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DIPHTHERIA;

A

PRIZE ESSAY.

BY

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# DIPHTHERIA:

ITS HISTORY, PATHOLOGY, NATURE AND TREATMENT.

AN ESSAY WHICH RECEIVED THE FIRST PRIZE OF THE MEDICAL  
ASSOCIATION OF THE STATE OF GEORGIA, June, 1866.

By E. S. GAILLARD, M. D., Richmond, Va.

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We have, in this Essay, made it our chief object to elucidate and establish the pathology of the disease which forms its subject, whilst, at the same time, there has been given careful attention to all else of interest and importance connected with it.

With the treatment and general history of diphtheria, very many of the Profession are of course familiar, but any one, who has bestowed even a cursory attention upon its literature, can not have failed to perceive the obscure, injurious, and even antagonistic views, that have been offered and received, in regard to its pathology.

It is in consequence of this confusion and contradiction, that the disease is still regarded as "lis sub judice," and therefore a most appropriate subject for analysis and examination.

In preparing this essay, we have sought to give it a practical character, by corresponding with the most distinguished gentlemen, in this branch of the profession, both in America and Europe; and from more than one hundred autograph letters, we have selected



much of the original and important testimony, that is now offered for consideration.

The literature of the subject, as represented by published works, monographs, essays and reports, has been carefully studied, and if, as a result, the views now presented, are not correct and just, it has not, at least, been for a want of material, or opportunity.

Whether these have been logically, or even judiciously used, it must of course be for others to determine.

We are fully aware of the extended field that has been entered and painfully sensible of the feeble power which has been brought to its cultivation; yet we have patiently tilled it, hoping that the harvest, such as it is, might, with its defective and unripened material, be received into the Professional garner.

No disease has, in recent years, attracted more of the notice of the Profession; its supposed novelty and obscure etiology; its insidious advent and treacherous departure; its peculiar history and unusual results have aroused the attention that induces study, and inspired an interest which promises better comprehension. Physicians, both in Europe and America, have examined, reflected, written, and the Press, in its mission, has widely disseminated the fruits of their labours.

We have received, and are daily receiving, the great essentials for scientific progress—the indispensable requisites for investigation, in all branches of pathology—testimony and fact. Theory and hypothesis seem to have become a part of the Past; demonstration and proof only receive the cautious seal of the Present. A growing skepticism has at last made fact the touchstone, in all that is offered for currency. The genuine material stands the ordeal and receives the stamp of validity; whilst the spurious is at once detected and rejected, as counterfeit.

Hypothesis and theory should then, as far as practicable, be abandoned, and testimony and fact be made the basis of every investigation. With such views and purposes, we undertake the analysis and consideration of our subject.

*History.*—We will first examine the history of diphtheria, to show that it is not, as has been so often declared, a disease of modern times; and then give (as well as the limited character of such a



paper will admit) a concise account of its prevalence, to any extent, in Europe and America. In this, we will, of course, be unable to present more than a passing allusion, and then only to those sections, (not localities) where the disease has prevailed to any extended or malignant degree.

Although, according to Brettonneau, from whom all writers must quote, this disease was known in the earliest periods of Grecian history, when the blind son of Mæon chaunted his immortal verse in the streets of Smyrna and along the bridle-paths of Ionia, yet we cannot take the obscure allusions of Homer, whose very existence has been doubted, for the establishment of historic facts. Brettonneau states, that at the time to which we have alluded, it was described as the *Malum Egyptiacum*. There is one period, however, from which we can historically date this disease. Ten centuries after the supposed existence of Homer, Aretæus of Cappadocia writes of an epidemic, in most respects similar to this malady. As to the exact period, at which this writer lived, it would be, perhaps, impossible accurately to state; this is not important; he is mentioned, as a contemporary of Galen, and again as living in the time of Vespasian; he is however one of the earliest and best writers, among the Greek Physicians.

Aretæus writes of this disease as the *Malum Egyptiacum*, while at the period immediately preceding, it is mentioned as the *Ulcus Ægyptiacum*, *Ulcus Syriacus*. The Cappadocian author enters fully into all of the details of his subject, and writes particularly of its history and treatment; his description of the symptoms is often quoted, and it will be seen at a glance, that the disease could have been no other than that which now attracts so much attention.—  
 “*Ulcera in tonsillis fiunt, aliqua mitia, aliqua pestifera, necantia. Pestifera autem sunt lata, cava, quodum concreto humore albo, livido, aut nigro sordentia. Quòd si concreta illa sordes altius descenderit; affectus, ille eschar est, atque itá Graecè vocatur Latine crusta.*”

Again he writes: “*Crustam verò circumveniunt rubor excellens et inflammatio, et exiguæ raræque pustulæ orientes, hisque aliæ supervenientes in unum coalescunt, atque indè latum ulcus efficitur.*”

It will be seen, that Aretæus describes the tonsils, in an ulcerated condition, covered with a white, livid and black crust.

Dr. Cartwright, of New Orleans, always wrote of diphtheria, under the name selected by Aretæus. We may conclude then, as this point has been carefully examined by Rilliet and Barthez, by Brettonneau and others, that the history of this disease, if not its existence, must be dated from the writings of Aretæus of Cappadocia.

Macrobius speaks of its existence in Rome, A. D. 380. It is next after this time mentioned by Cœlius Aurelianus. Hecker speaks of an epidemic, of this character in England, in 1517. Dr. Slade mentions an epidemic in Holland in 1337. Another epidemic, in Holland, is mentioned by Pierre Forest, as having prevailed in 1557. It is next described, as existing in Paris in 1576. Fontecha, a Spanish Physician, states that it prevailed with him in 1581; and epidemically in 1599 and 1600. Villa Real, also of Spain, describes it as existing in Andalusia in 1590. A few years after this, the disease seemed to have swept over Europe. In Naples, where it destroyed five thousand persons, it is described by Carnevale, Nola, Zactus, Lusitanus, Marcus, Aurelius Severin, Syambati, and others. Herrera, Villa Real, Fontecha, Mercatus, Tamayo, Nunez, and others, write of it as an epidemic in Spain, in the early part of the Seventeenth Century. Alaymus and Cortesius describe the disease, as it, about this time, prevailed in Sicily. It visited the Island of Jamaica in 1636. These authors all write of it under different names, but the disease is the same. In Sicily, it was called *gulæ morbus*; in Spain, *garrotillo*, or *morbis suffocans*; in Holland, the suffocating complaint; in England, *angina maligna*, etc. In the early part of the Eighteenth Century, we find the disease very generally mentioned, by medical writers, in almost all countries. Rev. Jonathan Dickinson, of Elizabeth Town, New Jersey, America, in 1738, wrote a letter on the subject of an epidemic, then prevailing in that neighborhood, which was undoubtedly this disease. He speaks of it, as the "throat distemper." In describing its symptoms, he states that "it frequently begins with a slight indisposition, much resembling an ordinary cold; with a listless habit, a slow and scarce discernible fever, some soreness of the throat and tumefaction of the tonsils; perhaps a running of the



nose ; the countenance pale and the eyes dull and heavy. The patient is not confined, nor any danger apprehended for some days, till the fever gradually increases, the whole throat and sometimes the roof of the mouth and nostrils are covered with a cankerous crust, which corrodes the contiguous parts, and frequently terminates in a mortal gangrene, if not by seasonable applications prevented. The stomach is sometimes, and the lungs often covered with the same crustula. The former is discovered, by a vehement sickness of the stomach, a perpetual vomiting ; and sometimes, by ejecting of black and rusty, or fœtid matter, *having scales like bran* mixed with it, which is a certain index of fatal mortification. When lungs are thus affected, the patient is afflicted with a dry and hollow cough, which is quickly succeeded with *an extraordinary hoarseness and total loss of the voice, with the most distressing asthmatic symptoms and difficulty of breathing*, under which the poor, miserable creature struggles, until released by a perfect suffocation, or stoppage of breath. This last has been the fatal symptom, under which the most have sunk, in these parts. And indeed there have but comparatively few recovered, who suffered thus, and whose lungs have been thus affected. All that I have seen to get over this dreadful symptom, have fallen into a ptyalism, or salivation, equal to a petit flux de bouche, and have, by their perpetual cough, expectorated incredible quantities of a tough, whitish slough from their lungs, for a considerable time together. And on the other hand, I have seen large pieces of this crust, several inches long and near an inch broad, torn from the lungs, by the vehemence of the cough, etc. \* \* \* The first assault, seen by me, was in a family, ten miles distant from me, which proved fatal to eight of the children in about a fortnight. \* \* \* I have frequently observed, that once having this disease is no security against a second attack. I have known a person to have it four times in one year ; the last of which proved mortal. \* \* \* The lungs and the throat, and especially the epiglottis, are inflamed, and the last much tumefied. \* \* \* This may be distinguished from an angina by the crustula in the throat." The Professional reader at once detects the errors of examination here, and if the trachea and larynx (as the seat of the disease, when it extends beyond sight) were mentioned,

in the place of the lungs, he will recognize, in this language, the description of a simple, and again of a malignant attack of diphtheria. The same writer speaks of eruptions in his letter; but it is evident that, when these are mentioned, he confounds scarlatina at one time, and then erysipelas and other diseases, with diphtheria. Scarlatina, measles, and erysipelas were prevailing at the time, and it is manifest, that either he confounds the diseases with each other, or that they were blended, which frequently occurs; and if not blended, succeeding each other, as has repeatedly been observed, in the history of diphtheria, during the last few years. Dr. Greenhow, of London, Dr. Clark, of New York, and many gentlemen of England and of America have published such cases; and in the scarlet fever epidemics, published by Fothergill and Huxham and others, such instances are frequently detailed.

We cannot find space for many such lengthy quotations, but this has been given, because it furnishes clear and undoubted evidence of the malignant prevalence of diphtheria in America, as early as 1738, when on the contrary *all* writers, in England and America, state that it did not here exist before 1771, at which time it was graphically and first described by Dr. Samuel Bard. It is given merely as an historical fact, connected with diphtheria in America. The disease described by Dr. Douglas, of Boston, in 1736, to which Dr. Bard alludes in his essay, was evidently not diphtheria. The disease is generally and fully described, about the period of its prevalence in New Jersey, by most of the authors in Europe. In 1743 it made its appearance in Paris, and seemed to have prevailed there until 1748. This epidemic is described by Chomel, Malouin, and others. Chomel, speaking of the exudation, tell us, that about the third day, an unpleasant odour was apparent, and that this soon became insupportable. There was ichorous discharge from the nostrils, the trachea ulcerated, and death occurred about the tenth or twelfth day.

Ghisi, of Cremona, has given a description of the epidemic which prevailed there from 1740 to 1748. The epidemics of diphtheria, during the 18th Century, in England, are described by Fothergill, Starr, Cotton, Huxham, Wall, Wethering, Rumsey, and others. Dr. Fothergill described the disease as it existed in London about 1750;



Dr. Starr as he saw it in Cornwall in 1749 ; Dr. Cotton as it appeared at St. Albans in 1748 ; Dr. Huxham as it prevailed at Plymouth 1753 ; Dr. Wall as manifested at Worcester ; Dr. Wethering as he saw it at Birmingham in 1778, etc. In America, it prevailed in New York in 1771, and was classically described by Dr. Samuel Bard. It is mentioned, as prevailing in France, about the middle of the Eighteenth Century, by Dr. Slade, who quotes from the writings of Arnault and Marteau de Grandvilliers. It prevailed in Sweden in 1755, 1759, 1761 ; it existed epidemically at Upsala in 1762. Rosen describes the history of this epidemic : it is also described by Wilcke. There seemed to have been an arrest or absence of this disease, from the latter part of the Eighteenth Century, until one-fourth of the next Century had expired ; when it reappeared, and has prevailed, with deadly violence, at different periods, up to the present time.

We have thus concisely traced the history of this disease, from the time of Aretœus, to the early part of the Nineteenth Century. It has been impracticable to quote from the authors given, as such a course would be adapted to a volume, and not to a paper of this limited character.

The history, symptoms and general cause of the disease, as described by these authors, are for the most part similar, and such quotations would have presented more of literary, than pathological interest. For the same reasons given, we have deemed it unnecessary, and certainly not important to describe the epidemics, as detailed by these innumerable writers.

We find, in the history of diphtheria, during the present century, that it has prevailed most malignantly in France, England and the United States, and that this malignancy would be represented, by the order in which these countries have been named. Although, in the description of this disease, it would be interesting to give a brief sketch of the manner of its prevalence, in the large cities that have been subjected to its epidemic desolations, yet (as each one of these epidemics would alone, furnish material for a more extended paper than the present) it will only be possible to give the localities involved. Furnishing thus an historical abstract, from which the proper references may be obtained, by any one desiring

to investigate the character of the disease, as it may have prevailed, in each country or locality.

The first epidemics, of which we have any records, during the present century, prevailed at Tours, in 1821; in La Ferrière in 1826 and in Chénusson in 1827. These epidemics, as is well known, furnished the subjects for the classic essays of M. Brettonneau, of Tours, France. It was supposed, by the author of these essays, that the disease was first introduced into the population of Tours, by the military legion of La Vendée. He named the disease diphtherite, and, with some modifications, it has been the name, selected by many authors, for the description and history of the malady. We will postpone an examination of the name, until we make its etymology a subject of brief consideration. The disease is next seen at Marseilles in 1826; and in Orleans in 1828. In 1843 it prevailed, as a slight epidemic, in Paris; Becquerel has given a description of this. M. Empis gives a brief account of its prevalence, as seen by himself in 1848. Boulogne became, in 1855, the scene of its earliest malignant appearance, and to M. Perrocheaud, we are indebted for a graphic description of its desolations there. With very little interruption, the disease prevailed in that city until 1857, and in this period we are told it destroyed 275 persons; it chiefly attacked the English residents. About the same time, it commenced to gradually extend over France, and we find it visiting Mont Martre, Causery, Vernuis, and many other places, described by Pichenot, in his account of the epidemic at Causery. Lespian has described its history, at Avignon in 1854, and Lemaire its course, at Cosneé. It appeared in Paris at this time, and may be said, with slight exceptions, to have prevailed there ever since; it seems to have become one of the Parisian endemics. During the years 1855 and 1856, it prevailed with very great severity in that City. There are interesting descriptions of its history, as it prevailed at St. Omer, Haute Marne, Ingrandes, L'Yonne and other places. The first reliable writings on this subject were published, as has been said, by M. Brettonneau, of Tours. Since this period, diphtheria has been the theme, for the most brilliant writers in France. We mention the well known names of Louis, Lemaire, Trousseau, Guersant, Isambert, Bouchut, Andral, Chomel, Barthez,



Empis, Lemoine, Lespian, Jobért, Duché Penant, Riliet, Pichenot, Loisseau, Olliviér, Faure, Becquerél, Aubrun, Duliquier, Charnaux, Isnard, Peter, André, Desmartis, Bouchet de Vitray and many more, the works of whom may be, with profit, consulted by those particularly interested in the study of this subject. With this brief notice, but correct record, of the history of diphtheria in France, from the commencement of this century, to the present time, we pass to the consideration of its course in England, during a similar period.

The first case authentically recorded, as having taken place in England, was at Spalding, Whaplode Drove, Lincolnshire, July, 1856. Of course other cases must have occurred, but this was the first recognized case of diphtheria. This was placed under the care of Mr. Wilkinson. A few months after, other cases were reported, and it soon prevailed as an epidemic. We find the disease, now existing in Leek, Pinchbeck, Birmingham, Brewood, Water-Orton, Erdington, and other localities soon to be mentioned. At the same time, the disease was carefully studied, and the materials now collected furnished the basis for some of the best papers on diphtheria, that have yet been published. From the period of 1856, the disease gradually extended over England, and the names of the following places represent the scenes of its epidemic visitations: Wolverhampton, Dudley, Clapham-Rise, Tattershall-Thorpe, Horncastle, Dursley, Christ-Church and Strouden, London, Manchester, Cam, Brentwood, Malden, Coningsby, Belper, Nantwich, Coltishall, Hanley, Sussex, Norfolk, Kent, Essex, Cornwall, Holdenhurst and Islington.

