregular but not stridulous: he was feverish,
the pulse not unduly rapid but weak & slightly
irregular in force & rhythm. Stethoscopic examination
of the chest revealed nothing abnormal. On looking into
the throat the mucous membrane of fauces was found
to be slightly swollen & red, & there was a very small
patch of loose white membrane on the right tonsil.
He got one or two doses of Epsom Salts & ʒi. Ipecac:
the throat at the same time being poulticed: Brandy
was also ordered. Under this treatment the breathing
seemed to be somewhat relaxed. In the afternoon
he became weaker however & died about 6-30 p.m.
apparently of asphyxia.

Examination of the throat shortly after death showed
white tough membrane covering the right tonsil
& extending over the arch on to the right side
of uvula.

Case XI

Mary S — 16 months 15 March 1892
Small dirty syle roomed house with no sanitary

appliances. Abstractions made on drains recently which
 are on street level open. No connection traced with
 other cases. Child had not been strong since an
 attack of measles some months ago & for the last
 3 weeks had been on the sick list with some
 diarrhoea & slight bronchitis, both of which had been
 improving, the former being nearly a right. On the
 morning of 16th the parents noticed that the breathing
 seemed to be embarrassed when seen about 1 pm.
 some day the breathing was rapid & short & there was
 a foul smelling discharge from both nostrils. Altogether
 the child seemed to be in a dying condition, the pulse
 being small, feeble & fluttering. On examining the throat
 the whole of the mucous membrane of tonsils, pharynx,
 uvula & soft palate were seen to be covered by a dirty
 white membrane, small parts of which could be
 removed with difficulty leaving a raw bleeding surface.
 Externally the throat was swollen, - both glands & soft parts.
 Treatment consisted of spraying the parts with a 2%
 solution of perchlor. of mercury every 4 or 5 hours,
 which made the child vomit up foul smelling
 thick fluid with pieces of membrane floating through it;
 it also seemed to check the factor of the discharge

4.3
coming from the nose. Internally a mixture of parts of
mercury & of precipitates. was given every 2 hours; also
brandy & milk.

The child now rallied properly but gradually got
weaker, dying on the 18th apparently from septicæmia.
The soft palate & uvula sloughing a few hours
before death.

Case 711 Kate R — 3 1/2 years 16 March 1892

Larger, across Orleans house in same street as last
case but grandmother had been assisting in the
handling of last case.

On the morning of 16th the child was sick & fevered.
The breathing was slightly croupy & accompanied by an
occasional hard croupy cough, but still the symptoms
were not so severe as to cause the child to stay in
bed. She made no complaint of sore throat but
both sides of neck were slightly swollen & tender on
deep pressure. No physical signs in the chest except
slight harshness in inspiratory murmur towards
the upper part.

On examining the throat there was a small patch
of tough grey membrane seen on the right tonsil

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on a point of similar membrane on the left of fauces generally congested looking. Her symptoms were altogether respiratory, which got more severe on the afternoon of the 4th day & she died at night asphyxiated. The treatment consisted of spraying the throat as in former case with perchlor. of mercury & internal administration of mercury & iron. This however had not the slightest effect on the progress of the disease.

Case XIII & XIV Two Polish children came under our care with well marked membrane on uvula, soft palate, pharynx & tonsils. We got them early when the membrane was just forming & tried constitutional treatment alone, saturating them with bicodide of mercury but it had not the slightest effect unless perhaps in helping on the end.

Case XV Elizabeth C - 13 years
House of 2 apartments occupied by 8 persons. This house was in a dirty part of the town none of a tenement consisting of about 50 such. Air open gutter was in front, & behind were open ash-pits & fetid privies. The people themselves were dirty in

very dry, & most of the neighbors about were of the same turn.

This girl complained of her throat one afternoon when seen next day she was somewhat febrile, temp. 102° pulse 120, the cheeks were red & flushed. A white patch was seen on both tonsils extending from base on to the soft palate; there was also a small patch on uvula at the tip. The rest of the mucous membrane of the throat was somewhat inflamed. All the parts were brushed 4 times a day with a saturated solution of Boracic acid in glycerine, & after 5 or 6 applications the membrane began to loosen off, the parts then inclining to bleed slightly. By the end of 5 days there was nothing left but superficial ulcers which healed rapidly. Throughout the child fed well, the constipational symptoms lasting only 2 days & about the fourth day the glands at the angle of jaw were tender to pressure.

