

THE ETIOLOGY AND PATHOLOGY OF DIPHTHERIA,  
AND THE DIAGNOSIS OF

CROUP, DIPHTHERIA, AND SCARLATINA:

with

Notes of 29 original cases

by

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## P R E F A C E.

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Since entering private practice my attention has been specially directed to certain cases of Diphtheria, Croup, and Scarlatina which have come under my care, and my views regarding these conditions have received some modification during the last few years.

I have, therefore, in presenting this thesis to the Medical Faculty for promotion to the degree of M.D. taken the opportunity of recording the results of my experience and the opinions which I have formed regarding them.

In addition, I have given a brief outline of the Pathology of Diphtheria so far as is known at the present time, and have recorded in detail the notes of the cases upon which I have based my opinions.

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## I. BRIEF HISTORICAL INTRODUCTION.

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Until Bretonneau published his well known memoirs in 1821 little was known about the disease which he then described under the name of Diphthérite.

That such a disease had prevailed over different parts of the globe previous to this date there can be no doubt. In the works of Aretæus<sup>2</sup>, written about the end of the first century, we find an account of a throat affection which prevailed at that time, presenting the character of Diphtheria and he mentions it as a disease known in Egypt and Syria under the name of Egyptian and Syriac ulcer. From this time until the middle of the 18th century we find various physicians referring to a throat affection which was undoubtedly Diphtheria. In Spain, Italy, England, France, Sweden and America it showed itself, being known by such names as garotillo, malè in canna<sup>â</sup>, and Angina Malignâ. In 1747 Ghisi gave a description of an epidemic which prevailed in Cremona and pointed out the nature of the pseudo-membranous exudation. Some years later in 1765, Dr. Home<sup>3</sup> of Edinburgh published a paper "An enquiry into the Nature, Cause and Cure of Croup." In this work he described diphtheria as a disease which had entirely

escaped all regular examination and concerning which there was little to be learned by inquiry and still less from books. He goes on to say "I have never seen anything written on this subject, except a thesis where the author gives us no facts." Further on he writes "I shall therefore treat this disease as entirely unknown as to its nature, cause, effects and cure and try how far our facts will carry us towards a discovery of these." In 1801 another Scottish physician, Dr. John Cheyne<sup>4</sup> described ten cases of Croup in a paper contained in his Essays on the diseases of children - following on much the same lines as Home. Then in 1821 Bretonneau<sup>4</sup> published a description of an epidemic which prevailed at Tours and a few years later of other outbreaks which occurred at La Ferriere and Chemisson. In a series of five memoirs he seeks to prove that the disease which Home called Croup was only the last degree of malignant angina, and that this latter disease was not of a gangrenous nature. He was followed by many French writers who all corroborated his views.

In our own country we find few references to the disease until the year 1861 when Sir William Jenner<sup>5</sup> published his lecture on Diphtheria. He then refers to it as having become epidemic in London three years previously.

From this date onwards it became the subject of much discussion and endless writings.

I have endeavoured to discuss the latest views of this subject, when the pathology of Diphtheria is under consideration.

## II. ETIOLOGY.

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The study of the Diphtheritic membrane from an anatomical point of view has failed to completely differentiate Diphtheria from other similar diseases. Nor can more be said of the immense amount of clinical study which has been devoted to the same end. Bretonneau at first believed that by the former method a sure basis of diagnosis could be formed ; but experience taught differently and later on he had to admit the failure of this means.

In recent times the study of the etiology and pathology of the disease has gone a long way towards clearing up the difficulties connected with it : and there is every reason to believe that by following in these lines of investigation we may arrive in time at a proper understanding of the morbid process.

### 1. Contagion.

That Diphtheria is contagious is now a generally accepted fact upon which stress must be laid, though we ought always to be careful not to confound cases depending upon a common cause with those due to contagion. Three interesting cases bearing on this point were related to me by Dr. Clarke of the Royal Military College and are

worth recording. They are somewhat singular in being examples of long periods of incubation - in each case about thirteen days.

Case a. A boy whose brother and sister had died from Diphtheria in London was sent to Camberley to be away from infection. He was quite well on arrival but on the thirteenth day Diphtheria appeared and he had a severe attack. No other cases had occurred in Camberley for some months previously.

Case b. is that of a boy who lived in the adjoining house and with whom the previous patient had associated on one occasion. Thirteen days after this he also developed Diphtheria and a younger child in the same house subsequently contracted the disease and died.

Case c. A child living in an isolated house a mile distant, sickened with Diphtheria fourteen days after Case a. who had slept in the house one evening when he was apparently quite well.

A case resembling the above and which occurred in 1856, mentioned by Dr. Fagge<sup>6</sup> is that of a child who arrived in Folkestone from Boulogne when in an advanced stage of the disease and who died on the following day. No case of Diphtheria had previously been seen in the town ; but three days later her sister who had always lived there, was attacked and in another three days a



case occurred in the same house.

Lastly it is scarcely necessary for me to point out the well known medium of contagion especially common among the attendants on the sick, derived from sucking the tracheotomy tubes of Diphtheritic patients, or from having portions of membrane expectorated during the examination of the throat.

2. Soil and climate are also, I believe, factors in the spread of the disease, although the influence of the former has been disputed. Dr. Thorne Thorne<sup>7</sup> thus expresses his opinion "where a surface soil is such as to facilitate the retention of moisture and of organic refuse and where a site of this character is in addition, exposed to the influence of cold wet winds, there you have conditions which do tend to the fostering and vitality of Diphtheria and which also go to determine the specific quality of local sore throat." As a matter of clinical experience one finds this to be the case, and I think there are few practitioners who will dispute this point.

3. Season, Sex, Age &c. Diphtheria is most prevalent during the months of October, and November, and least so during June and July. It is rather more frequently met with in females than in males and the greatest number of cases occurs between the ages of 3 years to 12 years.

4. Family predisposition. Diphtheria is not an hereditary disease but there is reason to believe that certain families and individuals are more liable to infection than others. I may mention the case of my own family in this particular. When living in Cornwall one sister contracted the disease and died. Two years later another succumbed to the same affection. Seven years after this I myself had a sharp attack of the malady in Edinburgh, and at the same time three other sisters were similarly affected, <sup>and</sup> one of them died from it. Seventeen years later another sister suffered from a mild attack. Statistics made during an epidemic in Florence also bear out this statement, and many instances are recorded of certain families being attacked by Diphtheria at intervals of years, even when the members have been widely apart.

5. Local predisposing causes. That ordinary inflammatory sore throat is another predisposing cause can also be proved. The transition from follicular tonsillitis to Diphtheria is so gradual that it becomes difficult to say when the one ends and the other begins. The following cases are illustrative of this relation :-

SE I.

March 20th, 1891. Ainslie T. - aet. 4 residing in York Town, became sick and feverish and developed an attack of influenza. He had almost recovered when he again became feverish and on examining his throat both

tonsils were noticed to be swollen and inflamed and two or three follicular spots were also observed.

SE 2.

March 30th, 1891. The following day a sister of the above Irene T - aet. 7 complained of feeling ill and feverish and in like manner she too suffered from Influenza but at the same time her throat became inflamed and follicular spots appeared on both tonsils.

Both children gradually recovered but for several weeks were under treatment on account of the enlargement of the tonsils which showed follicular spots.

SE 3.

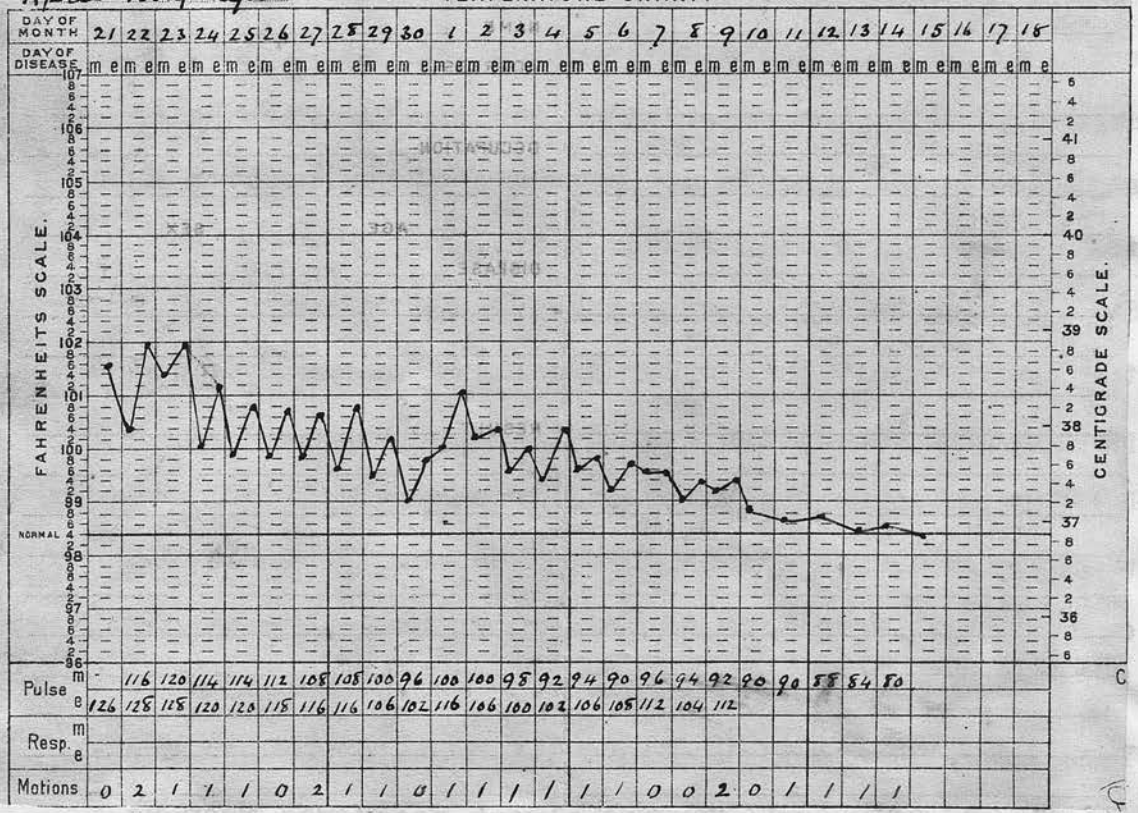
April 6th, 1891. Eva T. - aet. 6 years a week after her sister Irene became ill was seized with shivering and severe bleeding from the nose. Her throat at the same time became red and inflamed ; but no spots were visible. The case was diagnosed as one of Influenza and she gradually improved under treatment. Fifteen days after the commencement of the attack her temperature rose to 101.6 F. She appeared exceedingly weak and complained of her throat being painful. Two days later a grey patch was observed on the already enlarged right tonsil and at the same time the glands on the right side of the neck were found swollen and painful. The tongue was coated with a whitish fur and her temperature registered 102°F. For several days she continued in a critical state. The membrane extended to the left tonsil and walls of the pharynx, the breathing