Webster, of Dulwich, gives cases that occurred in his practice, from 1824 to 1829, which must have been diphtheria, and Ryland, writing in 1837, furnishes cases that must have been true diphtheria. There are cases reported from Herefordshire in 1849 and 1850, that were most undoubtedly instances also of this disease. There is of course a history connected with the prevalence of diphtheria at each and all of these places, but, however instructive, it must all be omitted, and our course limited to the concise relation of the localities thus visited. To conclude the abstract, that we have thus prepared of these places, we will farther mention the remaining

names : Liverpool, Lincolnshire, Muscliffe, Whitham, Penn, Red-ditch, Canterbury, Suffolk, West-Bromwich, Yorkshire, Bagshot, Erdington, Rumford and Wirksworth. We are not aware, that up to the present time, any epidemics of diphtheria have prevailed in England, the localities in regard to which have not thus been obtained and recorded. Of course sporadic and occasional cases have occurred, which, not being reported, are not here noticed, but all of the epidemics, strictly so called, are most probably represented in these lists. In England, the medical writers have paid very general attention to the study and elucidation of this disease, and we consequently have a full and valuable literature, connected with it. Including those who wrote of this disease by description, if not by name, we have the familiar names of Sir E. Home and Dr. Watson; Baillié, Hart, Sanderson, Semple, Farr, Greenhow, Ranking, Hillier, and others of London; Wilkinson, of Spalding; Heslop, Wade, West, Fleming, Russell, Schofield, and Keyworth, of Birmingham; Palmer, of Water-Orten; Oates, of Erdington; Topham, of Wolverhampton; Webb, of Wirksworth; May, of Malden; Lambden, of Conningsby; Dodge, of Cornwall; Ballard, of Islington; Monckton, of Kent; Stiles, of Pinchbeck; Blount, of Bagshot; Davey, of Rumford; Cammack, of Spalding, with others whose localities are not definitely known; Gull, Lambden, Plaskitt, Britowe, Keysworth, Birch, Leonard, Morris, Houghton, Nicholson, Bellyse, Rigden, Wigan, Hulme, Kingsford, Whitehead, Bottomley, Camps, Davey, and many others, who are not so well known to the Professional reader. It is proper to say, that this disease has not been much seen in the large hospitals of London, and this will account for the absence of so many names, that are, to the Public, "as familiar as household words." Dr. Peacock, of London, writes: "I have not seen very much of diphtheria, for in London, at least, the disease has been quite local in its appearance, and has rarely been seen in the General Hospitals."—(Autograph letter to author, December, 1860.) This is also the testimony of many others, connected with the largest Institutions of Europe and America. We pass now to consider that portion of the history of diphtheria, which is most interesting to the American reader: the course and prevalence of the disease in the United States.



Soon after the appearance of diphtheria in an epidemic form in England, it prevailed in California. As was the case in England, the Profession had no practical acquaintance with the disease, for those who had seen it in a former century, had long since been removed. All readers were familiar with the general description of the disease, as given by Fothergill, Cotton, Starr, Huxham, Bard, Wall, and more recently by West, Copland, Evanson, Tweedie, Maunsell, and others; but these descriptions were not yet recognized, as applicable to diphtheria specially, and on its first appearance, there was of course much speculation as to its pathology, and much doubt as to its proper treatment. Dr. V. T. Fourgeaud has given a partial description of the disease, as it prevailed in California in 1856, 1857, and 1858, though the greater part of this (one of the earliest American papers on the subject) is devoted to discussing the diagnosis and pathology of the disease. He regarded it as a strictly local affection. Dr. Blake, of Sacramento, California, has given us an account of diphtheria, as it prevailed in that section of his State in 1857, 1858 and 1859. He regarded it as a distinct disease, different from croup, cynanche tonsillitis and scarlatina—a disease of the zymotic class. The disease has prevailed, at intervals, up to the present time, and having seen perhaps as much of it as any one in that State, he has not yet had cause to change his opinion. In an autograph letter of December, 1860, he thus writes: "That the old doctrine of its local character is unsustainable, few who have witnessed its effects, during the past two or three years, will be disposed to deny. I still regard it, as a strictly constitutional disease." Diphtheria has prevailed very generally in California since the early part of 1856, up to the present time, and its course and history there have been well described by many of the Physicians of that State. Very excellent papers have been prepared by Dr. V. J. Fourgeaud, of San Francisco; Dr. Blake, of Sacramento; Dr. D. Wooster, of San Francisco, and Dr. J. P. Whitney, also of that City. Dr. E. S. Cooper claims to have seen and treated quite an astonishing number of cases. Dr. H. W. Nelson gives a description of an epidemic of diphtheria which prevailed at Dutch-Flat, California; and Dr. Bynum, of Cache-Creek, California, has presented an account of the disease, as it prevailed with him.

The disease spread throughout the United States so irregularly, that it has been impossible to keep a record of the places and sections successively visited; we will not attempt this, but give all that is necessary—a list of the chief epidemics, that have appeared up to the present time. A malignant epidemic of diphtheria appeared at Albany, New York, in 1858; an account of this has been given by Dr. S. D. Willard, of that City. It prevailed chiefly among children under twelve years of age. Dr. Willard regarded it “as nearly allied to scarlatina.” The disease prevailed to a very great extent in New York in 1859, and occasionally there since that period. The epidemic in that City, during the Winter and Spring of 1859, has been admirably described by many of the Profession, in the Journals contemporaneously issued. There have been excellent papers prepared by Drs. A. Clark, J. B. Reynolds, Jacobi, and others. In the published proceedings of the New York Academy of Medicine, the pathology, cause and treatment of this disease will be found fully analyzed and discussed. Here will be found, what we have not space to give: the views and experiences of many of the most generally known speakers in that body—Drs. John Watson, Gurdon Buck, A. C. Post, Krakowitzer, Jacobi, Sayre, Barker, T. G. Thomas, Percy, Green, Peaslie, J. R. Wood, Markoe, and many more whose names we have not space to mention. Dr. Jacobi testifies, that at the Canal Street Dispensary, he had treated one hundred and twenty-two cases. This may serve as an index of the general prevalence of the disease at that time. The disease has prevailed to some extent in the New England States. Dr. Lawrence describes its course at North Adams, Mass., and Dr. Holmes gives an account of its prevalence at South Adams, Mass. Its appearance and history at the following places have been thus described: at West Stockbridge, by Dr. Meacham; Orange, Conn., by Drs. Beardsley and Jewett; in Canterbury, Conn., by Dr. Jewett, with a few scattered cases, in the Counties immediately adjacent to the last named Village. It prevailed in New Hampshire to some extent, in 1857; in Boston in 1858. Dr. Seymour has given its history at Troy, New York; in Rochester; as described by Dr. Bostwick, at Red Rock; at Austerlitz, Lebanon, Chatham, and Gallatin in the State of New York. At Buffalo, it prevailed some



years since, and its history there was given by Dr. Rochester and by Dr. Austin Flint. Dr. J. G. Orton, in an autograph letter of January, 1861, states: "The present epidemic of diphtheria made its appearance at this place (Binghamton, N. Y.) about two years since, and has continued, almost without interruption, up to the present time. It has been, in fact, the only epidemic that has extensively prevailed in this region, for the past twenty years." It has prevailed at Providence, R. I.; but Dr. Snow, of that City, writes that this has been to only a limited extent; there were seventeen deaths there from this cause in 1859, and six in the year previous. In Berkshire County and in Pittsfield, Mass., the disease has at times existed epidemically. In Philadelphia, diphtheria has at times prevailed to an alarming extent, and the disease there has been quite fatal. Its history has been well described by Drs. Condie, Meigs, Wood, Nebinger, Beasley, and others. Dr. Condie's reviews of this disease are instructive and interesting. One of the best papers that has appeared, anywhere, on the subject of diphtheria, was presented by Dr. Henry Hartshorne, of Philadelphia, in March, 1860. Dr. W. H. Thayer, of Keene, N. H., and Dr. D. D. Slade, of Boston, have each written most valuable essays on this subject. In Ohio, diphtheria has prevailed to a great extent. The epidemics at Cleveland and at Cincinnati have been very severe.—Dr. C. A. Hartmann, of Cleveland, has contributed quite an interesting paper on the disease, as seen by himself; and from Dr. Comegys we have a letter, giving a graphic description of the disease, as it prevailed at Cincinnati. Diphtheria has made its appearance, as an extensive epidemic, in Kentucky, Mississippi and Tennessee. Dr. S. A. Cartwright, of New Orleans, has given a description of the disease, as he saw it in that State. Dr. Warren Stone, who, in the death of his son by diphtheria, has had a melancholy yet practical experience with that disease, has contributed his views in regard to it. Dr. R. H. Goldsmith, of Oakland College, Miss., has published his experience; and he has had "three hundred cases in his practice."

But this branch of our subject has already extended beyond the limits that can be assigned to it, and we must terminate its consideration by briefly giving an abstract of the chief epidemics, whose

history has been *published*, and adding, in conclusion, whatever information, of a practical character, that has been furnished us by letter. Diphtheria has prevailed at Baltimore, Md.; at Charleston, S. C., (American Journal of Medical Sciences, vol. xxiv, page 82; a paper by Dr. E. Geddings); at Nashville, Tenn.; at Louisville, Ky.; at Iowa City; at Milwaukee, Wis.; and in many of the Counties of the States thus named. Dr. Meranda has described an epidemic at New Carlisle, Ohio; Dr. Coskery, of Baltimore, an epidemic in South Pennsylvania. Epidemics have prevailed at the following places, and their published description given by the following writers. At River View, Ky., by Dr. Duerson; at Milwaukee, Wisconsin, by Dr. W. S. Wells, (whose paper is both extensive and interesting); at Jacksonville, Illinois, by Dr. Prince; at Sacramento, California, by Dr. Blake; at Milton, Ind., by Dr. V. Kersey; at Sacramento, Cal., by Dr. Hatch; at Falmouth, Ky., by Dr. J. H. Barbour; at Hopewell, Ohio, by Dr. J. A. Reamy; at Petersburg, Va., by Dr. W. M. Turner; at South Onandaga, N. Y., by Dr. J. Kneeland; in Lehigh County, Penn., by Dr. A. M. Sigmund; at Newton, N. J., by Dr. J. Ryerson; in Kentucky, by Dr. S. P. Bryan; at Flushing, Long Island, by Dr. C. M. Allen; at Homer, N. Y., by Dr. G. W. Bradford; at West Stockbridge, Mass., by Dr. Levitt; in Sligo County, Kentucky, by Dr. J. H. Wheeler; at Iowa City, by Dr. W. M. Cochran; Plattsburgh, Nebraska, by Dr. R. R. Livingston; at Baltimore, (to a limited extent,) by Dr. F. Donaldson; and at Cincinnati, Ohio, by Dr. J. A. Thatcher.

Dr. Sweat writes, that he has seen cases at North Parsonfield, Maine; Dr. Woodward, that the disease has prevailed epidemically at Brandon, Vermont; Dr. James A. Reeves, of Fairmont, Va., that the disease has prevailed with "appalling mortality" in Preston, Taylor, Barbour, Randolph, Marion, and other counties in Virginia; Dr. W. S. Chipley, that he has seen it at Lexington, Ky.; Dr. A. B. Palmer, that it has prevailed to a limited extent, in Ann Arbor, Michigan; Dr. C. S. Webber, that it has been seen at Charlestown, Mass.; Drs. Borland, Bowditch and Gould state, that the disease has never prevailed, to any marked extent, at Boston, Mass.; Dr. Cain, that he has frequently seen the disease in Charles-



ton, S. C.; and Dr. Bemiss, of Kentucky, that it had very generally prevailed in that State; Dr. M. L. Linton, of St. Louis, Mo., states that he has frequently seen the disease in his City, but that it has not prevailed to any great extent. Some parts of the United States have almost entirely escaped the visitations of diphtheria. Dr. Lee, of Pensacola, Fla., writes that the disease had not appeared there; such is also the testimony of Dr. Westmoreland, of Atlanta, Ga.; Dr. G. W. Dove, District of Columbia, writes that "it has been my good fortune not to have encountered a single case of diphtheria;" Dr. Bozeman states, that up to the time of his leaving Montgomery, Ala., he "had not met with a single case of diphtheria, nor had any other practitioner;" Dr. S. Howard, of University of Virginia, writes, "I have not met with a single case of the disease here;" Dr. Brown, of Yanceyville, N. C., states, that, if at all, it had only prevailed to a limited extent in his State.

Diphtheria has prevailed in Scotland and in Ireland; in Sweden, Switzerland and Germany; in Spain and Italy; in Mexico and in Peru; but we can not, with regard to the history of the disease, go any farther into details. Drs. MacKenzie, Abercombrè and Brown, of Glasgow; Drs. Laycock, Crichton and Alison, of Edinburgh; Dr. Corrigan, of Dublin; Dr. Adriaazala, of Lima, have all written on this subject, and their papers can be consulted, by those taking a special interest in the epidemics of these countries. In addition to these, we may mention the names of Friedereich, Virchow, Rokitsansky who have described the epidemics of Germany; and Laman and Mestizzi, who have described the disease, as it has existed in Mexico. The etymology of the word will next be considered.

*Name.*—There has been much contention, as to an appropriate name for this disease; it is almost beyond conception to see the titles, under which it has been described. Nothing, better than this, can explain much of the antagonism, obscurity and contradiction that have prevailed, in regard to its pathology. We have selected the names given by different authors and writers, as indicative of the controversies that have arisen in relation to them, and give them as follows: Morbus Strangulatorius (Dr. Starr;) Malignant Sore Throat, (Fothergill;) Suffocative Angina, (Bard;) Malum Ægyptiœcum, (Aretœus;) Ulcus Syriacum, Diphtheritis, (Brettonneau;)

Diphtheritica Maligna (Trousseau;) Diphtherite, (Rilliet, Barthez and others;) Malignant Ulcerous Sore Throat, (Huxham;) Angina Maligna, Angina Gangrenosa, Angina Pellicularis, Angina Pestilentialis; Angina Suffocante; Epidemic Angina, Scarlatina Anginosa, Angina Couenneuse, Pharyngite Couenneuse, Pharyngitis, Pultaceous Pharyngitis, Plastic Pharyngitis, Cynanche Maligna, Cynanche Gangrenosa, Epidemic Cynanche, Membranous Cynanche, Membranous Tonsillitis, Membranous Disease, (Cotting;) Pseudo-Membranous Pharyngitis, Putrid Sore Throat, Throat Distemper, Garrottillo, Male de Canna, Gulæ Morbus, Morbus Suffocans, and infinitely contradictory names, in other languages. It will thus be seen, that it was not an easy matter to reconcile these endless differences and disputes and to select a name which would, at least, be adopted by a majority. It is of great importance, that a disease should always be described under an invariable name; otherwise, it is almost impossible to properly study its character and history. We can best obtain a true conception of a pathological condition, by adopting a word so clearly comprehensible that it shall express this condition, and by so defining the condition to which the word is to be applied, that such application shall be uniformly and necessarily correct. If this is not done, the inevitable result always is, that writers, by the same word, symbolize different pathological conditions and the same pathological conditions, by different words. This is remarkably true, in regard to the written history of diphtheria. We have the same word applied to very many and different diseases and the same disease described, under entirely different words. Most of the writers of England and America have selected the word adopted, though not suggested, by Dr. Farr, (The Registrar General of England,) Diphtheria. It is the word most commonly used, by those who write in English, though many prefer to continue the existing confusion, by adopting some of the many titles already existing, or to increase it, by forming a word to suit their own fancies. It is to be hoped, that however much it may do violence to their peculiar rules of etymology, all writers will adopt the word, now so universally used, in the valuable medical literature of England.— Many writers object to the term diphtheria, as “barbarous” and unscientific; and as an absurdity in the uses of etymology. With



unscientific, and as an absurdity in the uses of etymology. With all deference, we submit, that the word diphtheria is correct in etymology, correct in analogy, and correct in euphony. It is based on the Greek root *διφθερα*, signifying a membrane, skin, or hide. Diphtheritis signifies an inflammation of the skin or hide, which is false in fact; whereas, diphtheria signifies a disease, characterized by the formation of a skin or membrane. It does not define the disease, but it certainly suggests its chief characteristic. The termination in *itis*, by the general usages of terminology, signifies a high degree of inflammation; whereas, in diphtheria this is not always the case, and is often a gratuitous assumption. Many of the most fatal cases never manifest this inflammation. Again, the termination in *itis* usually implies, that there is an attending constitutional disturbance, as a result of this inflammation; whereas, the constitutional disturbance is, at times, not a result, sometimes it is absent, and, at other times, it precedes the local trouble.