Case XVI Mary 3 — 3 years
Lives in a thickly crowded dirty locality much the same as last.

The folks thought she had what they called croup, this having taken place through the night. In the morning on examining the throat patches were seen on both tonsils & back of pharynx. The breathing was harsh & croupy. The throat was treated by means of inhalations of steam from a kettle, the symptoms to a great extent pointing to trouble pretty well down. She died of asphyxia the same night.

Case ~~xviii~~ John B - 2 years

Brother of last patient. He was running about the house at the same time, but noticing him to be pale looking the throat was examined when patches were seen on both tonsils extending over on to the uvula.

General condition seemed quite normal, he feeding well & seemingly not at all disturbed.

The parts in sight were painted 4 times daily with a saturated solution of Boracic acid in glycerine, this treatment going on for 10 days, when there were only some superficial ulcers left which soon healed.

The membrane now extending much more & the breathing now becoming any more affected.

Cases. recovered. dead.

Sulphur	1	1
<u>Liq. Ferr. perchlor. fort.</u>	<u>7</u>	<u>7</u>
Boracic acid	2	2
Hydrag. perchlor. spray	2	2
- lincol. internally	2	2
Stimulants.	3	3

In all my cases the local origin was clearly proven, with the exception of the first, & in that case I am certain that had the throat been examined at the beginning the nature of the disease would have been seen, because when it was suspected, the whole of the visible parts were coated with the false membrane, as also was the mucous membrane of the nares.

Some put aside the idea of Diphtheria being a local disease in the first instance because they say, that they have seen cases in which the constitutional disturbances occurred before any local changes could be made out, but in so doing they forget that only a very small part of the mucous membranes of the body is visible of the mouth. I know of two cases of regional diphtheria, in which

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the medical attendant could not make out what was wrong with the child until the local changes made an appearance on the pharynx & adjacent parts. In these cases he saw the changes on the mucous membrane of the vagina at the beginning, but did not diagnose diphtheria, which diagnosis would now have been made had not the throat affection occurred.

By those who believe that the disease is in some cases constitutional from the beginning, the mode of entrance of the virus into the body is considered to be through the lungs & thence into the blood; but anyone thinking this to be the case cannot for a moment hold the bacillary theory to be correct, since by it the poisons are generated by these organisms at the seat of lesion & none of them seem to live in the blood. Chief amongst those thinking thus is Jacobs & he is against the bacella altogether for reasons previously stated.

Many (Roux, Yersin, Ragnin) in papers before referred to) urge that for a correct diagnosis the presence of the bacella should be demonstrated, & describe simple methods for doing so. The following seems to be the simplest, being one advocated by

D. Ashby of Manchester at the Manchester Pathological Society.

* Lancet - Feb, 10, 1892

"Detach a small piece of membrane & place it for 5 minutes in a 2% solution of boracic acid, then draw the piece of membrane along the surface of sterilised blood serum in a test tube, & maintain it at a temp. of 37°C. for 12 to 24 hours. At the end of that time if the bacilli are present characteristic small, white rounded colonies will be visible along the tract of inoculation. The bacilli are then stained with a pure carbol-fuchsin & examined with an oil immersion lens. To obtain a fair cultivation a second or a third preparation must be made."

No doubt this is the true scientific course but in private practice one has not always the time to go into every kind of detail. For general work every case should be treated as Diphtheria which in any way resembles that disease, & in all throat affections (tonsillitis etc) the greatest care should be taken to keep the parts antiseptic until all danger of infection taking place through the altered mucous membrane is over.

As regards the treatment of Diphtheria I

merely want to lay down what, in my opinion, should be done in the first instance generally. From the foregoing facts it must be evident that the sooner the diseased parts are attacked the better, but the difficulty is by what or in what manner this should be done. Nearly all authorities agree in thinking the perchloride of Mercury a very powerful agent when sprayed on the parts, no doubt it may be so, but in the two cases in which it was used by me, it seemed to do no good, but they were both pretty severe cases. What seems to be a much better method of employing this agent is described in Keating's Cyclopaedia page 666.