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**EVA, T.—.**

TEMPERATURE CHART.

April - May 1891.



being at the same time laboured and along with this there was great debility. Her recovery was exceedingly slow and it was not until May 10th that the nurse was able to leave. From this date there was gradual improvement ; but at the beginning of June it was noticed that she did not seem able to stand erect ; walked like a "little old woman", she also had some difficulty in swallowing, her own statement was that she had to swallow everything twice, although there was no regurgitation of food through the nose and on June 10th she suddenly developed a marked convergent strabismus presumably from paralysis of the external recti muscles. These symptoms did not entirely disappear for three months ; but ultimately she made a perfect recovery.

The points of interest in these cases are ;-

Firstly, debility following on Influenza.

Secondly, as a result of the enfeebled state of health follicular tonsillitis ending in resolution in two cases.

Thirdly, The engrafting of the Diphtheritic virus upon a soil prepared for its reception.

The chart appended is also ~~worthy~~ of note as showing the long period of time which elapsed before the temperature regained its normal level.

Careful enquiry was made as to the state of the drains connected with the house in which these children

lived, the result of which was that some grave defects were discovered. The house forms one of a row occupied by officers connected with the Royal Military College and their families. Each house is separated from the one next it by a distinct interval, and not very long ago the whole of the drains were strictly examined and relaid. It appeared however, that certain old cesspools situated between <sup>some of</sup> the houses had not been removed and that they were a causal factor in the illness seemed more than likely from the fact that a lady living in the next house but one was seized during the month of December with a sudden and virulent attack of Diphtheria followed by paralysis.

6. Contagion from Milk. In the year 1878 Mr. Power,<sup>s.</sup> after investigating the cause of an outbreak of Diphtheria in North London, proved conclusively that it had been spread through the agency of milk. It proved to be a valuable step in our knowledge of the etiology of the disease, and was the stepping-stone to many interesting experiments from which our facts as to the relation of diseases in the lower animals with those affecting the human subject, have been mainly derived. In 1886 a serious outbreak of Diphtheria prevailed in the villages of Yorktown and Camberley.<sup>9.</sup> The total number of cases between the 11th of October and the 14th November was eighty-eight and of these eighteen died.

A careful investigation led to the conclusion that infected milk had been the sole cause of the outbreak, and moreover, in nearly every instance the milk supplied to the household affected was proved to have been obtained from one particular dairy. The collateral evidence of minor facts in connection with this outbreak are most striking. Thus a lady whose family obtained milk from another source, went to lunch with a friend whose household was supplied from the dairy under suspicion, she drank two tumblers of milk at lunch<sup>and</sup> and thirty-six hours afterwards was down with Diphtheria and was the only member of her household who had it.

At another house, a tumbler of milk left by the children, was sent down to the servants; one had cocoa without milk for her supper, the other drank this tumbler and sickened two days after with Diphtheria; and so on in many similar instances.

Although the milk was evidently the medium by which the disease was spread, no satisfactory explanation could be found to account for the infection of the milk itself, the only possibility being that it arose from two cows whose udders and teats were reported by Mr. Power to have sores and suspicious looking ulcers upon them. At the same time it must be noted that Professor Axe had twice

inspected the cows and certified as to their healthy condition.

Dr. Klein,<sup>o</sup> in last year's report to the Local Government Board, shows that "recently calved cows inoculated with a cultivation of human Diphtheritic membrane become attacked by definite illness, having as one of its manifestations a peculiar acute eruptive affection of the udders and that from the milk of an animal made ill in this way the Diphtheria Bacillus ~~could~~<sup>can</sup> be isolated by cultivation." This year he records the results of fresh experiments and finds that by using less virulent culture he gets local swelling ; but the effects are very slight. He also shows that by feeding cats repeatedly with cultures of the Bacillus diphtheriae distributed in milk Diphtheria can unquestionably be produced. Single feedings failed to give any results.

7. Infection from the lower animals. Before concluding this part of my subject I would briefly refer to a disease resembling diphtheria which occurs in certain of the lower animals.

Fowls and pigeons are not uncommonly affected with an illness which begins with hyperaemia of isolated spots of the mucous membrane, which ultimately becomes covered with a yellow secretion. In pigeons it is seen chiefly on the base of the tongue, mucous membrane of throat, and the angle of the mouth. In fowls, on the tongue, palate,



nasal cavities, conjunctivae and entrance of the larynx. Certain bacilli have been discovered in the exudation which are not found in human diphtheritic membranes and the two diseases are supposed to be etiologically distinct.

The diphtheria which occurs in calves has the following symptoms, lassitude, flow of saliva, yellow exudation from <sup>the</sup> nose and diarrhoea. The mucous membrane of the cheeks, tongue, hard palate, entrance to the larynx and nares are usually covered with yellow deposits.

Pseudo-membranous diseases have also been observed in cats, horses and swine. In a certain number of instances maladies of this kind have been found occurring simultaneously with or preceding human diphtheria, and Dr. Thorne quotes many examples of what seem to have been infection from turkeys, fowls, and cats, the proof being exceptionally strong, and convincing, in the case of the last named animals.

Diphtheria may be defined as a specific, contagious febrile disease characterised by (a) a formation of false membrane, (b) great depression of vital powers, and (c) frequently followed by evidences of disturbed innervation.

Although for many years it has been recognised as an infectious disease, it is only during recent times that any real advance has been made in our knowledge of its pathology

Empis' in his paper on Diphtherite expresses clearly his belief that the membrane is not the result of a simple inflammation, "but reveals the presence of a special "pathological element" and that "in Diphtherite there is "no relation between the intensity of the inflammation, and "the intensity, the abundance, and the rapidity of the "formation of the false membranes". What this special pathological element was, he was unable to determine, and for years afterwards it continued to baffle the most careful researches of investigators.

Virchow' made a distinction between a "croupous" form of inflammation, and a diphtheritic one. In the former the exudation lying on the surface of the mucous membrane, in the latter within its superficial layers.

Rindfleisch' again described the latter form as an infiltration of newly formed cells into the sub-epithelial connective tissue, which caused compression of the blood

vessels, ~~arrest~~ of the circulation and death of the affected parts. Diphtheria itself he described as Croupous inflammation, under the name of pharyngeal croup. In this complaint he refers to the pellicles on the palate and tonsils as consisting entirely of cells fused together, whilst in the air passages he found them to consist of layers of cells which alternated at tolerably regular intervals with layers of a homogenous, substance, probably fibrine. The variations in the degree of adhesion of the false membrane to the mucous membrane he ascribed to the presence of the lining membrane in the air passages, and its absence in other parts. Fagge, in writing on these points, says "the fact that in the very same case of Diphtheria the pellicles on the tonsils and those in the larynx differ essentially in their histology is of itself sufficient to show that our views in regard to the disease are not to be based on its pathological anatomy alone, and further that in the fauces themselves wide variations of intensity may be observed, sometimes, indeed, the tonsils and uvula being simply reddened and inflamed without any membrane".

Later on, as the germ theory in relation to other infectious diseases came to be proved, the greatest difficulty was experienced in its application to Diph<sup>eria</sup> and it was not until the year 1875 that any definite discovery was made in this direction.

In that year Klebs discovered in the false membrane a small bacillus with rounded ends, which, inoculated into

animals, gave rise to a dirty fibrinous slough at the seat of inoculation. These, however, he found were not present in all cases, the principal organism there being a micrococcus arranged in masses or in chains. These observations led him to describe two forms of Diphtheria according as one or other organism predominated.