Death frequently takes place, when the constitutional trouble is slight, and occasionally when it is absent. Even granting, that the word diphtheritis did not suggest an error, there is no more reason for the etymologist to use this word, in the place of diphtheria, than there is for his using the term pneumonitis, instead of pneumonia; When, however, the term diphtheritis implies not only an error, but a pathological condition, not in any degree existing; and when the word diphtheria suggests a disease, whose chief characteristic is indicated in the etymology of the word selected, it seems strange indeed, that there should be the least difficulty or hesitation manifested, in making an appropriate and proper choice in the titles presented. Etymology, analogy and euphony are all consulted and respected, in the name now generally adopted, viz: diphtheria.

#### PATHOLOGY.

This is confessedly the most difficult and important branch of this subject; its etiology is not specifically a necessary and essential object for study, as even if neglected, it would but place the disease in the long catalogue of those whose causes are unknown. Its treatment, however, to be rational, and its investi-

gation to be successful, must be based upon a correct knowledge of pathology.

What is diphtheria? The diseases with which it may be confounded are chiefly pharyngitis, muguet, aphthous inflammation of the mouth, erysipelas, croup, and scarlet fever. We will examine and carefully contrast it with each of these diseases; but with croup and scarlet fever more particularly, as with these diphtheria is chiefly confounded.

*The difference between pharyngitis and diphtheria is clear and decided.* In the first, we seldom find a false membrane present; in the last, this is seldom (if ever) absent. In the first, if this membrane is present, it rarely extends; in the last, almost always present, it seldom fails to extend. In the first, the constitutional disturbance is usually severe; in the last, it is usually slight. In the first, the swelling of the lymphatic glands behind the jaw, is seldom present; in the last, this swelling is seldom absent. In the first, the fauces are generally of a scarlet colour; in the last, they are more nearly of a claret colour. In the first deglutition is invariably painful; in the last, it is exceptionally painful. The fever attending the first disease is marked, the pulse rising often to one hundred and twenty beats in the minute; in the last, it is slight, the pulse rarely exceeding ninety to one hundred beats per minute. Convalescence, from the first, is prompt and continuous; from the last, it is slow and frequently interrupted. In pharyngitis, we seldom have complications, and there are no sequelæ; in diphtheria, we have frequent complications, and we very often have sequelæ. The prognosis in the first is, as a rule, very favorable; in the last, it is very often unfavorable. The mortality of the first is slight; that of the last, often severe. The first is seldom, if ever, epidemic; the last is very often epidemic. The diagnosis of the first is simple; that of the last complicated.

*The differences between muguet and diphtheria are sufficiently numerous and marked, to render a mistake, in regard to them, almost impossible.* Without entering into the elaborate researches of Guersent, Plumbe, Gyot, Gurly, Oësterlein, Empis, Laycock, Harley, Rogers, Lebert and others, in regard to the special peculiarities of the exudations in muguet and diphtheria, it will be suf-



ficient to say, that the existence of the parasites, *oidium albicans*, *leptothrix buccalis* and the *hæmatophyta* of microscopists do not serve the purpose of a theoretical or practical distinction between the respective diseases. Muguet is chiefly and perhaps solely, a disease of infants at the breast; whilst diphtheria is not peculiar to any age. The first usually commences in the mouth; the last in the fauces. The exudation of the first is curdy and flocculent; that of the last membranous, uniform and coriaceous. The constitutional symptoms of the first are slight and often absent; those of the last are often grave and usually present. Muguet is not epidemic; diphtheria is very frequently so. In the first, the swelling of the lymphatic glands behind the jaw is seldom seen; in the last, it is seldom absent. Deglutition is not impaired, in the first; in the last, it is troublesome and frequently painful. In the first, there are no complications, no sequelæ, and there is prompt and continuous convalescence; in the last, there are complications, troublesome sequelæ, and the convalescence is slow, protracted and frequently interrupted. The prognosis is always good in the first; in the last, it is often grave.

*Aphthous inflammation of the mouth is often mistaken for diphtheria.* The distinction between them is marked and decided. The mistake, however, has been made, we have observed, by Bretonneau, Valleix, Roche, Barthez, and others. The microscopic distinctions will not be given, for they are not uniformly recognized, even by good authorities on this subject. They are not easily made by the majority of the Profession. [Laycock observes, that in diphtheria the microscope reveals the spores and mycelium of the fungus; in aphthous inflammation of the mouth, there is nothing of peculiar or special importance revealed.] The exudation in diphtheria is not follicular, vesicular, nor ulcerative; in aphthous inflammation of the mouth it is follicular, vesicular, and often ulcerative. In the first, (diphtheria,) there are swellings of the lymphatic glands, obstructed deglutition, fever, sequelæ, complications, notorious mortality, epidemic prevalence, interrupted convalescence, and frequently a grave prognosis. In the last, (aphthous inflammation of the mouth,) there are no swellings of the glands, no impairment of deglutition, no fever, no sequelæ, no complications,

no mortality, no epidemic prevalence, no interruptions in convalescence, and no doubt as to recovery.

*Erysipelas is considered, by very many, as closely allied to diphtheria.* It is stated, by one of our best and most careful authorities, "that, in the whole range of nosology, the nearest analogy to diphtheria appears to be presented by erysipelas." We propose, with all deference to those more capable of judging, to examine this relation, and to show what we believe are the great and irreconcilable differences.

We will speak of erysipelas, as pathologically restricted to the idiopathic form, and that in which the head and face are the chief seats or manifestations of the disease.

In erysipelas, the throat does not always suffer; if it does, we have a simple sore throat (a pharyngitis), with no membranous exudation, and with a diffused redness of the fauces. In diphtheria, the throat is almost invariably affected; we have a membranous exudation (of progressive character) formed, with a claret and not a scarlet coloured appearance of the fauces. In erysipelas, we have occasionally an ulceration of the throat; in diphtheria, as a rule, the inflammation is not vesicular, follicular nor ulcerative. In erysipelas, the invariable rule is a cutaneous eruption; in diphtheria, cutaneous eruption is the rare exception to the rule.—Erysipelas, as a rule, is sporadic and rarely epidemic; its contagiousness, unless by writers in England and America, generally denied. Diphtheria is often epidemic and its contagiousness very often admitted. In erysipelas, the constitutional disturbance is seldom slight; in diphtheria, it is seldom severe. In erysipelas, the eruption (always attendant) is marked by heat, swelling, tingling, stiffness, and continuous red colour; it has a distinct elevation of margin; advances progressively; is sometimes attended with bullæ or blisters; is frequently deep-seated, sometimes resulting in sloughing; ends generally in desquamation. In diphtheria, the eruption (seldom attendant) is not marked by swelling or stiffness; is not continuous, but appears in patches; has no elevated margin; does not (on the skin) extend creepingly, or progressively; is never deep-seated; never attended with bullæ; never causes sloughing; ends, very rarely, in desquamation. Erysipelas is classed with the



exanthematous diseases; diphtheria is generally regarded as a specific disease.

In erysipelas, there is often cerebral disturbance and, in bad cases, there is delirium, stupor and coma. In diphtheria there is never any mental disturbance, and, in bad cases, the patient dies with intelligence and consciousness unimpaired. Diphtheria attacks children chiefly; erysipelas, chiefly adults. Metastasis is frequently seen in erysipelas; it is never seen in diphtheria. Cerebral effusion is not uncommonly the cause of death in erysipelas; it is never the cause of death in diphtheria. Œdema of the glottis is one of the terminations of erysipelas; exudation there being never seen. In diphtheria death, from œdema of the glottis, never occurs. Typhoid symptoms, (cerebral disturbance, frequent pulse, subsultus tendinum, floccitatio, dry and brown tongue, diarrhœa,) frequently occur in erysipelas; they never occur in diphtheria.

With traumatic erysipelas, erysipelas of the body, and infantile erysipelas, we do not think it necessary to contrast or compare diphtheria. If they be compared, however, the membranous exudation of the throat; the usual absence of cutaneous eruption; epidemic prevalence; contagiousness; slight constitutional disturbance at first; absence of swelling, stiffness and elevation in regard to the eruption; swelling of the lymphatic glands; superficial nature and character of the eruption, with invariable absence of sphacelation and sloughing; slight desquamation; freedom from metastasis, typhoid symptoms, mental disturbance, stupor and coma; peculiar complications, sequelæ (chiefly different forms of paralysis) and cerebral effusion always absent; laryngeal symptoms, etc., which are all characteristically peculiar to diphtheria, will serve to distinguish it readily from each and all of these forms of erysipelas. We do not see how, with these distinctions, they can ever be confounded.

*Croup differs radically from diphtheria.* We shall, by the term croup, always mean true croup; the disease as it has been described by Cullen, Cheyne, Home (who originated the name), Hosack, Stokes and others; cynanche trachealis, tracheitis. We shall not have any reference to false croup, (the spasmodic laryngitis of Barthez, Rilliet and others,) or to spasmodic croup, but to the

disease, as investigated by the concours of Napoleon I, in 1807—the disease, with which diphtheria is most frequently confounded.

Diphtheria is a disease of the blood (a toxæmia) with local manifestations; croup is a sthenic phlegmasia. (Dr. Hauner, of the Children's Hospital, at Munich, declares, that “it can not be shown, that croup is connected with any peculiarity of the blood crisis.”) In diphtheria, the blood is always primarily affected, whilst we may or may not have any local manifestation; in croup the blood, if at all, is affected secondarily, whilst we always have local symptoms. Diphtheria commences in the blood, and first exhibits itself, locally, in the fauces; croup does not commence with blood changes, and exhibits itself in the trachea. Diphtheria begins above the rima glottidis, and never extends below, unless it subsequently becomes complicated with croup; croup begins below the rima glottidis, and never extends above it. Diphtheria is a constitutional disease and asthenic; croup is a local disease and sthenic. In diphtheria, the constitutional symptoms are primary, and the local symptoms secondary. In croup the local symptoms are primary and the constitutional symptoms secondary. The first is often contagious; the last is not contagious. The first (though attacking children most frequently,) is not peculiar to any age; the last is peculiar to childhood; seldom attacking any one over the period of puberty. (In 91 cases of croup, Jurin reports only one over ten years of age.) In diphtheria, at first, the respiration is not affected, and not at all, unless the disease extends downwards. In croup, the altered and impaired respiration is immediately a prominent symptom; when the disease continues, it is the chief symptom. In diphtheria, there is no cough, unless croup supervenes; in croup, there is always a cough. (Croup is just as much a complication of diphtheria, as is bronchitis or pneumonia, and there is as much reason for calling diphtheria bronchitis or pneumonia, as there is for considering it croup; they are all complications of diphtheria; symptoms which are merely incidental.) The membranous exudation of diphtheria always commences above the rima glottidis; the exudation of croup always below. There is, occasionally, a cutaneous eruption in diphtheria; in croup, there is none. The first is often epidemic; the last always sporadic. There is, as a rule,



swelling of the lymphatic glands in diphtheria; in croup, as a rule, it never occurs. Diphtheria generally lasts two or three weeks; the mildest case, several days. Croup usually terminates in one, two or three days; the mildest cases, in a few hours. (Craigié affirms, that it is never protracted beyond the eleventh day.) In diphtheria the exudation is fibrinous; in croup it is albuminous. Dyspnœa (if it exists) in diphtheria is uniform; in croup it is spasmodic. In the first, it is not produced, or increased by deglutition; in the last, it generally is thus produced and thus increased. Diphtheria invades at all hours; croup invades (if it does not always commence) at night. Dampness and cold cannot produce diphtheria; they are the chief causes of croup. In true croup, anti-phlogistic treatment is demanded, and produces decided benefit. In diphtheria such treatment is forbidden, and produces decided danger, if not death. The testimony of Cullen, Craigié, Cheyne, Home, Hosack, Gregory, Stokes, Alison, Watson, Farre and others, on croup, and that of Brettonneau, Trousseau, Barthez, Rilliet, Sanderson, Greenhow, Hart and others on diphtheria, will verify this declaration. The statistics of tracheotomy prove, that there is a resiliency, a constitutional elasticity in croup; that there is none in diphtheria. [Note: Trousseau, whose experience on this subject, is the largest on record, states, that the indications for tracheotomy should be promptly and early met, unless the patient be suffering from diphtheria. This is now his rule.] In diphtheria we have, as a result, paralysis and other consequences manifested. In croup, we have nothing of this kind. In diphtheria fœtor of the breath is constant and invariable; in croup, it is slight, and seldom occurs. In croup, there is no "dissolution" of the blood; in diphtheria, it is a chief pathological characteristic. In diphtheria the constitutional symptoms precede the local; in croup, the local precede the constitutional. In diphtheria, the membranous exudation of the fauces is almost always present, and can always be seen. In croup, this exudation does not even frequently take place, and when existing, can seldom be seen without the laryngoscope; in diphtheria, it is present as the rule; in croup it exists as the exception. In diphtheria, the exudation is thick and coriaceous; in croup, it is neither thick nor coriaceous. The membrane of croup

is renewed, as an exception; that of diphtheria, as the rule. In croup death, usually occurs from apnoea; in diphtheria, uncomplicated, from asthenia. In croup, the sound of the cough is sonorous and metallic; in diphtheria, when cough exists, its sound is soft and moist. In croup, the convalescence is generally uniform and easy; in diphtheria it is slow, interrupted, unreliable and complicated with the frequent sequelæ of the disease. In the worst forms of croup, where death does not take place, the patient is usually in perfect health in a few weeks. In bad cases of diphtheria, convalescence progresses slowly, through a period of many months; many cases extending thus through six, eight and twelve months; the patient even, at the end of this time, dying from asthenia. These recognised differences will, with care, always prevent a confounding of these two diseases. Yet, croup and diphtheria have been considered synonymous terms, by many of the best writers on these subjects. Brettonneau, Barthez, Jodin, Blache, Duché, and almost all of the French writers, regard these diseases as identical. The English and American authors usually regard the diseases as specific and entirely different. Dr. Cotting, of Roxbury, Mass., considers the diseases as being identical, and writes of them as "the membranous disease." Drs. Cheyne, Tweedie, Watson, Geddings, and a host of writers, have pointed out occasional differences between the two diseases. Accumulated testimony and facts have served to make this distinction broad, clear and abruptly defined. Diphtheria and croup being considered identical, by the writers in France, and giving rise to so much confusion and contradiction, is not more to be regretted, than the trouble that has arisen, from the views advocated by so many of our English and American authors, that diphtheria and scarlet fever are one and the same disease.

We propose to show the great difference that exists between these two diseases, and as we have done in regard to the other subjects, shall avoid the literature, based on the identity of these two diseases. It may be interesting, to quote the endless views offered, in this connection, by the hosts of English, French, American, and other authors, but such a style is not adapted to a paper of this kind.—Folios could easily be thus filled, and, when read, could only be regarded as so many literary curiosities. There is nothing practical



in such a method of treating a subject. We prefer to avoid all theories and views, whether presented by societies, academies, or individuals, and to present facts, based on the oral and written testimony of the Profession. When these are given and read, each reader will be in a proper position to form his own conclusion. If the facts are sufficient, they must bring conviction; if not, theories and views can never be accepted, as a useful or efficient substitute.

We have endeavoured to accumulate all the facts in this connection, and, in their presentation, to establish a satisfactory and recognized difference, between these two diseases. We shall consider scarlet fever and scarlatina, as, for the most part, identical.