"Oatman of Nyack, New York, has lost but one patient in 23, by the following local treatment. Cotton is firmly wound round the end of a stick, about the size of a lead pencil, being drawn out as it is wound, & made to project beyond the end. This is dipped into a solution of the perchloride of Mercury, 2grs to the pint (16 3840) & passed into the throat until it touches the posterior wall of the pharynx. It is then instantly withdrawn & burnt. This treatment is repeated hourly

with a new swab each time until the inflammation begins to subside, which is usually in 48 hours."

Instead of putting the swab of cotton on to a stick it would be much better to use the holder made for the purpose, which, having a bend, allows of the parts farther down getting a touch also.

The two cases treated by the internal use of bichloride of Mercury did no good though at the beginning they were simple enough cases.

The three treated generally by stimulants go for little as they were, or at least seemed to be hopeless from the first. Internal treatment alone is of no use.

The two treated by means of Boracic acid painted on the parts did very well but I prefer a stronger solution.

The application which, to my mind, seems to answer all requirements is that of the *liquor fortis prochlor.* In this agent we have an antiseptic, a caustic or acid + an astringent. Froussau, in his time, used HCl, silver nitrate, copper sulphate + other such substances, at the same time bringing into the treatment the infusion of alum, *lithium* &c. as adjuvants; but in employing the *liquor fortis* these

latter are made away with, they being, as it were, bound up in the initial substance. In all my seven cases the result was favourable, & Dr McShail, whose assistant I am, has followed this line of treatment in many cases with success. In only one case, as before seen, did its use seem to cause any irritation & this was but slight. The use of such substances in this manner is put aside by some owing to the fight (none of my patients offered very great resistance) one requires to have with the child before getting the substance applied: this however seems to be a good reason for employing a remedy which, being powerful, requires but few applications.

Then again it is said by some that by using caustics & such like we may cause injury to parts around, & so make a further spread of the disease: but this new seat, if it should form, is soon rendered harmless, because it comes in for its share of the remedy the next time that that is applied, & surely it is better to run the risk of new seats being developed near the old one, which are early & easily got at, than to

apply mild remedies or none at all, & so allow the
poison time to increase & be absorbed in large
quantity & so poison the whole system before the
seat of the disease has been got under power.

During the intervals between the applications of the
swab the patient should be got to use a gargle,
or if too young, this can be swallowed & so
help to keep the parts as aseptic as possible.

There are two agents which might possibly
be better than the above, namely chloride of zinc
& the galvaneic cautery, none of which, however,
have I ventured to use.

In the Epitome of Current Medical Literature,
March 5, 1892, chloride of zinc is mentioned as a
remedy recommended by [†]Wilhelmy in Diphtheria.
He applies it by means of cotton wool & forceps
curved at the end; a 20% solution being used &
this as early as possible & only once. This is
said to penetrate deeply into the diseased tissues
but to spare the sound epithelium. It was
tried in 100 cases with the best results. The bleeding
was very slight & after pain was relieved by
sucking ice & drinking cold water. It was never

[†]From
Deut. Med. Woch. Feb. 4, 1892.

noted to cause any oedematous swelling. The sloughs generally separated in from 3 to 6 days, the disease never spreading to any other parts. A gargle consisting chiefly of lime water was used & nourishing food administered.

* In 1855 & 1856 J. Bloebaum recommended the use of the galvanic cautery in the treatment of diphtheria. Since then Hagedorn, in Hamburg, has treated 30 cases, with 29 recoveries. Bloebaum published 40 cases in the Deutsche Medicinalzeitung, 1892, no 1, all successful but one which died 24 hours after the operation. He is a firm believer in the localistic theory of diphtheria, recognizing Loefflers bacilli as the true cause of the disease, and the other microbes found in the membrane as only secondary. His treatment aims at complete destruction of the bacilli at as early a stage as possible.

* From
Centralblatt für Chirurgie,
13, Febr. 1892.