A few years' later, Löffler as a result of his investigations, found that in the deeper layers of the Diphtheritic membrane the Klebs bacillus was almost always present, and was always most numerous in the oldest parts of the membrane. In cases of so-called Diphtheritic sore throat he found that the streptococcus appeared to be the prevailing organism,

That the bacillus was the one which set up Diphtheria was proved by a series of experiments by Roux and Yersin in which they inoculated the bacilli into the damaged mucous membrane of rabbits, guinea pigs and pigeons, and in all cases were able to cause typical Diphtheritic patches; and further, if death did not take place too rapidly, a characteristic form of paralysis usually supervened.

<sup>12.</sup> "From these facts it is concluded that the local  
 "symptoms of Diphtheria are due to the action of a specific  
 "bacillus on a weakened mucous membrane, and that once  
 "having gained a footing it gives rise to an acute inflam-  
 "matory process, probably by the direct action of the  
 "poisonous material that it forms on the cells and on the

"blood-vessels in the immediate neighbourhood; this caustic  
"action is so intense that the epithelial cells undergo  
"degeneration, the fibrinous lymph and leucocytes which are  
"exuded also become more or less rapidly degenerated, and  
"give rise to the grey false membranous patches that are so  
"characteristic of true Diphtheria. When the growth of  
"the organism is rapid, and when the area of surface  
"attacked is extensive, the amount of poison developed may  
"be very great indeed, and when this latter is greater than  
"can be dealt with in the inflammatory area, owing to the  
"rapidity with which it is produced by a larger number of  
"organisms, especially when they are situated deep down  
"in the tissues, there is rapid absorption of the poison,  
"but not of the bacilli, into the system, and the character-  
"istic constitutional symptoms of the disease are set up.  
"We must thus distinguish carefully between the local  
"action of the bacillus and its product, and the toxic  
"constitutional effects of these products".

The next point to be determined was the chemical nature of these products, and the part they played in causing the symptoms of the disease. For years it had been known that the local manifestations were not the most serious factors in the malady. It was felt that some poison must be generated and affect the system generally giving rise to the grave constitutional symptoms. The

most careful researches, however, failed to demonstrate any active agents existing in the blood, in the lymph, or in the various organs of the body.

To Dr. Sidney Martin<sup>'s</sup> we are indebted for a valuable addition to our knowledge as to the chemical Pathology of Diphtheria. In his <sup>o</sup>Gulstonian Lectures for 1892 he discusses this subject and gives the results of his investigations.

He finds that the symptoms of Diphtheria are due to a primary infective agent or living contagium, only found at the point of inoculation and also that a mere morphological study of it is not sufficient to explain the symptoms ; but that it requires a chemical examination.

He examined 8 cases of Diphtheria, all children, and in two of them there was no membrane present. As a result of his investigations he found that the chemistry of the tissues may be summed up by saying that two classes of substances are present which are abnormal to the body, one belonging to the group of digested proteids, namely albumoses - the other an organic acid.

The spleen was the chief repository of the poison in the body.

Injected intravenously into rabbits the albumoses caused fever, a general and progressive paresis, but without any appreciable wasting and a general loss of weight.

In addition the blood was found to coagulate slowly. The organic acid he found was a nerve poison like the albumoses but in a less marked degree.

The chemical examination of the diphtheritic membrane gave the following proteids - (1) one which was the fibrin of the membrane (2) Hetero-albumose (3) Proto-albumose (4) Dentero-albumose. In addition there was a small quantity of the organic acid.

Experiments showed that in the membrane there existed a poison which produced the same results as the albumoses found in the blood and spleen of Diphtheritic patients ; only the poison was of a more virulent nature. Its local action differed from the albumoses in producing a yellow grey sloughy area at the site of inoculation. He believes that the toxic effect cannot be ascribed to the albumoses alone ; but that there is something else probably of a ferment nature.

His examination of the nerves showed that they were not equally affected-in some the sheath of schwann was chiefly degenerated - in others the course of the axis cylinders was interrupted. For these reasons the muscular condition observed during life is a partial and not a complete paralysis, individual nerve fibres existing which innervate the muscles owing to some axis cylinders remaining intact.

The muscles to which the nerves went were also degenerated proportionately to the degree of nerve change. He sums up by saying "It is evident that the paresis observed is due to degeneration of the nerves themselves, and that any of the nerve fibres in the body, whether medullated or non-medullated may be affected."

The spinal ganglia, spinal cord, medulla and brain were in all cases found normal. Continuing he says "It is evident that the primary infective agent in Diphtheria is the Bacillus Diphtheriae : that this liberates in the membrane a ferment which when absorbed digests the proteids of the body forming albumoses and an organic acid. These digested products are the agents in producing death, in causing fever, the depression and the paralysis which follow Diphtheria." It is also clear that the diphtheritic products found in the body do not all come direct from the membrane. The large amount of albumoses and organic acid found in the spleen show that something more than absorption from the membrane is going on. There is no reason to suppose that these products merely accumulate in the spleen, it is more probable that the ferment absorbed from the membrane digests the more or less stagnating proteids in that organ, and we know indeed that the spleen contains a proportionately larger quantity than the blood, of bodies formed from proteids."



#### IV. CROUP & DIPHTHERIA.

Since Home in his treatise described what he claimed to be a hitherto unnoticed disease, a great controversy has existed as to whether membranous Croup and Diphtheria are one and the same, or whether they are distinct diseases. The word Croup has long been used to signify an acute febrile disease of children, attended with difficulty in breathing due to obstruction in the windpipe. In 1747 Ghisi noticed in the larynx of a child who died during an epidemic at Cremona the presence of a false membrane, and he was the first to distinguish this mode of termination as a peculiar disease, giving it the name of **Perfidious** or Mortal Angina, thus distinguishing it from what was then known as Gangrenous Angina which did not terminate by suffocation.

Home<sup>3</sup> refers to this case of Ghisi's and then goes on to give details of 8 children who had come under his care, and 2 others who had been treated by other physicians. Of his 8 cases, 3 recovered, the other 5 died. In the 3 who recovered there were no signs of false membrane, and he attributes this to their having been bled freely and treated in time. In reading over these cases one cannot help feeling that they were not true cases of membranous Croup, but rather examples of Laryngitis. The other 5 had all distinct membrane and of these not one recovered.

The remaining two showed membrane and they also died. He pointed out that the mass of febrine was adherent to the mucous membrane, but lying upon its surface, thus controverting the previously held idea that such exudations were part of the membrane itself detached in the form of slough.

When we examine Dr. Cheynde's cases we find a very similar state of affairs. He gives 10 instances of the disease:-

Case I. a boy aged 16 months, who had difficulty in breathing, and who was cured in 10 minutes by bleeding,

Case II. a boy 8 years of age who had had several similar attacks;

Case III. aet. 12, who had 2 or 3 attacks; and

Cases IV. and V. have similar histories.

Recovery took place in each of the above. In the remaining 5 children the disease was followed by death and a post mortem examination was obtained. Distinct membrane was present in each case, and he gives 5 illustrations showing the condition of the parts.

"With a view to cure", he says "we must look at the disease as consisting of two stages - complete and incomplete. In the former, membrane is present, and to prevent its forming, we must bleed, give emetics and freely purge". From his description one is driven to the conclusion that his last 5 cases were examples of

Diphtheria, and the first 5 cannot be accepted as proving the affection to be either the so-called Membranous Croup or Diphtheria. From the time of publication of Home's paper until Bretonneau read his first memoir, great confusion seems to have existed in the proper diagnosis of the disease, symptoms of difficulty in breathing in children, whether membrane was present or not, or whether death or recovery took place, being attributed to Croup.

Bretonneau published his ~~first~~ memoir with a view to prove by the testimony of facts that Scorbutic Gangrene of the gums, Croup and Malignant Angina were only one and the same form of phlegmasia. Further on he writes "Putting aside for a moment the conclusions which may be drawn from contagion and considering only the epidemic character in Scorbutic Gangrene of the gums, Malignant Angina and Croup, I think the identity of these 3 affections founded upon an identity of organic alterations which have been demonstrated by pathological anatomy cannot be invalidated by a few unimportant symptoms. If at the commencement of the epidemic, the death of many children was generally attributed to Croup, because it was sudden and preceded by all the symptoms of that disease, whereas in adults the foetid smell of the breath, and lividity of complexion, caused the ideas of gangrene and putridity to prevail, the difference in the development of the air

"passages at the different periods of life, sufficiently  
"explains the anomaly".

He goes on to show that Gangrenous Angina and Croup had always presented themselves in combination in all the epidemics of Malignant Angina described by ancient writers and by those of his own day.

Bouchute<sup>4</sup> (1852) held that Croup was that disease of the larynx in which the inflamed mucous membrane was covered by a fibrinous layer of new matter and that without this new product Croup did not exist. Six years after this, Diphtheria became epidemic in England, and general attention was drawn to the disease and its relation to Croup became the subject of much discussion and many investigations.

Sir W. Jenner<sup>5</sup> who in the 3 years ending 1861 had seen 58 cases of Diphtheria (34 fatal) wrote as follows:- "Are "Diphtheria and Croup essentially the same disease? I "think not, because there is no evidence to show that "Croup is anything more than a local disease, that it "occurs as a widespread epidemic, that it affects a large "proportion of adults, that there is albumen in the urine, "that symptoms of disordered innervation follow recovery "from the primary affection". Since writing the above, however, he has withdrawn his opinion and now believes them to be forms of the same disease.