*An attack of scarlet fever, as a rule, produces a decided immunity from future attacks of the same disease.* An attack of diphtheria produces no such immunity. The first attack only of scarlet fever is usually severe; the second, when rarely occurring, is mild; a third is seldom seen. Diphtheria occurs repeatedly; there are many instances of a second and a third attack, and it has prevailed four times, with one individual, in one year. The succeeding attacks of diphtheria are usually more severe and malignant than the first. In scarlet fever, the heat is intense, at the outset, and subsides slowly; in diphtheria, it is very moderate and subsides quickly. In scarlet fever, the eruption is present, as the rule; in diphtheria, as a rule, it is absent. The rash, (when present), in diphtheria is of a uniform erythematous redness—without a punctuated appearance—appearing suddenly in patches. The rash, (almost invariably present), in scarlet fever is without a uniform erythematous redness—with a punctuated appearance—not appearing in patches. The exudation in diphtheria occurs in various localities, on almost all mucous surfaces not exposed to light, and is almost invariably present. The exudation in scarlet fever appears only in one locality; it never appears on other surfaces, while in diphtheria, it appears on the conjunctiva, in the meatus auditorius, in the vagina, etc. In scarlet fever, the exudation is not generally present, and if present, does not extend or show a disposition to extend. In diphtheria the exudation is generally present and does extend. In diphtheria, the tongue is coated white or yellow, and when this disappears, the tongue is not red or glossy, and does not show elevated

papillæ. In scarlet fever, the coat on the tongue soon disappears, and then the tongue appears of a deep, glossy red; the papillæ are much elevated, and we have the "strawberry tongue," which is so characteristic of the disease. The convalescence from scarlet fever is generally rapid, when the throat has not suffered severely from ulceration, and the subsequent trouble is chiefly local. In diphtheria, convalescence is slow, unreliable, complicated and interrupted; if the throat has suffered severely, the after trouble is not local, but constitutional. The sequel of diphtheria is, as a rule, paralysis, and very rarely anasarca. The sequel of scarlet fever is anasarca, as a rule, and not paralysis. Hæmorrhage, in aggravated cases of diphtheria, is not uncommon; in the worst forms of scarlet fever, it is very rare. In diphtheria, death, in three-fourths of the cases, is produced by membranous laryngitis. In scarlet fever, death, from such a cause, is rare. Ulceration and sloughing of the mucous tissues is exceedingly uncommon in diphtheria; it is not uncommon in scarlet fever.

Scarlet fever attacks many who have had diphtheria; it is a predisposing cause of diphtheria. Scarlet fever tends to create an exemption from succeeding its attack. Diphtheria tends to create a susceptibility to its succeeding attack. We find that those who have had scarlet fever, have afterwards diphtheria, and those who have had diphtheria, have afterwards scarlet fever. If these are identical as is claimed, those having had scarlet fever (which, as a rule, secures exemption) should not have diphtheria, unless as an exception to the rule. If they are the same disease, those who have had diphtheria should not have scarlet fever. Shall the many cases (of both examples) that occur be claimed, as exceptions? It is frequently urged, that diphtheria is scarlet fever without the rash; and that in malignant cases of scarlet fever, the rash is often wanting. This last statement may be, at times, true, that, in malignant cases of scarlet fever, the rash is sometimes wanting; but scarlet fever, without the rash, is an exception to the rule, and in an epidemic of diphtheria, surely no one can be so irrational, as to claim, that we are having only exceptions to the scarlet fever rule, the scarlet fever without the rash; that the rule (the fever with the rash) has strangely become the exception, and the exception (the fever without the



rash) the rule! Yet, if this exceedingly irrational claim is not made, it must be admitted, that diphtheria and scarlet fever are separate and distinct diseases. As Dr. Thayer justly says of an epidemic of diphtheria, in Albany, N. Y., "of 2,000 cases of diphtheria, not one was known to have a rash; such an epidemic of scarlet fever would be unprecedented." Were the 2,000 cases of diphtheria, but scarlet fever without the rash? Were they all exceptions to the rule in scarlet fever, or were they not examples of a separate and distinct disease?

Scarlet fever tends to produce a susceptibility to diphtheria, and an exemption from itself. "Willan met with only a single instance of a second attack of scarlet fever in 2,000 cases"—(Batesman's Synopsis.) Bouchut says he has never met with a single well-authenticated case. In forty-eight cases of diphtheria, "Dr. Ballard reports, that twelve had had scarlatina previously." Diphtheria does not tend to produce a susceptibility to scarlet fever, and does not produce an exemption from itself. Reverse this and we have the truth in regard to scarlet fever. Scarlet fever does tend to produce a susceptibility to diphtheria, and does produce an exemption from itself. Can exactly opposite laws be cited to prove the pathology of the same disease. It is more than probable, when a rash is manifested in diphtheria, that the disease is complicated with scarlet fever; and that in cases of genuine diphtheria, there is no rash whatever. In scarlet fever, albuminuria is a secondary symptom; it occurs only when the characteristic stage of the disease is past. In diphtheria, albuminuria is a primary symptom, and occurs chiefly in the early stages of the disease. The larynx is commonly invaded in diphtheria; it very rarely ever suffers in scarlet fever. The sequelæ of the two diseases, are very different. Anasarca is common after scarlet fever; it is very uncommon, after diphtheria. Paralysis is not uncommon after diphtheria, it is exceedingly uncommon after scarlet fever. Arthritis is not uncommon, after scarlet fever; it is almost unknown after diphtheria. Pericarditis is never seen after diphtheria; it is frequently seen after scarlet fever. Chorea is a sequel of scarlet fever; it is not known after diphtheria. In aggravated cases of scarlet fever, we have great cerebral disturbance, delirium, stupor and speedy death. In ag-

gravated cases of diphtheria, we have nothing of this kind; the intellect is invariably undisturbed to the last. Scarlet fever is a protection from scarlet fever. Diphtheria is not a protection from diphtheria. Can such totally opposite laws and conditions all be true, in regard to the same disease?

We submit these facts, as being sufficient, we think, to prove that diphtheria and scarlet fever are distinct and separate diseases.

It will be observed, that we have not fortified the different positions assumed, by appropriate cases, and that we have not thus illustrated, from nature, the truth of the views advocated. In a paper of such a character as the present, we have not space to devote to such a purpose, and indeed, when the reader is assured, that such declarations are solely based on cases that have been seen by us, published by others, or made known to us, he does not require the record; he desires only its result and the truth, as established by it. That diphtheria constantly prevails, after scarlet fever, is well known; every Medical Journal will furnish cases in support of the assertion. Drs. West, Sanderson, Greenhow, Hart; Drs. Alonzo Clark, Jacobi, Orton, Hatch and many others, have either seen or published such cases; and indeed the examples of this kind are so numerous, as to almost make the record of every epidemic of diphtheria a record of this truth.

That scarlet fever prevails after diphtheria has not been so publicly and conspicuously known. Dr. Greenhow, of London, England, has published eleven cases of this kind. Dr. J. G. Orton, of Binghamton, N. Y., writes, that "many cases have occurred, with me, which established, beyond a doubt, that an attack of scarlet fever, accompanied with all of its characteristic symptoms, does not in the least protect an individual from an attack of diphtheria, and vice versa." (Autograph letter, Jan. 1861.) Dr. Hatch, of San Francisco, in a letter of December 1860, writes that he has had such cases. Dr. J. H. Barbour, of Falmouth, Ky., testifies as follows: "In my experience, patients that have had the scarlet fever, enjoy no immunity from diphtherite; nor do the diphtherite patients enjoy any immunity from scarlet fever." Dr. Edward Ballard, of Islington, England, reports a very interesting case of this kind. Dr. West, of England, furnishes a case also. We could furnish



other examples, but the testimony given is already more than sufficient. The writings of almost every author, show that the blending of these two diseases in the same locality, and in the same person, is very common. This blending of diseases is so common, that, according to Willan, Sydenham was the first to mention the existence of scarlet fever, as a separate and distinct disease. (Willis first defined pertussis, etc.) Diphtheria and scarlet fever prevail simultaneously, in the same sections; they prevail simultaneously, in the same individual; they precede and succeed each other, in persons and places. Dr. Greenhow gives a list of over twenty places, in which these diseases prevailed simultaneously. Again, he gives instances, where one disease precedes or succeeds the other, respectively; where they would, at times, be blended. Dr. A. Clark, of New York, gives a case of a child dying, under his notice, who had, in succession, suffered from scarlet fever, measles and diphtheria. Dr. Jacobi states, that, in thirty-two days, he saw a child suffer from "scarlatina, urticaria, measles and varioloid." The blending of exanthematous diseases, however, is too well known to call attention to it in this connection. Though diphtheria cannot, of course, thus be classed, its being blended with these diseases is a truth, supported by the testimony of the most accurate and competent observers in the Profession, yet, with care, it can as easily be separated, pathologically, from these diseases, as these diseases always are from each other. Diphtheria can as well be diagnosed from scarlet fever, as from erysipelas, croup, or the other diseases mentioned. That it is a distinct, separate and specific disease, the facts presented, we hope, sufficiently prove. It always requires much time to procure a satisfactory collection of efficient testimony and available facts, for the defence of any pathological statement; and such a statement should only be adopted when thus fortified. The most contradictory and confusing opinions relative to a disease, are always offered, until the accumulated records, experiences and statistics, in regard to it, furnish sufficient proof to establish, beyond a doubt, its true pathology. Only in such a way, can this ever be done, and if the records and testimony, now presented, are not sufficient, for this purpose, it is only in this way, that some future writer may hope to succeed.

Among the views of the pathology of diphtheria, may be mentioned those of M. M. Bouchut and Jodin. It is the opinion of M. Bouchut, that the disease is limited to the tonsils, and that, if these be ablated, the disease is removed. M. Jodin regards diphtheria and croup as the same disease, caused by the lodging of a peculiar parasite upon the fauces; that any treatment which destroys this, destroys the disease. M. Sée, in his comments upon Bouchut, states that as the disease is frequently manifested in the nose, he would ask whether Bouchut would advise the removal of this organ. But we will not attempt to give the heterogeneous opinions that have been presented. Such a catalogue would be endless, and even if a curiosity, could be neither important nor useful.

In concluding this portion of our essay, (devoted to the pathology of its subject,) we assert, that diphtheria is a separate, distinct and specific disease.

For the sake of convenience, and to present a clear summary of its pathology, we will (by tables) antagonise with diphtheria, the diseases with which it is so frequently confounded. These tables will show, at a glance, the difference between the pathology of diphtheria and the pathology of each one of these diseases—

#### *Diphtheria.*

Membranous exudation seldom absent.  
 Membranous exudation generally extends.  
 Constitutional disturbance slight.  
 Swelling of the lymphatic glands behind the jaw usually present.  
 Fauces generally of a claret colour.  
 Deglutition exceptionally painful.  
 Fever slight and soon terminating.  
 Pulse seldom over 100.  
 Convalescence slow and frequently interrupted.  
 Complications frequent and sequelæ severe.

#### *Pharyngitis.*

Membranous exudation seldom present.  
 Membranous exudation does not extend.  
 Constitutional disturbance severe.  
 Swelling of the lymphatic glands behind the jaw usually absent.  
 Fauces generally of a scarlet colour.  
 Deglutition invariably painful.  
 Fever rather severe and not soon terminating.  
 Pulse seldom under 120.  
 Convalescence prompt and not interrupted.  
 Complications infrequent and sequelæ absent.



*Diphtheria.*

Prognosis frequently unfavourable.

Mortality often severe.

Laryngitis frequent.

Most often epidemic.

Diagnosis complex.

Throat lesions not in proportion to severity of the disease.

*Diphtheria.*

A disease of adults and children.

Commences in the fauces.

Exudation membranous and coriaceous.

Constitutional symptoms sometimes grave and never absent.

Generally epidemic.

Lymphatic glands behind the jaw very generally swollen.

Deglutition not much impaired and not painful.

Frequent complications and grave sequelæ.

Convalescence protracted and interrupted.

Prognosis often grave.

Mortality frequently severe.

Diagnosis complex.

*Diphtheria.*

Exudation not follicular, vesicular, nor ulcerative; but pellicular.

Lymphatic glands behind the jaw swollen.

Deglutition obstructed, but not painful.

Accompanied with fever.

Complications frequent and sequelæ grave.

Prevails epidemically chiefly.

*Pharyngitis.*

Prognosis invariably favourable.

Mortality never severe.

Laryngitis infrequent.

Most often sporadic.

Diagnosis simple.

Throat lesions always in proportion to the severity of the disease.

*Muguet.*

A disease chiefly of infants.

Commences in the mouth.

Exudation non-membranous and flocculent.

Constitutional symptoms never grave and frequently absent.

Always sporadic.

Lymphatic glands behind the jaw never swollen.

Deglutition always painful and generally impaired.

No complications and no sequelæ.

Convalescence neither protracted nor interrupted.

Prognosis never grave.

Mortality never severe.

Diagnosis easy.

*Aphthous Inflammation of the Mouth.*

Exudation follicular, vesicular, and ulcerative: not pellicular.

Lymphatic glands behind the jaw not swollen.

Deglutition not obstructed, but painful.

Not accompanied with fever.

No complications and no sequelæ.

Prevails sporadically only.

*Diphtheria.*

Convalescence slow and interrupted.  
 Mortality frequently severe.  
 Laryngitis frequent.  
 Prognosis often grave.  
 Diagnosis complex.

*Diphtheria.*

The fauces most generally suffer; there is, then, a membranous exudation of a progressive character exhibited.  
 The fauces are most generally of claret colour.  
 Exudation is pellicular; ulceration rare.  
 Cutaneous eruption the exception; rare.  
 Chiefly epidemic and seldom sporadic.  
 Contagiousness seldom denied, out of America.  
 Constitutional disturbance seldom severe.  
 Eruption, when present, not marked by stiffness or swelling; is not continuous but appears in patches; has not an elevated margin; does not (when cutaneous) extend creepingly; is never deep-seated; not attended with bullæ; does not cause sloughing; very little desquamation.  
 No cerebral disturbance, and, in bad cases, no delirium, stupor and coma.  
 Attacks children chiefly.  
 Metastasis unknown.  
 Cerebral effusion never the cause of death.

*Aphthous Inflammation of the Mouth.*

Convalescence prompt and not interrupted.  
 Mortality always absent.  
 Laryngitis infrequent.  
 Prognosis never grave.  
 Diagnosis simple.

*Erysipelas.*

The fauces most generally escape; if not, there is a simple pharyngitis, with no exudation, of a progressive character.  
 The fauces are most generally of a scarlet colour.  
 Inflammation is follicular; ulceration being then common.  
 Cutaneous eruption the rule; invariable.  
 Chiefly sporadic and seldom epidemic.  
 Contagiousness admitted only in England and America.  
 Constitutional disturbance seldom slight.  
 Eruption always present, marked by stiffness and swelling; is continuous and not in patches; has quite an elevated margin; almost always extends creepingly; is often deep-seated; often attended with bullæ; often causes sloughing; very general desquamation.  
 Frequent cerebral disturbance, and, in bad cases, delirium, stupor and coma.  
 Attacks adults chiefly.  
 Metastasis frequent.  
 Cerebral effusion often the cause of death.



*Diphtheria.*

- Laryngitis common.  
 Œdema of the glottis not a cause of death.  
 Typhoid symptoms (cerebral trouble, frequent pulse, subsultus tendinum, dry and brown tongue, diarrhœa, delirium, stupor and coma) never occur.  
 Mortality chiefly from membranous laryngitis.

*Diphtheria.*

- Disease of the blood; a toxæmia; a constitutional disease, with local manifestations.  
 Blood primarily affected; sometimes there are no local manifestations.  
 First exhibits itself in the fauces, locally.  
 Commences always above the rima glottidis.  
 Does not extend below the rima glottidis, unless complicated with croup.  
 Asthenic disease; constitutional symptoms primary; local symptoms secondary.  
 Depression often manifested without dyspnœa.  
 Contagious.  
 Not peculiar to any age.  
 Respiration not affected, unless the disease extends downwards; dyspnœa not a prominent symptom.  
 No cough, unless croup supervenes.  
 The membranous exudation of fibrin always commences above the rima glottidis.

*Erysipelas.*

- Laryngitis very rare.  
 Œdema of the glottis one of the causes of death.  
 Typhoid symptoms (cerebral trouble, frequent pulse, subsultus tendinum, dry and brown tongue, diarrhœa, delirium, stupor and coma) frequently occur.  
 Mortality never from membranous laryngitis.