Dr. West<sup>14</sup> in the earlier editions of his work on the Diseases of Children advocates the view of the two diseases being distinct. Striking points of similarity, however, and the positive teaching of the best French writers, caused him to doubt the correctness of his opinion, and at a meeting of the Medico Chirurgical Society of London he proposed the formation of a committee whose object should be "The determination of the disputed question whether there is such a disease as Idiopathic Membranous Croup i.e. whether membranous laryngitis exists independently of the diphtheritic poison; and whether, if so, there are any criteria by which it can be distinguished clinically or pathologically".

The decision of the committee<sup>26</sup> was in favour of the two diseases being identical, and suggested that the term Croup be used as a clinical definition implying laryngeal obstruction occurring with febrile symptoms in children.

Dr. West afterwards expressed his belief that for all practical purposes membranous laryngitis, or membranous Croup, must be regarded as the outcome of Diphtheria, and consequently as essentially different from catarrhal croup or catarrhal laryngitis.

Before giving my own opinions on the different conditions, I will relate one or two cases as examples of laryngeal obstruction occurring in children, which though

not illustrating any particular point, will indicate the type of disease which commonly goes under the designation of Croup.

CASE 4.

Horace H-- aet. 2. Carlisle. Was seen by me for the first time on Tuesday evening July 31st. 1888. He had been brought from Workington on the previous Saturday, was an only child and had never been very strong. On Monday July 30th. he was taken out and appeared to have caught cold, for, on that evening he was coughing and seemed feverish. On Tuesday morning the cough was worse, his breathing noisy, and his voice hoarse. As he looked very ill his mother sent for me late in the evening, and I found him suffering from bronchitis with "croupy" breathing. His temperature was high and his respirations quick. I advised them to apply poultices and ordered a diaphoretic and expectorant mixture. The following day he was very ill and weak, and the symptoms of obstructed breathing had become greatly aggravated. Dr. Maclaren, who then saw him, considered his condition so grave that he recommended tracheotomy as a last resource. To this the mother would not give her consent, and the child died at six o'clock the same evening. No post mortem examination was obtained, and the presence of membrane in the larynx and trachea could not be ascertained. As far as his mother knew there had been no similar cases in Workington before they left,

and there were none in Carlisle at that time.

CASE 5.

Mary H-- aet. 3. Carlisle. August 15th. 1888.

Early on the morning of this day I was summoned to see this child, and found that she had been apparently quite well on the previous day, but during the night had become feverish with crowing respirations. Her condition at the time of my visit was a serious one. The temperature was high, and she was evidently suffering great distress from the difficulty in breathing. The respirations were loud and crowing, and her face was considerably cyanosed. I immediately sent for some ipecacuanha wine and administered this until it caused sickness. With the vomiting a large piece of false membrane was ejected, and immediately afterwards her condition became much easier, and no return of the obstructive symptoms occurred. In two days she was apparently quite well again.

CASE 6.

Harry C-- Aet, 5, Carlisle. On Sept 29th. 1889, I

was called up during the night to see this boy who was said to be suffering from Croup. He had been quite well during the preceding day, and when put to bed had showed no signs of being ill. During the night he became a little feverish, and his breathing quick and "crowing". We applied hot sponges over the larynx and trachea and soon after the obstructive symptoms passed off and he fell into an easy sleep, and the next day was apparently quite

better. It was his first attack, and until I left Carlisle did not have any return of the complaint.

CASE 7.

John T-- Aet. 2. Carlisle. March 3rd. 1889.

During the month of February this boy had been suffering from Bronchitis with occasional attacks of "croupy" breathing. No doctor had been consulted. Late in the evening of the above day I was asked to see him, as the symptoms of Croup had become more marked. He had then a loud brassy cough, with noisy respirations; but as there did not appear to be any immediate cause for alarm I simply advised warm applications to be applied to the chest and throat, and told the parents to get some ipecacuanha wine in case it should be necessary to administer it. He very soon became much quieter and gradually fell asleep. He continued steadily to improve and at the end of a fortnight was comparatively well. During this time he had occasional returns of the "croupy" symptoms, but never of such severity as to cause any anxiety.

These four cases will serve to show how difficult it often is to say absolutely this is or this is not a case of Diphtheria. In the first of them one is driven to the conclusion that there was a membrane present in the child's larynx, and in the second the presence of membrane was proved; but whether the membrane was caused by the



Diphtheria bacillus I do not think can be determined by the clinical history. In the other two children there is no proof that any membrane was present, and I think the symptoms may be regarded as having been set up by simple laryngeal catarrh.

After a careful study of the literature of the subject and from my own experience, I have come to the conclusion that Croup and Diphtheria are two separate and distinct conditions, and for the following reasons:-

1. That there are several local laryngeal conditions with croup as a symptom, and these are classified as follows by Professor Grainger Stewart:-

- (a) Laryngismus Stridulus,
- (b) Catarrhal Laryngitis with Spasm,
- (c) Simple Membranous Laryngitis,
- (d) Diphtheria.

2. That Croup as a disease ought to be limited to simple Membranous Laryngitis.
3. That simple Membranous Inflammation of the larynx finds its analogy in the so-called "Croupous" inflammations of other mucous membranes, e.g. Membranous Bronchitis and Tracheitis, Membranous Colitis, Membranous Cystitis. §

§ A case of Membranous Bronchitis was related to me by Dr. Aldren Turner, and I myself while House Surgeon with Mr. Duncan in the Edinburgh Royal Infirmary had under observation a case of Membranous Cystitis.

4. Although the clinical histories of the latter differ from those of simple membranous laryngitis, I am of opinion that they are essentially of the same pathological nature as instanced by their histological characters.
5. That of the membranous affections of the larynx much the most common form is that due to Diphtheria, the simple form being rather the exception.
6. The differential diagnosis between the two can only be made by consideration of the following conditions:-

  - (a) The absence of the bacillus diphtheriae
  - (b) The absence of albumoses and organic acid,
  - (c) The inoculation of the membrane or its products into animals being followed by no symptoms of Diphtheria in the simple form.

## V. SCARLATINA & DIPHThERIA.

Almost as interesting as the relation of Croup to Diphtheria is that of Scarlatina to the same disease.

Theoretically it seems a simple matter to say that one displays a certain train of symptoms, and follows a certain course distinct from the other, but clinically one is constantly forced to face the question "Is this a case of Scarlet Fever <sup>or</sup> one of Diphtheria?" and very often one finds it a most difficult point to decide.

My own experience in relation to the association of these diseases has been somewhat peculiar, for in the Camberley district it has been the exception rather than the rule to find the rash in Scarlet Fever well developed, and in almost every case the throat affection has been the prominent symptom.

That a similar difficulty in diagnosis has existed for many years is made evident when one reads Dr. Fothergill's <sup>15.</sup> account in 1748 of Sore Throat attended with ulcers. In this he first vividly described a throat affection prevalent at that time which was of a very different nature from the common sore throat or inflammation of the tonsils; and then he relates that "generally on the second day the face, neck, breast and hands and finger ends become of a deep erysipelatous colour, with a

"sensible temperature". Evidently his cases were those of Scarlet Fever in which the throat symptoms predominated.

At the present time, I believe, mistakes in diagnosis are constantly being made between Scarletina and Diphtheria, the former being commonly mistaken for the latter, and it is remarkable that until the year 1851 the two diseases were classed under one heading in the returns of the Registrar General.

Before discussing the connection between the two diseases, and the means of differential diagnosis, I will relate a few cases illustrating the difficulties one has to encounter in giving a definite opinion as to the nature of the affection.

CASE 8.

On Oct. 7th. 1891, I was asked to see a boy Harry H-- aged 6 years, who was said to be suffering from a sore throat. The history was that a week previous to this date he had been "out of sorts", and that a faint red rash had appeared on his chest. It affected his health so slightly that his mother could not get him to keep his bed and he was allowed to run about as usual. On the night of the 6th. Oct. he became feverish and said his throat was sore. When I saw him his temperature was 102.6°F. The tonsils were swollen and inflamed with spots of membrane scattered over them. The glands at the angle of the jaw were much enlarged and tender. The tongue was coated. The following day he was rather better and the

tonsils showed fewer spots. The glands were still enlarged. At the end of a week he was able to get up and ultimately recovered. There was never any great depression, albuminuria or desquamation.

CASE 9.

On the evening of Oct. 13th. John H--, a brother of the above, 16 years of age, complained of a severe headache with sore throat. He passed a restless night, felt hot and uncomfortable, and in the morning was very sick. I saw him soon after and found him very low and depressed, with a temperature of 102.4°F., and a weak, quick pulse. The glands on both sides of his neck were painful to touch and considerably enlarged; the mouth and tonsils had an angry red appearance, and on the latter were extensive membranous patches. The tongue was covered with a greyish white fur. Over the upper part of the thorax a very faint roseolar rash could be made out. The urine was examined but contained no albumen. Two days later a distinct rash made its appearance, and from this time onwards the disease ran a favourable course and ended in a certain amount of desquamation.

CASE 10.

On the evening of Oct. 26. 1891 I was sent for to see Mary H-- Aet. 11, a sister of the previous patient. Her mother told me that four days previously while at dinner she had complained that her throat was sore, and that it hurt her to swallow, but that she had been able to go about

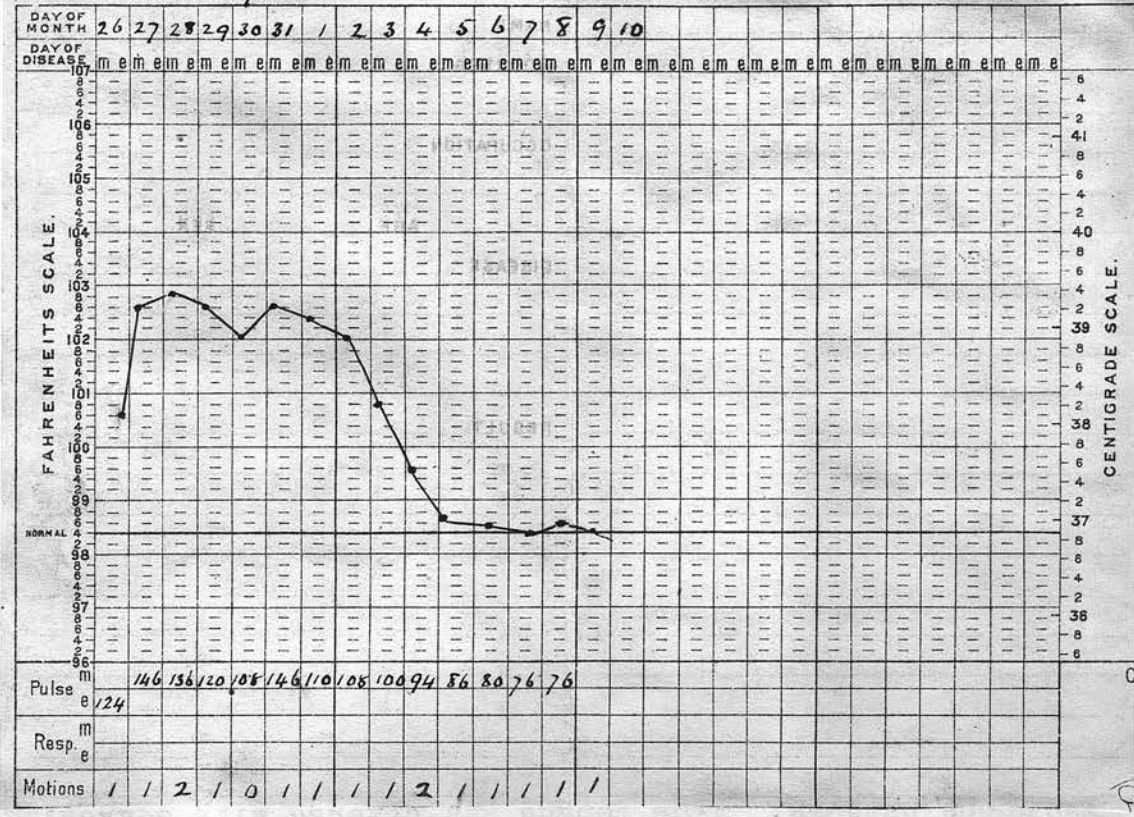
as usual until the preceding day when her throat became worse, accompanied with pains in the head and aching of the limbs. As she felt hot and thirsty, a cup of tea was given her and then she was put to bed. Soon after she vomited. She passed a restless night with much headache. On examining her I found the temperature 100.6°F. with a pulse of 124. A few of the posterior cervical glands were enlarged but not painful. There was no swelling at the angle of the jaw. She complained of pain on pressure over the upper part of the trachea. Slight conjunctivitis of the right eye; headache; thick whitish fur over the tongue except at the tip and edges. The bowels had acted regularly. The left tonsil was swollen and inflamed, and there was a general redness of the fauces. No exudation. A diffuse roseolar rash first appeared on the chest and then on the legs and arms. The following day the condition was much the same. No albumen in the urine. Three days later a spot appeared on each tonsil; but disappeared in 24 hours. The patient made a good recovery.

On looking up my notes on the above cases made at the time I find that the first was diagnosed as Follicular Tonsillitis, the second as Diphtheria; but this had been scratched out and Scarlatina put down instead; and the third as Scarlatina. On reading them over now I am not at all certain that my diagnosis of the two first was

Oct - Nov 1891

MARY H  
TEMPERATURE CHART

TREATMENT



On the evening of Oct. 25, 1891 I was sent for to see Mary H-- Ast, JI, a sister of the previous patient. Her mother told me that two days previously while at dinner she had complained that her throat was sore, and that it hurt her to swallow, but that she had been able to go about

correct. I am rather inclined to think that the first boy had gone through a mild attack of Scarlatina a week before I saw him, and that at the time of my visit he was suffering from a mild attack of Diphtheria. His brother, on the other hand, became ill with symptoms of Diphtheria which developed into Scarlatina. I may mention that they were both treated for the throat affection. Against this diagnosis it is right to mention that there never was any albumen present, and no signs of paralysis have since supervened, also that some cases of Scarlet Fever had occurred in two houses in the neighbourhood.

Even more interesting than the above are the seven following cases, all occurring in one family:- The house occupied by them is a small one consisting of 3 rooms opening one into the other. The water is obtained from a well close at hand, and the place is unconnected with the drains of Camberley.

CASE 11.

On Nov. 14th. 1891, I was sent for to see Bessie R-- Aet. 8. I found that for about a month she had been complaining "off and on" of sore throat. She had attended school on the previous day, but had felt weary and disinclined for work, with pain in the back, shivering, and sore throat. On examination I found her feverish and weak, and hardly able to sit up in bed. The fauces were much inflamed and tonsils enlarged, with large greyish patches on



each. The glands were swollen and tender and the tongue furred. No rash of any kind was visible. She made steady but gradual improvement with no complications.

CASE 12.            Nov. 14th. 1891. In an adjoining bed lay the second patient, Charles R--, Aet. 9. He complained of symptoms almost the same as his sister, and the throat, tongue and glands presented very similar appearances. There were no signs of any rash. I learned that 3 years before this he had suffered from an attack of Diphtheria. He also recovered from his attack, and neither he nor his sister had any trace of skin eruption, nor any appearance of peeling.

CASE 13.            Nov. 14th. 1892. In the same bed as his sister lay Arthur R-- Aet. 3. He had not shown any signs of illness until the preceding evening, but was now looking feverish. Temperature 103.2, and his pulse was rapid. His throat was inflamed with a few spots scattered over the tonsils; glands not much enlarged and very slightly tender to touch. At that time there was some appearance of a rash on the body and the following day it fully developed, and was ultimately followed by marked desquamation. His recovery was rapid.

CASE 14.            Nov. 15th. 1891. Horace R-- Aet. 4. Signs and symptoms almost the same as the preceding; distinct rash followed by peeling.

CASE 15.            Nov. 25th. 1891. Albert R-- Aet. 15. Page boy. This boy was a brother of the above children, but lived at

his master's house some distance from his own home. He said that he had not been near any of his people since Nov. 8th., nor had he held any direct communication with them since that date. During the afternoon of the 25th. he complained of feeling ill and was hardly able to do his work. In the evening his throat became painful, and he felt shivering and prostrate. His tonsils and mouth were reddened. Nov. 26th. Passed a very restless night, and was unable to leave his bed in the morning. Throat painful, and tonsils inflamed and reddened, especially the right one. Tongue covered with a greyish fur. No patches; no rash, but fearing it was Scarlet Fever he was sent home. On the evening of this day the glands on the right side became swollen and tender, chiefly at the angle of the jaw. The tonsils very red and covered with slimy mucous which, however, could easily be removed. Nov. 27th. Numerous greyish patches scattered over both tonsils, able to remove most of them easily. No rash. Bowels relaxed.

Nov. 28th. Tonsils larger and more inflamed, several large grey patches towards posterior surface of them. Glands exceedingly tender. Much depression, breathes with difficulty.

Nov. 29th. Herpetic eruption round lips, low muttering with delirium and great prostration; tonsils nearly meet in middle line; on front of each is a large grey leathery-

**ALBERT R. —**

TEMPERATURE CHART

Nov - Dec 1891

DAY OF MONTH		26	27	28	29	30	1	2	3	4	5	6																													
DAY OF DISEASE		m	e	m	e	m	e	m	e	m	e	m	m e m e m e m e m e m e m e m e m e m e m e m e m e m e m e m e m e m e m e m e																												
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	Pulse		m	76	82	82	84	76	74	72	72	70																													
	Resp		m	24	24	22	24	22	22																																
	Motions			1	3	2	1	1	2	1	1																														

CENTIGRADE SCALE.

NORMAL  
107  
106  
105  
104  
103  
102  
101  
100  
99  
98  
97  
96  
95

C

looking patch about the size of a halfpenny and on inner surface of right tonsil is a nasty looking mass of membrane  
Nov. 30th. Feels somewhat better, but is very low and weak. Part of membrane away leaving an excoriated reddened surface.

Dec 1st. Breathing easier, but he still wanders when talking. Has taken nourishment better. A great deal of slimy discharge from nose with shreds of membrane. From this date he continued to improve and ultimately made a good recovery.

CASE 16.