*Croup.*

- Not a disease of the blood; a local disease, with constitutional manifestations.  
 Blood, if at all, affected secondarily; local manifestations invariable.  
 Locally, first exhibits itself in the trachea.  
 Commences always below the rima glottidis.  
 Never extends above the rima glottidis.  
 Sthenic disease; local symptoms primary, and constitutional symptoms secondary.  
 Depression not often manifested before dyspnœa.  
 Not contagious.  
 Peculiar to infancy and childhood.  
 Impaired and difficult respiration always a prominent symptom; often the chief symptom.  
 Cough almost invariably present.  
 The membranous exudation of albumen always commences below the rima glottidis.

*Diphtheria.*

Exudation only extends below, as a complication.  
 Occasionally there is a cutaneous eruption.  
 Epidemic chiefly and seldom sporadic.  
 Swelling of the lymphatic glands behind the jaw frequently occurs.  
 Duration, one to three weeks, with sequelæ.  
 Exudation fibrinous.  
 Dyspnœa rare and, when present, uniform.  
 Dyspnœa not produced or increased by deglutition.  
 Invades at all hours.  
 Not caused by cold and dampness.  
 Prognosis generally good; mortality slight.  
 Antiphlogistic treatment injurious.  
 Tracheotomy contraïndicated and generally forbidden; no constitutional resiliency.  
 Sequelæ; paralysis, strabismus, amaurosis, etc.  
 Fœtor of the breath constant and great.  
 "Dissolution of the blood;" loss of its coâgulating power.  
 Constitutional symptoms precede the local.  
 Membranous exudation always present (as a rule) and always seen; present as the rule.  
 Exudation thick, buff coloured; coriaceous.  
 Membrane renewed as the rule.

*Croup.*

Exudation never extends above.  
 There is never a cutaneous eruption.  
 Sporadic and never epidemic.  
 Swelling of the lymphatic glands behind the jaw never occurs.  
 Duration never beyond the 11th day (Craigië); no sequelæ.  
 Exudation albuminous.  
 Dyspnœa common and invariably spasmodic.  
 Dyspnœa frequently caused and increased by deglutition.  
 Invades chiefly at night.  
 Generally caused by cold and dampness.  
 Prognosis grave; mortality severe.  
 Antiphlogistic treatment curative.  
 Tracheotomy indicated and advised; constitutional resiliency very decided.  
 No sequelæ.  
 Fœtor of the breath generally absent.  
 "Dissolution of the blood" never seen; increase of its coâgulating power.  
 Local symptoms precede the constitutional.  
 Membranous exudation seldom present and never seen; present as the exception.  
 Exudation thin; not buff coloured; not coriaceous.  
 Membrane renewed as the exception.



*Diphtheria.*

Death, when disease is uncomplicated, from asthenia.

Sound of the cough sonorous and moist.

Convalescence slow, unreliable, and complicated with the sequelæ of the disease; interrupted.

*Diphtheria.*

One attack produces no immunity whatever from succeeding attacks.

One attack not influencing the severity of the next; if at all, generally increases the severity of the second, third, or fourth attack.

Heat, at the outset, very moderate and subsides quickly.

Cutaneous eruption present, as the exception; of a uniform erythematous redness; without a punctuated appearance; appearing in patches.

Exudation appears in various localities; present as the rule.

Tongue coated white or yellow; when this disappears, tongue is not red and glossy; papillæ not elevated.

Convalescence slow, unreliable, complicated and interrupted; bears no proportion, in length, to severity of the throat lesions; trouble chiefly constitutional.

Sequels—paralysis and very seldom anasarca.

Arthritis unknown; pericarditis never occurring; chorea never seen.

*Croup.*

Death from apnoea.

Sound of the cough sonorous and metallic.

Convalescence easy and uniform; no sequelæ; uninterrupted.

*Scarlet Fever.*

One attack produces almost a complete immunity from succeeding attacks.

One attack always influencing the severity of the next; second attack seldom seen and mild; third hardly known.

Heat, at the outset, very intense and subsides slowly.

Cutaneous eruption present, as the rule; not of a uniform erythematous redness; with a punctuated appearance; not appearing in patches.

Exudation appears only in one locality; present as the exception.

Coat very light and soon disappears; tongue is then red and glossy; papillæ elevated; "strawberry tongue."

Convalescence (when the throat has not ulcerated) usually continuous and uniform; bears a marked proportion, in length, to severity of the throat lesions; trouble chiefly local.

Sequels—anasarca and very seldom paralysis.

Arthritis often seen; pericarditis often occurring; chorea often seen.

*Diphtheria.*

Laryngitis frequent; "causes three-fourths of the deaths."  
 Ulceration and sloughing of the mucous surfaces not seen.  
 Creates a susceptibility to a second attack.  
 Albuminuria a primary symptom; occurs in the early stages.

In aggravated cases, no cerebral disturbance; no delirium, no stupor, no coma; intelligence and consciousness unimpaired.

Not peculiar to any age.  
 Desquamation very slight always.

Deafness not caused by it.  
 Strumous ulcers, boils, swelling of the cervical glands, inflammation of the eyes, diseases of the scalp, etc., never seen as the sequels of an attack.

*Scarlet Fever.*

Laryngitis not seen; does not cause any deaths.  
 Ulceration and sloughing of the mucous surfaces often seen.  
 Creates an exemption, usually, from a second attack.  
 Albuminuria a secondary symptom; occurs in the latter stages.

In aggravated cases, much cerebral disturbance; delirium, stupor and coma not uncommon; intelligence and consciousness often impaired.

Chiefly peculiar to children.  
 Desquamation extensive and general.

Deafness a frequent sequel.  
 Strumous ulcers, boils, swelling of the cervical glands, inflammation of the eyes; diseases of the scalp, etc., often seen as the sequels of an attack.

With these important facts placed prominently in antithesis, it is impossible to confound diphtheria with the diseases mentioned.

*Anatomical and physiological relations.* The membranous exudation of diphtheria varies much in colour and thickness. It is white, at times, and again opaque; ash-coloured, grey, buff, brown and sometimes black. It presents a great variety of texture; soft occasionally, and sometimes, like isinglass softened in water: it is generally, however, membranous, tough, dense and slightly elastic. In rare instances, it is dry and easily broken. Sometimes, it has the appearance of wash letter, or buckskin, saturated with water. Dr. Francis Minot, in giving a history of the sickness and death of the late and lamented Dr. H. W. Adams, of Boston, says, in regard to a portion of the uvula that was amputated, "it resembled a piece of umbilical cord, more than anything else." The exudation varies, from the fraction of a line, to two lines in thickness; it has been seen, of three lines in thickness. Dr. Sanderson, who has paid



great attention to this branch of the subject, states that the exudation of diphtheria is deposited in layers and that these layers can be separated. In lifting this membrane, from the mucous surfaces, it frequently appears attached by small filaments, which extend into the mucous follicles. Most generally, no ulceration takes place and when the membrane is raised up, though the mucous surface is tumefied, injected and inflamed, it will be found, as a rule, that the texture of the mucous tissue is uninjured; occasionally and in rare instances, ulceration has taken place, and when this exudation-pellicle is removed, an unbroken, but red and shining basement membrane is revealed. It is stated, that when this pellicle is not removed artificially, that ulceration more frequently occurs. But in our experience the opposite is far more often true—tearing away this exudation, forcibly, is well calculated to hasten, or cause ulceration. Sometimes, instead of a red and shining basement membrane being exposed, on raising the diphtheritic pellicle, the mucous surface appears of a dull, red colour, dotted here and there with black and ecchymosed spots. X

These membranes appear to be formed, by a coagulation of the plastic portion of the blood. Dr. Alonzo Clark considers its texture to be “a fibrillation of fibrine;” with no cells, but containing “a variable quantity of granules.” Dr. Sanderson has mentioned cases, where the exudation was non-fibrinous; “a granular and amorphous deposit;” these he considered mild cases. I

In the very mildest cases, we have a depraved and altered mucous secretion; this occurs, in the initial stage of a large proportion of the cases of diphtheria. Succeeding this, we have a coagulable exudation which never manifests any tendency to organization. Sanderson states, that the fact of non-development, in this exudation, is characteristic of diphtheria. It would seem from “the state of dissolution of the blood” in diphtheria, that the fibrin of the blood had been destroyed, and that the exudation, in this disease, could not (reasoning a posteriori) be fibrinous. Such a view has often occurred to us and we have bestowed much care in the investigation of this anomaly—this chemico-physiological paradox. There can however, we think, be given a rational explanation of it. What is the cause of the fluidity of the blood whilst in circulation, or rather

why, it does not coöguilate, is not yet clearly explained. Dr. Richardson's ammonia theory has been, we think, by Dr. Dalton and others, proved insufficient to account for it. This is not the place to refer to such a subject. We know, however, that to fibrine is the phenomenon of coöguilation invariably ascribed, and when we find that in diphtheria the blood seems to lose this property, it appears strange, at least, that the exudation, poured out, should consist of fibrin. Yet such is the case; the blood is usually "in a state of dissolution" and the exudation is nevertheless fibrinous. Careful observation will explain this apparent contradiction, and convince us of the truth of a most happy aphorism—"il est toujours téméraire d'attaquer des expériences, par des raisonnemens." We know, that there are many methods (chemical and others) for keeping the blood liquid, when out of the body, and yet, when this is done, the fibrin nevertheless exists in it, unimpaired. We know, that there are many substances, in chemistry, which exist frequently in an allotropic state; where their properties having been changed, their constitution yet remains unaltered. Lehman, Liebig, Faraday and other authorities give repeated instances of this. It is quite rational to suppose, that certain changes may take place in the constituents of the blood and that an abnormal fluidity might be the result of this,\* whilst a portion of exuded plasma, removed from the operation of such causes, would manifest all the properties, naturally belonging to it.†

It is also very rational to conceive, that the blood, in diphtheria, may exhibit this condition of "dissolution" chiefly, if not solely, because of a loss of its proper proportion of fibrin—a proportion sufficient to produce coöguilation. It is evident, that if blood be deprived by morbid, chemical, or physical causes of a certain amount of fibrin, it must (although it may yet contain fibrin) have lost its property of coöguilation. So in diphtheria, the blood may have had a sufficient quantity of its fibrin destroyed, or changed to lose its property of coöguilation, and yet

Dr. Sanderson, of London, considers that the diphtheritic membrane does not develop, does not organise, "on account of a morbid modification of the fibrin;" this may be the chief reason for absence of coagulation in the blood of diphtheria.

† This is the explanation, sent in an autograph letter, by Dr. Henry Hartshorne, of Philadelphia, Pa.



contain far more than enough of fibrin, to compose and constitute the membranous exudation of this disease. Whether this explanation, that we specially offer, be sufficient or not, to explain the conditions stated, we know that this exudation is chiefly, and almost invariably composed of fibrin.

This exudation always exhibits its characteristic peculiarity of non-organization and non-development. The coagulation is not due to the action of vital force, or local causes, for M. Empis states, that "at the end of a few hours after tracheotomy, whatever care is taken to clear the canula, the instrument is seen to be lined, with a layer of whitish concretions; the thickness of which continually increases. These concretions are evidently, only the result of the coagulation of the liquids, with which the sides of the canula were in constant contact."

When this exudation first appears, sometimes it consists only of altered and depraved mucus; if the case does not then improve, the exudation becomes muco-serous; then sero-fibrinous, and after this entirely fibrinous. The coagulation of this fibrin, as it is exuded, builds up the diphtheritic membrane; if it is daily removed, the membrane is thin and easily broken; if not removed, it becomes thick, dense and coriaceous. This will, in a great measure, explain the discrepancies seeming to exist in the accounts of the various autopsies. In some, the membrane is thin and soft; in others thick and tough, etc. Portions of it become detached, and it sometimes thus presents a rough and ragged surface. Not organized, it soon begins to decompose, and we have the constant fetor of breath, characterizing this disease. When the membrane is artificially removed, it reveals apparently a concave, or ulcerated surface. On close inspection, it will often be found that there is no ulceration; the tonsils in parting with the exuded fluid shrink in bulk; the fluid coagulates, and in this process, exerts a considerable pressure on the surface beneath; this pressure soon produces a whitish concavity, and this concavity has the appearance of an ulceration; on removing the exudation, the basement membrane is frequently exposed, and we have a shining and smooth-surfaced concavity.

Generally, the diphtheritic pellicle is seen only about the fauces; most frequently, on the tonsils only; but sometimes, it spreads over

Membrane

(the entire extent of the buccal surface. Dr. McDonald, of England reports cases, where "the appearance, on opening the mouth, is as though it were lined with plaster of Paris." The exudation extends downwards sometimes, as far as the minute ramifications of the bronchiæ. It is not uncommon for strips of exudation membrane to be cast off—sometimes small casts of the bronchiæ are coughed up. Dr. D. J. Cain, of Charleston, South Carolina, in an autograph letter, writes: "I took a small strip of membrane, from a lady who died recently, upwards of three inches long and one inch and a quarter wide. A larynx and trachea, completely closed and solidified, were exhibited a few days ago, at a meeting of our Medical Society." It will thus be seen, that the diphtheritic pellicle, varies much in extent; from a simple spot on the tonsils, to a condition involving the buccal cavity; and, where it extends downwards, invading the entire larynx, trachea, and the minutest ramifications of the bronchiæ. The rings of the trachea are seen distinctly impressed, on the membranous pieces discharged. At times, the membrane resembles a piece of old parchment, saturated with water. Its leading characteristic, is a disposition to extend, and also to constantly reform. We pass now to consider its microscopic appearances.

*Microscopic* (The microscopic characteristics of the exudation of diphtheria, have been closely studied and investigated. Brettonneau, Trouseau, Empis, in France; Wade, Wilks, Sanderson, Greenhow, in England; Rokitansky and Virchow, in Germany; Laycock, of Scotland; Clark, Hartshorne, Condie, Jacobi, in America; Rogers, Vogel, and many others, have laboured zealously in this field. The result is chiefly, that the membrane is "a fibrillation of fibrin," containing, in its net-work, granules, molecular particles, epithelial cells, exudation corpuscles and sometimes blood and pyoid cells. There are no formative cells. The fibrils of fibrin form a net-work, a matrix, in which the other component parts of the membrane rest. Mr. Simon, in a paper presented to the Pathological Society of London, states, in regard to the microscopic appearance of the diphtheritic membrane, that "when seen in thickness, it presented a pebbly character, like that afforded by an accumulation of nuclei; but the fallacious nature of this appearance was recognised, on



looking at the thin edge of a section, or by adding acetic acid, which rendered the whole transparent, at the same time expanding it, and bringing into view an exceedingly delicate and irregular network, of well and sharply defined, occasionally bulging, fibres, which appeared to be, so to speak, the skeleton of the original network. In some places, the false membrane consisted of an apparently uniform layer, composed of an extremely fine and indistinctly fibrillated tissue, studded with molecular matter, and presenting something of a ground glass character. Imperfect epithelium was entangled here and there, in the substance of the membrane, but was most abundant on the superficial surface. These microscopic appearances and characteristics, have since been fully examined, but, beyond what has been stated, there is nothing of special interest, or importance known. Dr. Harley has made many microscopic examinations of the diphtheritic membrane, and thinks there is nothing fibrinous in regard to it; in twelve cases he found nothing of the kind, "but simply mucus, epithelium and mucus cells." The explanation of this apparent contradiction is very simple; the specimens examined, by him, were either from mild cases, or obtained during the initial stage of other cases. Dr. Laycock, of Edinburgh, in a lecture published, May 29th, 1858, regarded the membrane due to a fungous growth, the *oidium albicans*, as frequently exhibited in ordinary thrush. He considers the membrane due "to the action of the parasite on the enfeebled mucous membrane." This view, which at the time attracted much attention, is now entirely abandoned. Dr. W. R. Rogers, in fourteen cases, found the parasite absent in all but one. This was read before the London Medical Society. It is of course unnecessary to say any thing, in reference to the competency of Dr. Rogers as a microscopist. In twelve cases, Dr. Harley found this parasite present only in one, and then the fungus did not grow upon it, until fifty-six hours after its removal. He considers the presence of all fungi, in these cases, due to accidental circumstances. They occur on the teeth and tongue of the most cleanly persons and it is not singular, that they should, at times, be found on the diphtheritic membrane. According to Berg and Gübler, (as stated by Dr. Thayer) "this fungus may be developed on any acid, thickened mucus of the

mouth and throat, as is seen in many chronic diseases." Warner, Robin, Leidy and others, have reported instances of vegetable, or parasitic growths on the diphtheritic membrane. Leidy considers these fungi, identical with those of the yeast plant. The membrane of diphtheria, Dr. Wade, of Bermingham, considers due to the presence of the *leptothrix buccalis*, frequently seen in the saliva. These fungi and algæ have, however, ceased to attract attention, for their presence is known to be entirely accidental. Dr. Harley states that these algæ frequently prove to be "crystals of fatty acids." Dr. Alonzo Clark, of New York, has apparently made the same observation; he says "these granules, under the microscope, appear to be fatty." Dr. Wilks states, that he examined sputa from the mouths of persons, suffering with various diseases, and found the fungous growths, when present, not differing from those seen in diphtheria. The practical fact, in regard to the subject, is, that these growths are all accidental, and have nothing, whatever, specifically to do with this disease.