Ellen R--, 41 years of age, the mother of above children, fell ill on Dec. 1st. Temperature 100.F. Pulse 100. Throat sore, and on looking at it the right tonsil was seen to be much inflamed with a small patch on its inner surface. There was also a greyish discoloration on posterior wall of pharynx. Glands of right side swollen and painful; thick fur on tongue. Put on treatment at once, and in a few days appeared quite well. She had had an attack of Diphtheria 17 years' ago.

CASE 17.

Edward R--, Aet. 1. On Dec. 2nd. 1891 became feverish; the throat was evidently sore, as he would not take his milk. Tonsils swollen and showing a few points of exudation. Faint rash on following day which never properly developed, and there was no subsequent peeling. A week or ten days after the beginning of the attack he had severe pains in right ear, followed by a considerable

amount of suppuration.

It is worth noting that 3 years before this a child belonging to this family died from Diphtheria, having had tracheotomy performed 3 days previously.

Of the cases here recorded 5 were reported as being Scarlatina and 2 as Diphtheria. As in the case of the H-- children (Nos. 8, 9, & 10) one found it difficult to arrive at a certain diagnosis. Although no rash was present in either of the two first children I concluded they were suffering from Scarlatinal sore throat more from their general state, and the fact of the third child developing well marked Scarlatina, than from anything else. There was absence of the profound depression one usually sees in Diphtheria when the throat is much affected, and the patches had more the appearance of exudation than typical membrane. Still, even now, I feel doubtful whether after all I was not mistaken, and the undoubted Diphtheria which developed in Albert R-- (No. 15) and his mother (No. 16) tends to further shake my opinion.

One other case bearing on the same point may be mentioned.

CASE 18. Edith V-- Aet. 8. June 20th 1891. On the previous day she complained of sore throat and was generally "out of sorts". She was seen by my partner, Mr. ~~Nanders~~ on the following morning, and he pronounced her to be suffering from Diphtheria. The same evening I saw the child. The

tonsils were swollen and on the left one was an extensive membranous-looking patch. The glands were enlarged and slightly tender, especially on left side. There was no rash on any part of the body. Temperature 103°F Tongue covered by a whitish fur. The following morning a roseolar rash came out on <sup>the</sup> chest and arms; but never was very marked. The child improved steadily and in about 5 days had no signs of membrane. Desquamation supervened.

Interesting from the fact that my partner, who has had great experience in dealing with Diphtheria, asked me to see the child, as showing a typical example of Diphtheritic membrane.

The following case is an instance of what I feel sure was undoubted Diphtheria, resulting from contact with children affected with Scarlatina.

CASE 19.

On Sept. 17th. 1891. I saw Ruth D-- Aet. 16. One week before this, two children came down from London to spend the day with the people who lived in the adjoining house, and soon after their arrival one of the children became ill and was carried to the station by my patient. The latter felt her throat painful on Sept. 16th., and was languid and disinclined to do anything, and, as on the following morning she felt no better, she walked up to the surgery for advice. Her appearance at once showed that she was suffering from some serious illness, and on looking

at the fauces a large grey leathery-looking patch was seen on the right tonsil. The tongue was thickly coated, and the glands on the right side of the neck were swollen and tender. Her temperature was 102°F. She was at once ordered to return home, and I there continued to attend on her. The disease ran an ordinary course; the membrane cleared off in 4 days; the swelling of the glands subsided, and her strength gradually returned. There was never any trace of an eruption resembling Scarlet Fever, and the membrane did not in any way resemble the kind of exudation one meets with in that disease.

Inquiry was made about the child who returned to London, and it was found that she had developed Scarlatina soon after reaching her home. Two children in the house she had visited in Yorkshire became ill with the same disease, and one of them had it combined with a malignant form of sore throat.

CASE 20.

During the time Case 19 was ill her sister Elizabeth D--, aged 7 years, suffered from a slight sore throat, so slight that her mother did not think it necessary to have medical advice about it, and in a few days she apparently got quite well. Three weeks from the date of the commencement of her sister's illness it was noticed that her face, especially about the eyes, was swollen, and she appeared not quite her usual self. During the afternoon she was

suddenly seized with convulsions, both sides of the body being affected, and one hour elapsed before they ceased. On going to the house I found that she had regained consciousness and knew me. Her urine when examined was found to contain a very large amount of albumen. I examined both eyes, but nothing abnormal could be discovered in either fundus. For three days she continued in a drowsy condition and had two more seizures. Her breathing became rapid and laboured and a few crepitations could be heard at both bases ; but there was no appreciable dullness. On the evening of the fourth day she sat up in bed, complained of feeling cold, then threw her arms round her mother's neck and died suddenly.

This probably was a case of uraemia following Scarlatinal Nephritis, although there never was any trace of a rash and the only symptoms indicating Scarlatina was the slight sore throat.

On looking up the literature on this subject, one finds many references to the association of the two diseases. Bretonneau refers to the phlegmasia and the pharynx, proper to Scarlatina, often existing without the symptoms of Scarlatina, and he distinguishes this from Diphtheria by the deposit consisting rather of membranous exudation than of membranous pellicles, and never assuming the lichenoid aspect nor coherence of a false membrane. In Scarlatina he says the whole cavity of the back of the



mouth and nostrils is simultaneously attacked with an acute inflammation and the origin of the morbid affection is not as in Diphtheria at first limited and circumscribed.

Further, it has no tendency to propagate itself into the air tubes. He gives a most graphic account of the Scarlatinal Angina, concluding by saying that even when the throat symptoms are at their very worst, they do not constitute the most dangerous symptoms of the disease.

Empis describes the two affections as being quite distinct, the mode of development and formation of the Scarlatinal membrane rather resembling Thrush than Diphtheria by appearing simultaneously on both tonsils, and being formed of small white points superimposed one on another, and giving rise to a continuous whitish layer, which presents only a slight degree of cohesion.

On the other hand Daviot's experience of the two affections induced him to believe they were identical, and he based his belief on the facts that "they differed only by epidemic circumstances which impress a greater or less intensity upon sporadic diseases in general, and by the nature of the exanthematous affection which produces in the whole organism, a pellicular modification, under the influences of which the cutaneous inflammation assumes a greater degree of development".

Jenner<sup>5</sup> asserts that Diphtheritic inflammation of the pharynx sometimes complicates Scarlet Fever.

Reports from various officers of Public Health are

interesting in this connection. Thus Dr. Bond<sup>7</sup> writing in 1881 groups Scarlatina, Croup and Diphtheria under one heading, saying that he knows of no line of demarcation by which they can be theoretically separated. Scarlatina, he says, shades off into Diphtheria, though there are cases of Diphtheria which are unconnected.

Dr. F. Parsons<sup>16</sup> states that the two diseases often prevail in the same locality, and may concur or closely follow each other in the same individual. Diphtheria generally being reported as secondary to Scarlatina. He points out that they resemble each other (a) in the relative mortality at different times of the year and (b) at different periods of life; they differ, in that Diphtheria is more fatal in females than in males. He acknowledges that there is an apparent connection between the two diseases; and gives the following hypothesis in explanation:-

- (1) Mistakes in diagnosis,
- (2) Diseases being concurrent, and the one rendering patient more susceptible to the other;
- (3) Scarlet Fever and Diphtheria two different forms of one and the same disease,
- (4) The view of Dr. Walker who held that the membrane is a pathological process, which may occur during the course of various diseases, and thus that Diphtheria is not a distinct disease.

From what we now know as to the pathology of Diphtheria I think this last hypothesis cannot be accepted, nor do I think there is sufficient evidence to identify the two diseases as one. Of more probability is the view held by Dr. Townsen<sup>17</sup> that Scarlatinal Diphtheria is a disease distinct

from Diphtheria and also from Scarlatina; but it must be accepted with caution, and to my mind it would be exceedingly difficult to draw the line separating the diseases. This may be illustrated by taking the following case which is an example of an ordinary typical attack of Scarlet Fever with sore throat, and comparing it with some of the preceding ones.

CASE 21.

Florence E-- Aet. 16. April 15th, 1892. This girl had been living in a house as a general servant. A week before I saw her one of the children was seized with a sharp attack of Scarlet Fever, with bad throat symptoms (a woman in the same road was suffering at that time from Diphtheria). My patient left the house on the second day of the fever and returned to her own home. On the evening of April 14th she complained of headache with an uncomfortable feeling in her throat. On examining her I found both tonsils much inflamed and greatly enlarged. Scattered over the opposed surfaces were spots of whitish exudation. Some fulness on both sides of neck, with tenderness on pressure. Tongue partly covered with white fur and dotted over with red papillae. There was a faint rash over upper part of chest.

April 16th. Tonsils covered with white exudation, much enlarged, difficulty in swallowing, tongue red towards tip, white behind. Rash more distinct.

April 17th. Tonsils touching in middle line, but exudation



less in amount. Rash spreading to legs.

April 18th. Tonsils clear of exudation and not quite so swollen, tongue cleaner, rash fading. Had passed a good night.

April 21st. Rash disappeared, much better .

April 23rd. Tonsils still enlarged and left one slightly painful.

April 27th. Able to be up for a little this afternoon. Traces of peeling.

May 6th. Still being kept in the one room on account of general desquamation affecting chiefly hands and feet.