Brettonneau, Sanderson and others have imitated in a measure, the exudation of diphtheria, by injecting an oleaginous preparation of cantharides, into the throat and fauces of the lower animals. "The concretion possesses a structure which is identical with that of the early conditions of diphtheria; consisting of a fibrinous matrix, in some parts of which cells are imbedded." The chief, yet interesting, difference between the diphtheritic exudation and that artificially formed is, that in the last, there is a distinct tendency to development and organization, whilst in the first there is nothing whatever of this kind. This as a pathological fact is of much importance; it shows, that in diphtheria, the blood has undergone a marked and decided change. It forms a strong link in the chain of argument used in this essay to prove, that diphtheria is a blood disease. We see thus, that the diphtheritic membrane is not only fibrinous, but that it possesses the peculiar and specific characteristic of non-development; that it does not organize; that it varies in thickness, extent, colour, density, elasticity and tenacity, but that, wherever found, it is peculiar, and serves in a great measure to characterise this disease.



## DIAGNOSIS.

This to the Physician is, next to treatment perhaps, the most interesting, if not the most important, branch of the subject.—With him, must ever be prominent before the mind the Latin injunction, “*prius cognoscere, dein sanare.*”

The diagnosis of diphtheria ought not to be very difficult, after a careful study of its pathology. We have almost invariably the diphtheritic membrane as a guide, with its characteristic disposition to extend, and, in a few days, to cause the marked and peculiar fœtor of the breath; its invariable tendency to reform, after removal; the facility, as a rule, of its removal, and the peculiar appearance of the tissue beneath—swollen, injected, shining, or covered with ecchymosed spots—concave and red; the fœtid discharge from the nostrils; its constancy, quantity and irritating effects on the parts subjected to its contact; the almost universal swelling of the lymphatic glands behind the jaw; the unusual prostration attending or resulting from such a slight and brief attack of fever; the frequent appearance of albuminuria, in the early stages of the disease; the infrequent, weak and compressible pulse. These will, when taken together, enable one, without much difficulty, to pronounce upon the character of the disease. As it is absolutely important, to determine very early the existence of diphtheria, we will introduce a differential diagnosis—serving to certainly distinguish it from the diseases with which it may be confounded.

It will be distinguished from pharyngitis, by the presence of the membrane, and its disposition to extend and reform; by the slight and brief character of the fever; by the early and unusual prostration; by the swelling of the lymphatic glands; by the little inconvenience and pain caused by deglutition; by the occasional supervention of laryngitis; by the disease not being, in severity, proportional to the lesions of the fauces; and lastly, from its epidemic prevalence, and the constant fœtor of breath.

From muguet, we distinguish it, by its commencement in the fauces and not on the buccal surface; by the exudation being membranous, and not curdy or flocculent; by great prostration, early manifested; by the disposition of the membrane to reform after being entirely absent, for a time; by the

great fœtor of breath; by the swelling of the lymphatic glands; by the little pain in the act of deglutition; by the presence, at times, of laryngitis; by the severity of the disease not being in proportion to the lesions observed; by its frequent epidemic prevalence.

From aphthous inflammation of the mouth, it is distinguished by the exudation being membranous, pellicular and non-ulcerative, instead of being follicular and ulcerative; by its disposition to reform; by the fœtor of breath it occasions; the facility of its removal; the swelling of the lymphatic glands behind the jaw; the fœtid discharge from the nostrils; the strange prostration; the act of deglutition not being painful, but being physically obstructed; the occasional appearance of albuminuria; presence of fever; supervention of laryngitis; the weak and compressible pulse.

From erysipelas, by the presence of a membranous, extending, reforming, pellicular, non-ulcerative exudation; instead of a follicular exudation, attended with ulceration; the great facility of removing this exudation and the non-ulcerated appearance of tissues underneath; the fœtor of breath being greater; usual absence of cutaneous eruption and when present, not having an elevated margin, and not causing tumefaction; fever being usually milder—no cerebral or typhoid symptoms manifested; laryngitis supervening; great prostration succeeding a short attack of fever.

From the croup, by the fauces, and not the trachea being affected; by the constitutional symptoms preceding the local; commencing above the rima glottidis invariably; exudation being always seen; fœtor of breath and discharge from the nostrils being manifested; usual freedom from dyspnoea; occasional presence of cutaneous eruption; swelling of the lymphatic glands behind the jaw; dyspnoea not increased by deglutition; not invading, as a rule, at night; not directly the result of exposure to cold and dampness; cough soft and moist, if present, and not being harsh and metallic in sound; albuminuria often present.

From scarlet fever, by less heat, and this subsiding quickly; early prostration; cutaneous eruption, if present, of a uniform, erythematous redness, appearing in patches and non-punctuated in character; tongue not red, shining or having a strawberry



appearance ; supervention of laryngitis ; the appearance of hæmorrhage, from the mucous surfaces ; discharge from the nose appearing early in the disease ; albuminuria also soon manifested ; no ulceration, or sloughing of the mucous tissues ; absence of all cerebral and typhoid symptoms.

With these differences carefully recollected, it will not be difficult to form a correct diagnosis of diphtheria.

#### SYMPTOMS.

It is both useless and impossible to give the rare and anomalous symptoms that have been, and are developed, during an attack of diphtheria. What is chiefly required is, that there shall be presented a clear and well defined type of the disease ; the variations from this, though constantly occurring, not being sufficiently great, in any one case, to render the general description obscure, or inaccurate. The division of the disease, into a number of forms, has been adopted by a great many writers, but there will be no difficulty in referring all cases, to either one, or the other of two forms of diphtheria. We have descriptions of the mild, the simple, the ordinary, the croupal, the ulcerative, the malignant forms of the disease. This is confusing to the Student and even to the Practitioner, and it is neither necessary nor important. We will speak of diphtheria, as manifested in two forms : the non-malignant exhibition of the disease, and its opposite, the malignant.

An attack of diphtheria, almost invariably appears insidiously ; it never invades suddenly. There is usually diminished appetite, and this soon gives place to an anorexia, that is persistent and embarrassing throughout the disease. There is languor, of more than the ordinary kind manifested, in cases of equal constitutional disturbance ; foreshadowing the nervous prostration and muscular debility, characterising this disease. This languor is both mental and physical. Usually headache is soon a source of complaint ; then most commonly a chill, followed by fever, makes its appearance. If the patient be now examined, the tongue will be found but little changed ; coated, perhaps slightly, with a white, or yellow fur. The fauces will appear injected ; sometimes of a red, most commonly of a purplish colour, soon after this there appears on the tonsils,

(which with the fauces are now swollen,) an ash-coloured spot, or exudation. There is some stiffness of the muscles of the neck, with more or less swelling of lymphatic glands, behind the jaw. Very generally a slight discharge from the nostrils and an increased secretion from the salivary glands. With these symptoms, there is some dysphagia, with obstructed though not painful deglutition.

If ordinary care and prudence be observed, these symptoms will decline and disappear in from four to ten days, and convalescence, at this time, be fairly commenced. This is a fair example of a mild case of diphtheria, uncomplicated with any other disease. The fever will most commonly disappear, in twenty-four or forty-eight hours; never having been high or troublesome. The pulse rarely exceeds one hundred beats, in the minute.

The diphtheritic pellicle will either disappear gradually, becoming each day more thin, or it will exfoliate and be discharged in pieces. This is of course the mildest manifestation of the disease. Sometimes, there is no anorexia; no constipation; the digestion being unimpaired. The prostration may amount only to languor, or apparent indolence. Headache may be absent. There may be scarcely any fever and this preceded only by an unpleasant feeling of chilliness. The swelling of the fauces may be slight; the colour of the fauces but little altered; the pellicle may not cover even the tonsils, but amount to nothing more than a few spots upon the tonsils, the pillars, and the uvula. There may be only a slight enlargement of the lymphatic glands; the muscles of the neck, not unpleasantly affected; no dysphagia, and deglutition almost unimpaired; no discharge from the nose; and the patient not even confined to bed. With the disease diagnosticated however, the Physician should be none the less watchful, for even such cases become suddenly grave and dangerous, and are often followed by the most serious consequences. These symptoms may all be aggravated, and yet the disease cannot be called malignant. We may thus have great languor; much anorexia; chill with fever, though in the most cases this is strangely brief and mild; tongue covered with white, or yellow fur; the fauces injected, tumefied and of a claret colour; tonsils and the uvula covered with a whitish, greyish, or yellowish exudation; great fœtor of the breath; fœtid and corroding discharge from the nostrils;



nostrils plugged with a depraved mucous secretion and with the swollen tonsils and uvula causing a mechanical dyspnoea, well calculated to suggest laryngeal, or bronchial trouble; the lymphatic glands much enlarged and the muscles of the neck stiff and painful; dysphagia and impaired deglutition manifested; albuminuria present; and the patient's condition, generally, painful and dangerous. The profuse secretion of saliva and depraved mucus, with the swollen fauces, and elongated uvula, making sleep, or even rest, impracticable.

These instances, with the intermediate degrees of severity in each or all of the symptoms, can be referred to the first or non-malignant form of the disease.

The malignant form of diphtheria, is so terribly defined in its course, that there can be no error in the classification of the cases. In the malignant form, we have all of these symptoms aggravated, with other symptoms, that are happily peculiar to this exhibition of the disease. There is, at first, great headache; prostration; total anorexia; well defined chill, with low, but prostrating fever; tongue loaded with fur; throat enormously swollen; fauces dark-coloured; a yellowish or brownish, coriaceous exudation on the tonsils, pillars and uvula, and sometimes over the whole surface of the fauces; vomiting and diarrhoea; profuse secretion of saliva and an abundant discharge of depraved mucus; nostrils discharging a thin, corroding and exceedingly offensive liquid; tumefied tonsils and uvula, with the plugged nostrils, causing great dyspnoea; salivary and mucous secretions, rendering the recumbent position impossible; hæmorrhage from the nose, mouth and sometimes from the bowels; fœtor of the breath and the discharge from the nostrils affecting the entire chamber; weak, rapid pulse; complains of heat, with the body cool; lividity, thirst, and the ordinary symptoms that precede death. This form of the disease is happily rare. We have malignant cases, in which these symptoms are not all present, or where they are much milder. The excessive headache; the weak, frequent pulse, with no heat of surface; diarrhoea and hæmorrhage; yellow or dark, leathery exudation on the fauces; engorgement of the salivary glands; excessive fœtor of the breath serve always to make this form of the disease easily recognised.

*malignant*

With these two forms of the disease as given, and the intermediate examples belonging to each form, we have a fair conception of the symptoms of diphtheria. As laryngitis and tracheitis are absent in a large number of cases of diphtheria, (chiefly in those which recover) we have not introduced the symptoms, peculiar to these diseases, in the symptoms of diphtheria. Being totally different in pathology, we can not see the propriety of introducing the symptoms of these diseases, with the symptoms of diphtheria; it would certainly be as appropriate to introduce the symptoms of bronchitis, or pneumonia, or of any of those diseases which form the complications of diphtheria, or which prevail, so as to be blended with this disease. We can as well speak of bronchial, pneumonous, scarlatinous diphtheria, as we can of croupous diphtheria. These diseases are all complications of diphtheria. We will not enter more minutely into the description of symptoms, when croup supervenes in diphtheria, than to say, that we have added to the existing symptoms of diphtheria at this time, the symptoms belonging to croup. We have, in the same way, when other diseases supervene, the symptoms which are peculiar to them. It must not be taken for granted, when dyspnoea is manifested, that croup has made its appearance. The nostrils occluded with their depraved secretion, and the swelling of the tonsils and uvula produce a mechanical obstruction which renders breathing difficult, when the larynx and trachea are uninjured. When the nostrils are not thus closed and the tonsils are not much swollen, we have also impaired respiration from bronchial, or pneumonic trouble. If, by auscultation, we have evidence that this kind of trouble does not exist, and if, by ocular inspection, we find that the nostrils and tonsils are not in the condition represented, there is then every reason to believe, that this symptom (taken with others, belonging to the disease) is due to the invasion of croup. With this dyspnoea, we have the metallic, sonorous cough; voice much altered; restlessness, etc., which lead at once to a suspicion of the existence of croup.

The existence of the membrane upon the tonsils has been generally considered as one of the pathognomic signs of diphtheria. It is usually so, but we have cases of diphtheria, where the throat presents no such appearance. With the other symptoms of diph-



theria existing, the throat is found very little altered, (sometimes not in any respect,) and the diphtheritic exudation is manifested elsewhere. It has been found thus on the body, wherever the surface has been denuded; on the eyes; in the ears; in the vagina; on the anus; in the nasal fossæ; on the vulva, including the orifice of the meatus urinarius; and has recently been found in the intestines. Dr. R. H. Goldsmith, of Mississippi, writes thus of this disease, in regard to its membranous exudation: "Diphtheria has been endemic in this vicinity (Oakland College) for three years and epidemic since January, 1860. It has varied in severity, from the slightest disposition of exudatory membrane, to the complete plugging of the larynx and trachea. I may add, with the deposition of the diphtherial membrane from the fauces to the anus." Dr. Goldsmith states that he has treated 300 cases, and on one plantation, saw 120 cases. If he is correct, in regarding what he saw, in the intestinal tract, as diphtheritic membrane, M. Empis is wrong in his assumption, that this membrane is not formed on surfaces "removed from the contact of the air." As the disease, even when the larynx is covered with this exudation, has not extended to the œsophagus, it should require careful and repeated examinations, before assuming that it does invade surfaces, not in contact with the atmosphere. Dr. Greenhow states, that Dr. Gull has been led to suspect the invasion of the œsophagus by diphtheria, but there is no positive proof, that the membrane of this disease has ever been found on surfaces, not exposed to the air. Dr. Goldsmith has reported the first instance of this kind in America on record.\* It has been claimed, that as cantharides will produce a membrane, in many respects similar to that of diphtheria, that the membrane formed on blistered surfaces, is due to the action of the cantharides and is not the result of the disease. This may be true, but there are repeated instances of the formation of this membrane on wounds, when the disease was prevalent. Dr. Greenhow reports a case of the formation of this membrane on the chest of a child; the skin of the chest had been excoriated by the acrid discharges from the mouth—the case is reported by him, on the authority of Dr. Sanderson.

\* M. Guersent has reported a few such cases.

The fever, in diphtheria, is usually mild and brief; the pulse rarely exceeding one hundred beats per minute. In a Spanish epidemic, cases occurred where there was no fever. It usually terminates in twenty-four or thirty-six hours. The pulse is sometimes abnormally slow. Dr. Heslop, of England, found it only forty, in a child of five years of age. Dr. Kneeland, of New York, reports a case, where the pulse was sixty-five, in a boy ten years of age. Dr. Huxham, of Plymouth, England, states that the discharge from the nostrils was so acrid, in cases under his observation, that "it corroded the lips, cheeks and hands of the children that laboured under the disease and the fingers and arms of the nurses that attended them."