As the result, then, of my practical experience derived from the cases which have just been recorded I am led to the following general conclusions as to the relations between Diphtheria and Scarlatina:-

1. That Scarlatina and Diphtheria are two distinct entities, each caused by its own specific virus and conferring immunity from a second attack.
2. That the two diseases may occur in the same individual in close relation to each other.
3. That the Scarlatinal Virus instead of preventing the growth of the bacillus Diphtheriae rather tends to favour its development in the body.
4. That in any given locality the conditions which favour the spread of the one specific agent also tend to the propagation of the other.
5. That the differential diagnosis is rendered more difficult

by the fact that a Scarlatinal form of Sore Throat may occur without any cutaneous eruption, and the Diphtheritic throat may be associated with one or other form of exanthem

6. That proof of the existence of a separate form - Scarlatinal Diphtheria - as suggested by Dr. Town<sup>e</sup>nsen is not yet forthcoming.

## VI. SYMPTOMS, COMPLICATIONS AND TREATMENT.

I will now record one or two additional cases illustrating the symptoms and complications one meets with in Diphtheria and add a few words on the best means of treating the disease.

In the following case albuminuria was met with as a complication.

### CASE 22.

On September 10th 1891, I visited Mabel H. - - aet. 15 who during the two preceding days had complained of headache, occasional shiverings and latterly of a sore throat.

On looking into her mouth the tongue was seen to be covered with a grey fur, the fauces had an angry red appearance and the tonsils were swollen, with a large wash-leather looking patch of membrane on the right one. The glands were enlarged and painful. On the following day the membrane had spread to the other tonsil - her general condition was lower and a few faint rose coloured spots were noticed on the abdomen. The urine was examined for albumen and an appreciable amount was discovered, it was also present on the next day: but did not again appear. The after course of the disease was satisfactory except that there was an unusually prolonged period of depression. The ultimate recovery was complete.

Albuminaria occurs in a certain percentage of cases of Diphtheria. It differs from that occurring in Scarlatina in coming on at a much earlier stage of the disease and lasting generally only for a few days. As a rule it is not supposed to have much prognostic significance; but Oertel<sup>21</sup> states that he has been able to make out a close relation between the quantity of albumen excreted in 24 hours and the general intensity of the disease. He also describes the presence of micrococci in the tubes, ~~and~~ Malpighian bodies, and interstitial stroma and considers their existence an important factor in the disease, this, however, has been much doubted. Out of nine of the cases in which I examined for albumen, it was found in small amount in 3 of them.

CASE 23.

A brother of the last mentioned case, Edwin H. - - Aet 11 woke up on the morning of September 15th 1891 feeling very ill. For some days previous to this he had complained of being irritable, had felt low spirited, and cried frequently. On this morning he was very sick after breakfast and said it pained him to swallow.

The throat, on examination was seen to be red and angry in appearance; but there were no signs of any membrane. The glands were moderately swollen and tender and the tongue furred. He appeared weak and depressed and the temperature was 101.2 F. He was treated for Diphtheria and



in five days was practically better and during that time there was never any trace of membrane to be seen. I think that this boy who sickened during the time his sister was ill really had an attack of Diphtheria. It is an example of a type of cases which sometimes occur in which the membrane does not develop.

Another complication of Diphtheria is paralysis and as an example of this I would refer to the case of Eva T. (No.3.). where a partial paralysis of several of the muscles commenced about 6 weeks from the onset of the disease. In her case the pharynx, the external recti of the eyeballs, and the muscles of the neck, back and legs, were all affected, and as a general rule this represents the usual sequence of events. The condition of the nerves and muscles has been already referred to under the heading of Pathology. I will now relate two cases more in detail to indicate the usual train of symptoms, and the means which give the best results in treating the disease.

CASE 24.

James P. ~~Weston~~, 33 years, Bootmaker, on the morning of November 16th, 1891, came down to <sup>the</sup> surgery. He looked very pale and ill, and was hardly able to crawl into the room. He said that on the evening of the 15th ~~Nov:~~ he had felt uncomfortable and disinclined to do anything - passed a restless night and the following morning got up with pain in his back, headache and a slight sore throat. He was

only able to take his breakfast and afterwards was obliged to go and lie down. On taking his temperature it was found to be 101.6 F. with a pulse of 108. He complained of feeling weak and shivering with sore throat and pain in swallowing. His tongue was clean; but on looking at his throat a large grey patch of membrane was seen on the right tonsil, and the fauces generally were much reddened. The glands were not enlarged and not tender. On the evening of this day the glands on the right side were slightly swollen and painful to touch, the tonsils presenting much the same appearance as in the morning.

Nov. 17th. Had passed a fair night and was feeling somewhat better. Tongue furred. Tonsils still very red; but instead of the one patch on the right side there were now two smaller ones.

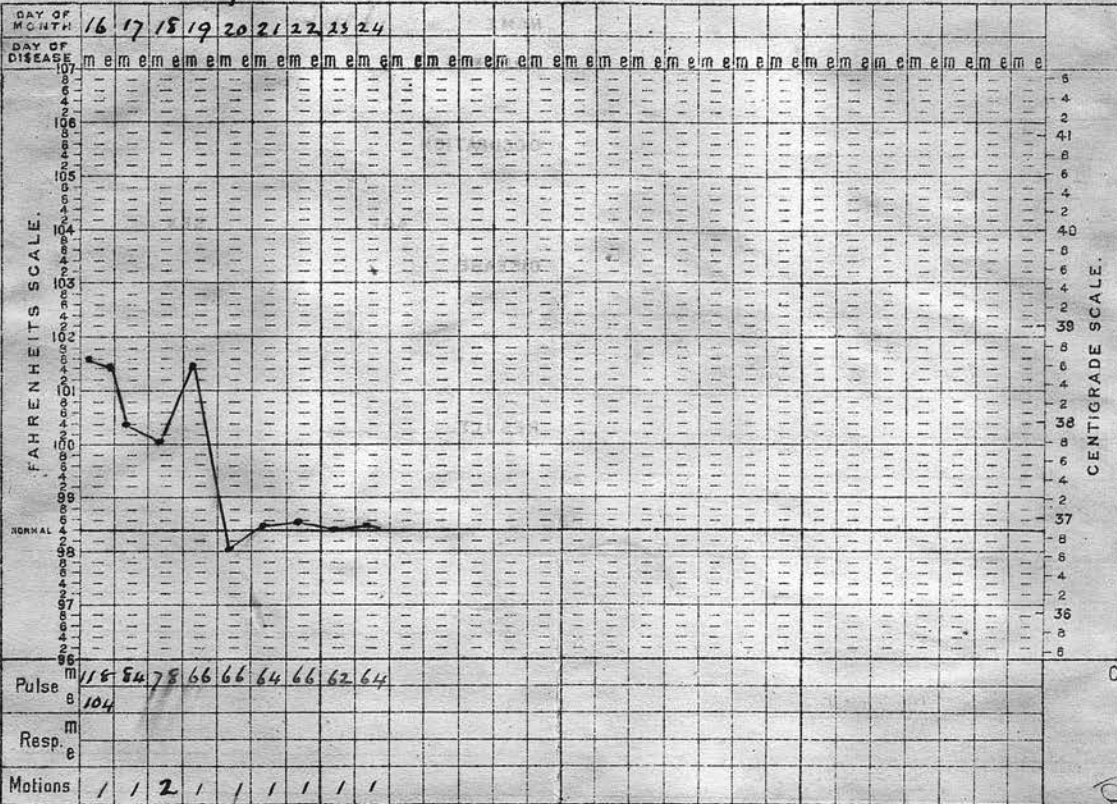
Nov. 18th. Passed another fair night and feels better. Tonsils still enlarged but membrane disappeared. On examining abdomen several small rosey red spots were observed which disappeared on pressure.

Nov. 19th. Still improving. Glands still enlarged, but now feel like small nodules. Right tonsil still somewhat swollen and inflamed. The spots noticed on abdomen have disappeared, but two fresh ones have come out.

Nov. 20th. Swelling of glands has gone. Throat still rather inflamed. Spots observed yesterday are very faint and no

November 1891

JAMES P. W.  
TEMPERATURE CHART.



History. I will not relate the case more in detail so  
 indicate the usual form of typhoid, and the manner which  
 give the best results in treating the disease.  
 James P. Weston, 33 years, bookbinder, on the morning  
 of November 15th, 1891, came down with typhoid. He looked  
 very pale and ill, and was hardly able to crawl into the  
 room. He said that on the evening of the 13th he had  
 felt uncomfortable and distressed so he went to bed  
 a restless night and the following morning got up with pain  
 in his back, headache and a slight sore throat. He was

fresh ones to be seen. Made a good recovery, with no complications.

As regards the source from which the disease was contracted there can be little doubt that he was infected from the cases Nos.9,10,11, who lived almost next door to him.

CASE 25.

James G.G. - - 10 years. A school-boy from Wellington College.