Dr. L. N. Beardsley, of Milford, Connecticut, states that "the first symptom of this disease, (and it is one which we have never seen referred to by any writer on the subject,) was pain in the ear. It was not only pathognomic, but prominent and almost invariably present, in every case that came under our observation, for a day or two before the patient made the least complaint in any other respect, and before the smallest point, or concretion of lymphatic exudation could be discovered, on the tonsils or elsewhere." Among other anomalous symptoms, Dr. Thomas Ryerson, of Newton, New Jersey, mentions an ulceration of the toes. "In one of these epidemics of diphtheritis, many of the patients were affected with an extremely fetid ulceration of the toes, which could not be traced to any want of cleanliness." When there is any cutaneous eruption, coincident with diphtheria, it appears in patches and is not diffused over the surface, as in scarlatina. It is of a uniform erythematous redness and has not "the boiled lobster" appearance of scarlatina, and, unlike the scarlatinous eruption, it is not punctuated.

When the larynx escapes, the most careful and scientific observers are deceived. Children considered safe are, on the next visit found dead. When the larynx however does not escape, almost every case is fatal.

When the fever has passed off, the chief feature is prostration; not the prostration of typhoid disease, but something peculiar to diphtheria. There is no delirium; no wandering; no empty, fatu-



ous look, that speaks of a disordered brain ; no coma ; none of the idle comments, that foretell the ending of mortality. The patient is calm and quiet. Judging from the symptoms manifested, he might be considered convalescent. He is cheerful, perhaps, and hopeful, but be not deceived, it is all

“ The sick man’s lightning, half an hour ere death—  
 When faintness, the last mortal birth of pain,  
 And apathy of limb, the dull beginning  
 Of the cold staggering race which Death is winning,  
 Steal vein by vein and pulse by pulse away ;  
 Yet so relieving the o’er tortured clay,  
 To him appears the renewal of his breath,  
 And freedom, the mere numbness of his chain—  
 And then he talks of life, and how again  
 He feels his spirits soaring, albeit weak,  
 And of the fresher air which he would seek ;  
 And as he whispers, knows not that he gasps,  
 That his thin finger feels not what it clasps—  
 And so the film comes o’er him ; and the dizzy  
 Chamber swims round and round ; and shadows busy,  
 At which he vainly catches, flit and gleam,  
 Till the last rattle chokes the strangled scream,  
 And all is ice and blackness.”—ODE TO VENICE.

This is no fancy sketch, and will seem strangely familiar to those who have witnessed such scenes. The death of the lamented Dr. Adams, of Boston, as described by Dr. Minot, of that City, would be briefly depicted by these lines.

As croup sometimes complicates diphtheria, and we have the symptoms and termination of croup superinduced, so we have thus other diseases, with their peculiarities and history. Tonsillitis sometimes supervenes, and after much of its peculiar suffering, we have the formation and breaking of the abscess. Ulceration is occasionally manifested ; if scarlet fever is prevailing coincidentally, we have the throat symptoms of that disease manifested as a complication, or as the result of epidemic influences ; and the throat at times suffers as it does in that disease. The peculiarities of any prevailing epidemic, being impressed upon coincident diseases, is a phenomenon universally known and recognised. A prevailing epidemic, of any kind, will manifest its symptoms, as a part of the symptoms of coëxisting diseases. When we have occasional ulce-

ration of the throat manifested in diphtheria, during the coincident prevalence of scarlet fever, there is as much error in considering this ulceration as peculiar to diphtheria, as there would be in pronouncing the cutaneous eruption, of an intercurrent attack of measles, as a feature of this disease. If measles are prevailing, it is not uncommon to see the peculiarities belonging to it, impressed upon cases of diphtheria; but no one will, for a moment, confound the two diseases. Dr. Alonzo Clark, of New York, saw in the same child, and during the same illness, diphtheria, measles, scarlet fever and again diphtheria—the child dying of diphtheria; yet he found no difficulty, in diagnosing these diseases. One less careful, might have pronounced it simply a rare and marvellous case of diphtheria. It will thus be seen, that we may have, during an attack of diphtheria, complications of croup, bronchitis, pneumonia, scarlet fever, etc., but that care will enable us always to recognize the supervention of these diseases, and a want of care, or proper knowledge, may lead us to confound the symptoms of these diseases, with the symptoms of diphtheria. Again, we have from the coincident occurrence of other epidemics, one or more of the symptoms of these epidemics coexisting with the symptoms of diphtheria, yet a careful observation will easily preserve us from error and confusion. The symptoms of croup, tonsillitis, scarlet fever, bronchitis, pneumonia, etc., have nothing whatever to do with the symptoms proper of diphtheria; as well may we classify, with the symptoms of diphtheria, those of rubeola, varicella, or variola; for these last diseases, as well as the first, have complicated cases of diphtheria.

Albuminuria is often present during an attack of diphtheria, but we cannot of course, regard it as one of the symptoms of this disease. Dr. Wade, of Birmingham, was the first to observe its presence in diphtheria. It has been carefully watched and studied, in connection with this disease. The results of these observations may thus be stated: It is always a grave and serious circumstance in the history of the case, and most serious, if the quantity present be large. It usually occurs in the early stages of the disease. Its presence, even in large quantity, however, is not necessarily a fatal symptom. It is present in cases that recover, and



is frequently absent in cases that terminate fatally. It is found in the urine, even, of mild cases. It does not give to the urine the smoky appearance, caused by the presence of albumen in scarlet fever. When present, casts of the urinary tubes are revealed, on microscopic examination.

Phosphates precede and succeed the occurrence of albuminuria, as a rule; when the urine is heated, a cloud is produced, which disappears on the addition of nitric acid; this cloud is produced by the presence of the different phosphates; in a few days, the cloud produced by heat will be increased, under the addition of nitric acid; this is due to the presence of albumen. Uræmia does not coëxist with albuminuria, in diphtheria. With the exception of albuminuria, the urine is not specially affected. Sometimes there is an excess of phosphates, and again an excess of lithates, but there is nothing of special interest or importance in this connection. The specific gravity of the urine, in diphtheria, is almost always above the natural standard. Heslop, Sanderson, Hart, Houghton, Greenhow, Bristowe, Webb, Clark, Jacobi, Isaacs, Krakotwitzer and others have paid special attention to the urine in diphtheria and much of what is received, as of true pathological importance in albuminuria, is based on their observations.

Ulceration, though most commonly due to the complication or epidemic prevalence of scarlet fever with diphtheria, is occasionally manifested independently of these causes. It is a symptom very seldom occurring and rarely recorded, during the local or general history of this disease.

It sometimes happens, that the premonitory symptoms of diphtheria are very slight and the malaise scarcely perceptible, in the gravest cases. Sometimes great local and constitutional changes occur, with so little suffering, that when at last, the patient complains, the case is found in a hopeless condition. Malaise of the patient is not proportional, with the severity of the disease. Children have died, whilst sitting up, or dressing, when the parents were not conscious of any real illness; and "the ploughman has been unable to complete his furrow."\* The diphtheritic exudation is not in proportion to the gravity of the case; sometimes the uvula,

\* Reported by Dr. F. S. Coskery, of Baltimore, Md.

as mentioned by Dr. Comegys, of Cincinnati, appears "like a pearl ear-drop," so complete is the covering; sometimes the mouth appears "as though filled with plaster of Paris;" yet these cases may not be grave in character. Again, this symptom may be slight and yet the patient irretrievably sink, under the prostrating effects of blood-poisoning.

The degrees of fever, swelling of the lymphatic glands, discharge from the nose, fœtor of breath, dysphagia, membranous exudation, anorexia, etc., vary with the cases, the localities, the epidemics and the ages; it will be unnecessary to give cases in illustration of this truth, and we will find, that, in diphtheria, as in all other diseases, though we may have a type clearly defined, there will be an interminable and indescribable variation in the symptoms. We have given fair types and, though cases will, in comparison, vary much, there will be no difficulty, from the symptoms described, in recognising the disease.

#### ETIOLOGY.

Like that of all zymotic diseases, the etiology of diphtheria is obscure and not in the least understood. Whatever effect hygienic influences may have upon its course, they certainly seem to exert little or none on its cause. The meteorological attributes of Winter seem to have some little influence; yet it would be more correct to say, that diphtheria coincides, in its prevalence, with the existence of these causes; for we are unable to trace any direct relation, between the atmospheric conditions of Winter and the resulting invasions of diphtheria. Cold, moisture, dampness, snow, do not seem to bear any direct relation to the origination of the disease. In the descriptive language of Mr. Hart, of England, "it visited the open hamlets of rural districts and the crowded courts of the great Cities. It reached the seaside, and fell with violence upon the infant population of Boulogne. It raged, alike, under the intense heat of Summer, and during the cold Winter months. Its ravages affected, equally, the inhabitants of marshy, ill-drained land and those of dry and elevated situations. Brighton has not escaped; Scarborough has suffered. It has swept across the marshy lowlands of Essex, and the bleak moors of Yorkshire. It has traversed the flowery lanes of Devon, and the wild flats of Cornwall,



that are swept by the sea breeze. It has seated itself upon the banks of the Thames, scaled the romantic heights of North Wales, and has descended into the Cornish mines. Commencing in the Spring months, it has continued through the Summer, and if extremes of temperature have seemed to lend it new vigour, and the heat of the dog days, or the severe frosts of Winter have fostered its strength, yet, moderate temperature has not greatly abated its influence, and it has struck a blow here and a blow there at all seasons."

It was observed, that in France, or England, it did not obey any known climatic law. Brettonneau writes in regard to the course of diphtheria in France: "It did not appear possible to ascribe its appearances to any climatic or meteorological law. Historical documents show, that while it raged with terrible violence amongst the towns and hamlets of the Loiret, remarkable for their salubrity, and the advantages of their geographical position, it passed over the villages of Sologne, seated amid the marshes; while elsewhere it seemed to select marshy and ill-drained districts, and to spare those which were in a better sanitary condition. In the year 1825, remarkable for its dryness, it laid waste the communes North of Orleans, and in 1828, remarkable for its dampness, it desolated the country South of Orleans." This total independence of all hygienic influences, in diphtheria, seems peculiar to this disease. Dr. Thos. H. Peacock, in an autograph letter of December, 1860, thus writes: "the cases referred to, occurred in members of a high family, living in an elevated and well drained locality, reputed most generally healthy; in a house of unexceptionable character, with large and lofty rooms. I am not aware of any atmospheric condition which seems especially to influence the prevalence of this disease." Many observers in France, England and America, have supposed that malarial influences excited some effect on the disease, but these views have all been abandoned, as untenable. Dr. Hatch, of California, writes that barometrical, meteorologic and hygienic causes do not seem to affect the course of the disease. This is also the testimony of Fourgeaud, Blake and Wooster, of that State. Whilst prevailing at all times, and at all seasons, in America, it has seemed to spread more generally during the Winter and early

Spring months. Sudden alterations of temperature seem to act as exciting, if not as predisposing causes; so on the contrary, preceding attacks of the exanthemata, or their epidemic prevalence, at the time appear to act as predisposing, if not as exciting causes.

As diphtheria is very generally prevalent, when malaria has been destroyed by cold, and as it has prevailed with deadly malignity, where malaria is unknown, it is irrational to claim any connection between them. The Lancet Sanitary Commission thus sums up, on this subject—"it appeared to be equally independent of all atmospheric conditions—was a theory formed, that its intensity depended upon the solar influence, and that the heat of Summer lent fresh force to its destructive attacks; soon it raged with greater violence in the Winter months, and during the cold season; was a connection traced between the localities of its invasions, and the marshy, ill-drained character of the land; the next season it was found to ravage dry and elevated stations with equal rage." We could fill a volume with quotations from writers, in all localities, to prove the independence of diphtheria, in regard to atmospheric causes; but the testimony advanced, is more than sufficient. Again, we can not appreciate the practical good to be derived, in furnishing farther testimony on this subject, when it all tends to the establishment of a similar and well recognised fact. In America we find it prevailing amid the granite hills of New England, and the rolling prairies of Illinois; in the elegant mansions of New York, and among the pioneer hamlets of Wisconsin; on the marsh flats of New Jersey and the eminences, perched 4,000 feet above the level of the sea, in California; in the rapidly alternating climate of the Atlantic and the genial and uniform temperature of the Pacific slopes; amid the snows of the North and the malaria of the South; the damp atmosphere of the seacoast and the parched airs that render grassless the great plains of the trans-Mississippi.

It may be stated that diphtheria has in its history prevailed with an entire independence of all atmospheric causes and conditions.

Whilst hygienic conditions do not appear to bear any direct relation to the production of diphtheria, it can not be doubted that, during the epidemic prevalence or presence of the disease, they must act as predisposing causes. They certainly, in this disease as



in all others, influence the severity and result of individual cases; and whilst no atmospheric or hygienic condition can bring immunity to the opulent, those under the best hygienic influences, frequently escape death, from the same causes that entail it upon the poor, where sanitary influences are ignored and neglected. During the prevalence of diphtheria, however great the care and anxiety to prevent it, we find the pestilence in the palatial mansions of the rich, as well as in the hovels of the poor. "*Pallida mors æquo pulsat pede pauperum tabernas regumque turres.*"

It has been supposed that humidity had much to do with the causation of diphtheria; such was the conclusion of Ghisi, at Cremona; Brettonneau, of Tours, Trousseau, Isambert, Chomel, Lemoine and others; but the recent investigations of this subject in France, the report of the Lancet Commission, and the testimony of the most distinguished observers in England, France and America, have proved, that there is no reason, whatever, for this assumption. However humidity may act as an exciting, or even as a predisposing cause, during the existence of an epidemic, it is quite certain that it is powerless in the origination of the disease. As Dr. M. L. Linton, of St. Louis, very properly writes, "cold and variable weather, though not causing the disease, seem to favour it; that is to increase its mortality." This is all that can be claimed, for the action of these agents. Dr. Michel Peter, of the Hôpital des Enfants, at Paris, gives the same testimony—"a cold and damp season, with abrupt changes of temperature, has increased the number of diphtheritic affections."

The statistics furnished by Dr. Jacobi, of New York, also corroborate this view; whilst the number of cases during the months of January, February and March, vary each from 12 to 25; the Summer months furnish from 3 to 5. In 1859, the month of January exhibits 5; March, 21; April, 17; May, 14; June, 8; July, 4; etc., showing a gradual increase, during the variable weather of Spring, and a proportionate decrease, as the Summer, and less variable months come on. This, by many, may be supposed to be accidental, but we will find that the records of the next year tell the same story. In 1860, we find in January, 18 cases; February, 13; March, 26; April, 12; May 4; etc. These statistics are taken from

the records at the Canal Street Dispensary, and serve, with others, to show that though cold, dampness and variable weather are powerless in the production of diphtheria, they are, during the existence of an epidemic, greatly instrumental in contributing to its extension and mortality. It is proper to state, that Dr. Jacobi's statistics are taken, during the years which marked the prevalence of the chief epidemics of diphtheria, that have prevailed in New York City.

It is thus seen, that these causes do very conspicuously contribute to the extension of diphtheria, and yet they have nothing whatever to do, apparently, with its origination. In the severe epidemic which desolated parts of Wisconsin, and which has been well described by Dr. Wm. L. Wells, of that State, we find that "the epidemic commenced in July, and ended in the latter part of October. It seemed to have arrived at the height of its violence, about the middle of August; it then abated, and in September appeared to have entirely ceased, but in October, it broke out again with increased severity. The morbid agency ceased to act, as suddenly as it began, and in November it had entirely disappeared." The deduction here is very plain indeed—the disease did not begin in a cold and damp month; but in the variable weather of October it reached its greatest severity. Dr. Semple stated to the Medical Society of London, that, in an epidemic at Bagshot, the disease "did not specially attack the puny and ill-fed, nor those living under unfavourable hygienic conditions." We mention this statement, because it is often quoted, and is calculated, if taken as the rule, (which was not by any means intended) to do great injury. It is, of course, the exception, and the testimony of all competent observers serves to show, that, as a rule, during an epidemic of diphtheria, a neglect of hygienic precautions always tends to promote the extension and mortality of the disease; it is, in this respect, like all other diseases, and it is calculated to produce a most inexcusable injury, to inculcate any other view. In the epidemics of Paris and Boulogne "those children who possessed feeble constitutions, or were surrounded by the concomitants of depraved hygienic influences, for the most part became the chief victims of the disease." Dr. Blake, of California, states, that, in his expe-



rience, dampness seems to have no relation to the etiology of diphtheria, "the most fatal epidemic that has fallen under his observation, occurred at an elevation of about 4,000 feet above the level of the sea, at Dutch Flat, and again at Grass Valley, 2-3000 feet above the level of the sea." Dr. Wooster, of California, gives the same testimony.