For some time before this boy took ill there had been several cases of sore throat in the College. They were said to be cases of follicular tonsillitis; but two of the boys died and shortly after this the school was broken up. I saw this boy for the first time on December 18th, 1891. It seems that on the 15th he had felt a little pain on the right side of neck during the afternoon, became rather worse at night with insomnia. During the day he had felt tired and unable to apply his mind to his lessons. On the following evening had some pain in swallowing, and was sick after tea, was seen by the College doctor next day who said he had a simple ulcerated throat but advised that he should be sent home. I visited him within an hour or two of his return and found him slightly feverish and looking very ill. He complained of pain in swallowing. Tongue covered with a white fur. Right tonsil swollen and inflamed and on it there was a dirty grey coloured patch of membrane about the size of a halfpenny. The left tonsil was



slightly enlarged and breath had a very bad smell. A few of the posterior sterno-mastoid glands were enlarged (probably not recent) and a certain amount of fulness which he felt at angle of right lower jaw. On examining <sup>the</sup> abdomen three or four small rose coloured spots were noticed which faded on pressure.

Dec. 19th. Glands on right side somewhat swollen and tender and there was also tenderness of glands on left side. The middle and back of tongue covered with a greyish fur, edges and tip studded with red papillae. There was much pain on swallowing and the patch on right tonsil was large and mottled in appearance. Patient extremely weak. The spots observed on abdomen last evening had disappeared - two fresh ones had come out.

Dec. 20th. Passed a good night, breathing better - glands still tender. Tongue rather cleaner. Patch on right tonsil no larger; but a small one has appeared on upper part of left - partly hidden by uvula. The spots which were seen on abdomen yesterday are now very faint, but three fresh ones have appeared. On the same evening the membrane on left tonsil had increased in size, the one on right side was ragged - left glands larger and more painful - one or two fresh abdominal spots.

Dec. 21st. General improvement.

Dec. 22nd. Tonsils not so big and a patch on wall of

pharynx can now be seen, membrane on other places is disappearing and spots on abdomen fading.

Dec. 24th. Much better - able to take nourishment well.

Dec. 25th. Up for first time to-day - rapidly gaining strength.

Made a good recovery and no complications except a very slight difficulty in swallowing his food.

The treatment consisted in giving Perchlorides of Iron and Mercury internally and Benzoic Acid and Sulphur locally, also Beef tea, Port wine etc. at frequent intervals. In this case and that of J.P.W. - I have made special mention of certain spots which appeared on <sup>the</sup> abdominal walls. My partner directed my attention to them and said he had as a rule seen them in his cases of Diphtheria. They have very much the appearance of small typhoid spots only lighter in colour and generally last from 24 to 36 hours.

Knowing as we now do that Diphtheria is caused by the presence of Bacilli and that we have in our power the means of destroying these organisms, the means of treating the disease become at once indicated. Antiseptic applications to the throat - and antiseptic drugs given internally - plenty of fresh air, nourishing and stimulating but plain diet, are what are required. Personally I am in the habit of giving the Perchlorides of Iron and Mercury

combined with glycerine ~~or~~ tragacanth internally, and a powder consisting of Benzoic Acid and Sulphur grs  $\overline{V}$  ad  $3\frac{1}{4}$  to be dusted on the local seat of the disease. Three or four grains of calomel given at the beginning of the attack is often advisable, Sulphurous Acid, Tincture of Iodine, Boroglycerine and many other drugs are all of great value. In children ~~the latter application~~ <sup>Boroglycerine</sup> is especially good, and in solution it is strongly recommended by Dr. Hood of the West London Hospital, who has reported a series of cases in which it gave exceptionally good results, and he also speaks of the relief given by hot gargles. The diet must be liberal - plenty of beef tea - soups and stimulants, especially port wine. In conclusion I will refer to two cases bearing on the subject of tracheotomy.

CASE 26.

Henry L. - - aged 5 years. Carlisle.

My notes on this case are not complete; but it is worth mentioning as an example of unsuccessful Tracheotomy for Diphtheria, March 1st, 1889. The boy complained of sore throat with difficulty in swallowing and at the time of our first visit had a temperature of 105 F. As soon as we attempted to examine his throat there was spasm of the fauces and it was necessary to paint his throat with Cocaine in order to get a view of the parts. Several membranous looking patches were seen on back part of one tonsil, extending to <sup>the</sup> wall of <sup>the</sup> pharynx. The throat was painted with



Acidum Glycerini Carbolici and directions were left to apply Boroglycerine every 2 hours. On the following day his general condition had improved slightly, but the patches seemed larger. For 3 days Carbolic Glycerine was applied twice a day but after this a spray of Boracic Acid with Boroglycerine locally was substituted. His condition continued to get worse and his breathing became affected, with almost complete loss of voice. On the 12th March Dr. Maclaren performed tracheotomy, when trachea was opened a quantity of false membrane was ejected. A feather dipped in Boroglycerine was inserted and walls of trachea brushed round with it. Much temporary relief was afforded by the operation; but after 12 hours he began to get worse and ultimately died at the end of 24 hours. The case was diagnosed as one of Diphtheria commencing in the nasopharynx. The high temperature on the first day is interesting, because significant, I believe of a severe type of the disease, and I feel sure the application of the Carbolic glycerine rather did harm than good for its caustic action on the tissues seemed to form a fresh soil for the spread of the false membrane.

CASE 27.

Another case relating to tracheotomy came under my notice in Carlisle.

May B. - 5 years of age.

May 28th, 1888. About two years before this date Dr. Maclaren had performed tracheotomy successfully for

"Croup". For some reason (my notes do not state what it was) the tube had not been removed, and on the above mentioned day Dr. Maclaren resolved to take it out and try and get the wound to close. This was done and the child seemed fairly comfortable and breathed easily; and fell asleep. During sleep the breathing was of a crowing nature; but caused no uneasiness. The moment she awakened, however, she got frightened, and commenced to gasp for breath, became cyanosed, and the distress was so great that the tube had to be replaced. Two or three attempts were again made to get her to do without the tube; but each time the alarming symptoms ensued and ultimately the attempt had to be abandoned.

April 13th, 1892. On making enquiries about this patient I find that she still wears the tube. One other attempt had been made to remove it; but dyspnoea again came on and it was desisted from. The child is well and strong and her mother says "she can shout with the best, and attends school regularly in all weathers". The general results of tracheotomy in Diphtheria present a most discouraging picture. It is difficult to get any reliable idea as to the number of successful cases. In my own experience I have only known one child who survived the operation. This was a boy in Carlisle, 3 years of age, who was suffering from undoubted Diphtheria and on whom Dr. Helm performed

tracheotomy. Dr. Maclaren in the same town who has repeatedly done the operation has not had one recovery in cases of true Diphtheria. Dr. Thorn<sup>19.</sup> of Grief, in the Edinburgh Medical Journal gives an account of 7 unsuccessful cases - and at the West London Hospital there has been only one recovery out of the last 25 cases operated upon. Other surgeons record much more favourable results, but I think it may be safely stated that in ordinary general practice the percentage of patients recovering from the operation is exceedingly small, and thus, although the chances of success may be increased by operating early, it can still only be looked upon as a last resource, for until then one always hopes that the process of cure may set in and the life be spared.

As regards Intubation the results do not seem to be much more promising. Dr. Hunter Mackenzie<sup>24.</sup> relates his experience of 15 cases, all of which ended fatally.

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# References.

1. Memoirs on Diphtheria.

The New Sydenham Society. 1869

2. The Extant Works of Aretaeus

The Sydenham Society. 1856

3. An inquiry into the Nature, Cause & Cure of Croup.

Francis Home M.D. 1763

4. Essays on the Diseases of Children.

John Cheyne M.D. 1801

5. Diphtheria; its symptoms & treatment.

William Jenner M.D. 1861

6. The Principles & Practice of Medicine.

Charles Hilton Fagge M.D. 1886

7. Diphtheria: its natural history & prevention.

R. Thorne Thorne M.B. 1891

8. Report to the Local Government Board on an Epidemic of Diphtheria in North London.

W. W. H. Power. 1878

9. Report of an outbreak of Diphtheria in York & Scarborough.

Brigade Surgeon A. F. S. Clark M.D.

10. The 18<sup>th</sup>, 19<sup>th</sup> & 20<sup>th</sup> Reports of the Local Government Board

Papers by Dr. Klein. 1888-91

11. Microorganisms. by Dr. C. Flügge

The New Sydenham Society 1890

12. Bacteria & their products.

G. Sims Woodhead M.D. 1891.

13. The Goulstonian Lectures on the chemical pathology of Diphtheria

(British Medical Journal 1892) Sidney Martin, M.D.

14. The Diseases of Infancy & Childhood. 60  
Charles West, M.D. 1884
15. An account of the sore throat attended with ulcers.  
B: Fothergill. 1748
16. Transactions of the Epidemiological Society of London. Vol. III. 1883-84.  
Paper by B: F. Parsons.
17. The Medical Annual for 1892.
18. Clinical Notes on Diphtheria.  
Donald W. C. Hood M.D.
19. Edinburgh Medical Journal. 1888  
Paper by Alex Thom M.D.
20. Holmes System of Surgery.  
Article on Diphtheria.
21. Manual of General Pathology.  
Joseph F. Payne. M.D.
22. Ziemsser's cyclopaedia of medicine.  
Article on Diphtheria by Bertel.
23. Quain's Dictionary of medicine  
Article on Diphtheria by J. Ross Cornwell M.D.
24. Edinburgh Medical Journal. 1892.  
Paper on Intubation by Hunter MacKenzie M.D.
25. Diseases of the Throat Throat  
Morrell MacKenzie M.D.
26. The medico-chirurgical transactions VOL. LXII. 1879  
"Report of committee on the relation of membranous croup and  
Diphtheria".