There is one point which should receive attention, in this connection: it is that, however powerless in regard to the causation of diphtheria, the variable weather of Spring and Autumn seems to increase its prevalence. The researches of Wade, Peter, Jacobi, Wells and others, justify such a declaration. What can then be definitely said of the etiology of diphtheria? - We have examined the subject, in its climatic, meteorologic, and hygienic relations, and find that the etiology of diphtheria is entirely independent of these agencies. That, however much or little they may contribute to the extension of an epidemic of diphtheria, they are powerless in the origination of this disease. We have, however, been able to state, from the examination of the subject, that though diphtheria originates in all climates, it is chiefly found prevailing in those, marked by frequent and great changes of temperature. That when existing, it is increased by variable weather; that prevailing at all seasons, it extends most in Spring and Autumn; that the extremes of heat and cold, dryness and dampness of atmosphere, do not originate the disease, and do not specially increase it, but that rapid alterations of these agencies, if not originating, tend always to extend it. That hygienic agencies do not originate the disease, but that, with all allowance for the statements of Dr. Semple, in regard to the epidemic at Bagshot, Dr. Odriazala, relative to that at Lima, Dr. Heckstall Smith, in England, and a few others, they do, as in all other diseases, increase the extension and mortality of diphtheria. We find, in conclusion, that (as in zymotic diseases) though there is great obscurity in relation to the etiologic agencies of diphtheria, there is no obscurity whatever, but much unanimity, in regard to those circumstances which give, to these agencies, a general, diffusive and fatal tendency. We are in possession of this practical fact; that if we can not analyze and understand the causes of diphtheria, we can fully understand the method, by which

the effect of these causes can be definitely and certainly diminished. However obscure the etiology of diphtheria, its study inculcates this practical lesson; that when diphtheria is epidemic, every hygienic precaution should be rigidly adopted; that alternations of temperature and of the hygrometric condition of the atmosphere, should produce prudence and diminish exposure.

#### SPORADIC PREVALENCE.

The sudden appearance and rapid existence of this disease, in sections of Europe and America where distance and impossibility of communication forbid the idea of contagion, demonstrate that its sporadic generation is undoubted. Dr. M. L. Linton, of St. Louis, Mo., writes that "most of the cases, he has seen, have been sporadic." Dr. Peacock, of London, in his letter, states that he has "seen the disease, in its sporadic and epidemic forms, though he regards the latter as chiefly characteristic." Dr. D. J. Cain, of Charleston, S. C., states, that "he has seen it sporadically for very many years." Dr. Greenhow, of England, writes of a certain epidemic, "it is at least an important point, in its history, to have ascertained, that it began spontaneously in several centres, sufficiently remote from each other, to prove their complete independence." Dr. Abercrombie has described an excellent type of diphtheria, that occurred as a single and isolated case; it was severe and terminated fatally. Dr. Webster, of Dulwich, England, has given a description of six cases of this kind. In the wards of St. Thomas's Hospital, London, several cases of sporadic diphtheria have occurred; they are described by Dr. Bristowe.

It is not necessary to give farther proof of the fact, that diphtheria at times prevails sporadically; when thus prevailing, it is usually mild, though occasionally we find its several types manifested. There is nothing peculiar in regard to sporadic diphtheria, that deserves special notice.

#### EPIDEMIC PREVALENCE.

It is this manifestation of diphtheria, that has afforded all that is valuable and interesting in regard to the disease. It has inspired that alarm and terror which leads to investigation and study.

Were it not for its epidemic visitations, the disease would have been comparatively unknown and unnoticed. This subject has been



so fully examined, when writing of the history of the disease, that it would be but a repetition, to farther allude to it. There is one fact of special and practical interest in this connection; all epidemics of diphtheria begin and end, with mild and benign cases. It may be useful to bear this in mind, in connection with the treatment of the disease.

## ENDEMIC PREVALENCE.

Watson states, that diphtheria is endemic in Picardy and Touraine; Orton, that it has been endemic at Binghamton, N. Y., etc. We question the propriety of the use of the word in this connection. It is an established fact, that the disease is not due to any peculiarity of population or locality.

## CONTAGIOUSNESS.

There is no part of our subject, which we approach with more care and circumspection. Pathologists have yet to acquire definite ideas, and to submit clearly intelligible laws, on the whole subject of contagion. In the obscurity and confusion now prevailing on this subject, there is an almost ludicrous disposition to take refuge in the welcome labyrinth of words. One terms a certain pathological condition, contagion; another infection; a third, personal contagion; a fourth, immediate infection, and so with the endless catalogue, specific contagion, specific infection, immediate contagion, etc. We will not, in the use of the word contagiousness, have reference to the technicality of any particular authority; we will assume, for our brief purpose, that the word contagiousness shall signify, the contraction of a disease not epidemic, when exposed to its influences. When the disease is epidemic, it is manifestly very difficult to establish the fact of its contagiousness. It is illogical and unjust to claim, that any combination of circumstances demonstrates the contagiousness of a disease, when these circumstances coëxist, with the epidemic prevalence of the disease. Sporadic cases are usually and confessedly mild, and it is no proof of the non-contagiousness of a disease, that it is not propagated by such cases. It is thus manifest, that reasoning and argument are inadmissible in this connection, and it only remains, to state facts, as developed in certain well authenticated cases, and to leave the reader to draw his own conclusions. We will first pre-

sent instances, serving to show the non-contagiousness of the disease, by inoculation, or by personal contact with the diphtheritic matter.

Dr. Peter, desiring to prove the incorrectness of the position assumed by Brettonneau, Valleix, Rilliet, Barthez and Bard, that diphtheria was propagated by contact with the diphtheritic matter, inoculated himself with the matter, taken from a child, on whom he had just performed the operation of tracheotomy. He experienced no inconvenient results. In 1858, such matter was discharged from the throat of a child, and lodged on the ball of his eye, a portion resting between the lid and the globe of the eye; twenty-four hours afterwards, no change had taken place. From a case, on which tracheotomy had been performed by Coulon, he took some of the matter and inoculated himself with it, in the lip. In twenty-four hours afterwards, nothing was perceived, as a result, but "a slight ecchymotic projection." In 1859, he saturated a piece of lint with diphtheritic matter, and coated with the secretion, the tonsils, uvula, and posterior part of the pharynx. Not to dilute the matter, he abstained from eating and drinking; no evil resulted. Trousseau could not succeed in propagating this disease, by inoculation; he experimented upon himself and several of his pupils. Dr. Harley inoculated three dogs and a snake with diphtheritic matter; no result followed. Granting that these are fair and true examples, it does not prove that diphtheria is not contagious, but in the words of Trousseau, "that inoculation is not the means of transmission." But even this negative proof is destroyed, as we find that, in addition to other ways of transmission, diphtheria has been directly propagated by inoculation.

The *London Lancet* mentions the case of a Practitioner, whose finger was wounded, during the operation for tracheotomy, upon a diphtheritic patient; an abscess formed, and in a fortnight after, on exposure to cold, diphtheritic exudation occurred on the tonsils. The Practitioner's wife became affected afterwards; they both recovered, though one had, as a sequel, diphtheritic paralysis. Again, a medical student, in making a post mortem examination of a child, who died of diphtheria, pricked his thumb; in spite of every precaution—"washing, bleeding, and sucking" of the thumb—the disease was



contracted, and false membranes formed on the throat. It was contended, when these cases were presented to the Medical Society, that in the case of the Practitioner, diphtheria must have resulted from epidemic influence; as the period of incubation (fourteen days) was too long, to infer that the disease was the result of inoculation. Although M. C. Roger has found the period of incubation to be from two to seven days, it is proper to add, that Dr. Hatch, of California, has seen a case of diphtheria manifested, after an incubative period of twenty-one days. In the case of the student, the false membranes on the throat formed on the fifth day; here, at least, the period of incubation was not too long, to make the inference of the disease resulting from the inoculation, in any manner objectionable. Brettonneau has presented the following case: "A child, seized with diphtheria, who had transmitted the disease already to its nurse, was placed under the care of Mr. Herpin, Surgeon to the Hospital at Tours, and Professor at the School. At one of his visits, by access of cough, part of the diphtheritic matter was ejected from the mouth, while the process of sponging the pharynx was being performed, and it lodged on the aperture of the nostrils of Mr. Herpin. Occupied with his task, he neglected for a moment to remove it. A severe diphtheritic inflammation of the part ensued, which spread over the whole nostril and pharynx. Convalescence, from the attending prostration, occupied more than six months."

Dr. Gendron, of Chateau de Loire, received, on his lips, a portion of tracheal diphtheritic exudation; laryngeal diphtheria ensued and prompt treatment alone saved his life.

In 1826, at the military school at Tours, a boy, with frost-bites on the foot, used a bath that had been employed for a diphtheritic patient; the toe became the seat of diphtheritic inflammation. At Avignon, a soldier used the teaspoon of a diphtheritic patient; he suffered from buccal diphtheria. A boy, in one of the French hospitals, trod with bare and wounded foot, upon diphtheritic sputa; he had diphtheritic inflammation of the foot. Dr. J. B. Greely, of Nashua, N. H., writes, that "the wife of one of our most respectable citizens, while preparing, for the grave, the body of a child, who had died from diphtheria, unfortunately allowed one of her fin-

gers, upon which was a fresh wound, to come in contact with some of the fluids of the body, which soon produced the effects, usually following dissecting wounds; superadded to these, were all the symptoms of diphtheria; under these she sank." It will, at least, be admitted, that the testimony, in regard to the propagation of diphtheria by inoculation, is as strong as that presented, for proving the contrary; we will see in addition to this how convincing is the proof of the disease being, in other ways, contagious.

According to Dr. Greenhow, Cortesius, in describing the Sicilian epidemic of diphtheria, reports a case, wherein a friend was requested to verify the truth of a patient's complaint, that there was a foul and constant emanation from his mouth. This fact was verified by smelling. Inflammation of the fauces and tonsils resulted and the case terminated fatally. Mr. Wade, of Birmingham, states that frequent ablution and cleanliness, in houses, where diphtheria prevailed, appeared to produce a marked immunity; but if the utensils used by the sick, were also used by the well, the disease usually extended. Dr. Greenhow states, that at a boarding school, at Whitham, England, diphtheria prevailed, and proved fatal to one of the pupils; others caught the disease and the school was disbanded; one pupil, who was convalescent, returned home to an isolated farmhouse several miles distant. About a week after her return, a sister was taken sick with diphtheria, and died in twenty-four hours. The child from the boarding school was still suffering, voiceless, tonsils swollen and fauces congested. On the day after the death mentioned, another sister, aged seventeen, contracted the disease and died, in three days. Four cases of sore throat then occurred in this family, two of them with specks of exudation. In another instance, where a family had suffered, the servant, who was convalescent, visited her friends, in a hamlet several miles distant, and at which the disease was not prevailing. A few days after arrival, two of her brothers and a sister were seized with the complaint and died.

Mr. Lambden, of England, gives the case of a labourer, at Langrick, who left his place and went to Coningsby. At the time of his arrival, he had sore throat, and soon after diphtheria. The disease was prevalent at Langwich, soon after the labourer left, and may



have been prevalent at the time of his departure, but the writer (Mr. Lambden) could not ascertain this. The two places are five miles distant. His brother soon contracted the disease and died. These were the first cases in that region. Two other cases followed. A little girl returning from Mareham, where diphtheria was prevailing, to an out-lying hamlet, became sick and died; this was the first case at the hamlet. Two other cases soon occurred in the same house, but none in the hamlet. One of these cases, whilst convalescent, went to Tattershall Thorpe, where the disease was unknown; here a relapse occurred. A member of the same family was soon seized with diphtheria. Mr. Lambden furnishes also another instance; a farmer having two farms, ten miles distant from each other; his family being divided—a part at each house; at one of the houses, the disease prevailed, but not at the other. A child, apparently well, coming from the infected to the non-infected house, is soon seized with diphtheria; a child, who had never left the non-infected house, is soon after taken sick, with the same disease and dies. Dr. Greenhow gives an excellent example of the contagiousness of diphtheria, as furnished by Mr. Chavasse, of Sutton Coldfield: “Diphtheria was believed to have been imported into a boarding school, by a day boarder, some of whose family were suffering with the disease. Five cases soon occurred in the school. The patient, most severely attacked, was removed home, a distance of forty miles from Sutton Coldfield, when convalescent, and is supposed to have communicated the disease to her family; two children and a servant taking the disease and soon dying of it. Dr. Sanderson relates the case of a boy, who contracted a case of diphtheria, which was then prevalent; he was sent to Derrythorpe, several miles distant, where the disease had not made its appearance. Four days after, his sister was taken sick with the same disease, and seven days after his return, a brother and the youngest child of the family also. In the report of Mr. Simon, Registrar General of England, the following case is contributed by Mr. Eastes, of Folkestone—“No case of diphtheria had ever been seen in Folkestone until Isabella, æt. four and three-quarters, arrived from Boulogne, on the evening of July 2nd, being then in an advanced stage of the disease. She died on the following day. On the 6th of July, her

sister, who had never been in France, was attacked; in three days another case occurred in the same house—all terminated fatally.”

Mr. Rumsey, of Cheltenham, reports the following case: “A school-boy, convalescent from diphtheria, contracted by him at Swansea, where it was epidemic, and arriving home, in an open and healthy suburb of Cheltenham, where, at the time, there was no diphtheria prevailing, was received and embraced by one of his two sisters. On the fourteenth day afterwards, (another instance, serving to show that the incubative period, before mentioned, was not too long, to render the existence of diphtheria, due to inoculation,) she was attacked by diphtheria. Her sister, who did not meet the brother, helped to nurse her, and was attacked in fourteen days (still another instance of a long incubative period) after the first sister, by the same disease. Strict separation was enforced, with thorough ventilation—the mother and nurse only seeing the child; no more cases occurred.”

Dr. Goldsmith reports, that in an experience of three hundred cases, the disease was in the highest degree contagious; persons visiting the infected locality carried the disease home with them, and it was only by the strictest seclusion of these cases, that the spreading of the disease was farther prevented. This occurred at Oakland College, Miss. Dr. Hatch, of California, in a letter of December, 1860, writes that the Physicians of that State, have found diphtheria, as it has prevailed there quite contagious. Dr. D. J. C. Cain, of Charleston, S. C., writes, that “this disease, like all others, whether contagious or not, must have a spontaneous origin; but when this occurs, it then spreads by contagion. I have seen a number of cases,” etc. M. Penant, who observed the epidemic, in France, and whose report is considered by the Commission on Epidemics, the best presented to them, regards this disease as contagious. Wichmann, Boehmer, Migaël, Rasen and others, in Europe, adopt the same views. Jurin, Barthez, Bricheateau and many distinguished observers in England, do not think the disease contagious. The committee on epidemics of the French Academy state: “We do not hesitate to declare diphtheria contagious,” and the Lancet Commission asserts, that “it is propagated by infection and by contagion.” M. Perrochaud, in describing the Boulogne



epidemic, says the proofs of contagion were so numerous, that no one even pretended to deny them. There are a few distinguished gentlemen in America, who do not consider the disease contagious. In an autograph letter of January, 1861, Dr. D. Francis Condie, of Philadelphia, states—"no facts have been observed, by me, to warrant the conclusion of its contagiousness." The testimony, however, that has been presented to us, by a number of the most prominent Physicians in America, is overwhelmingly in favour of its contagiousness. Those in America who have written upon the subject, most generally advocate this view—Hartshorne, Slade, Thayer, Wynne, Hatch, Blake, Fourgeaud and many others, whose names are familiar to the Profession. Dr. Thos. Peacock, of London, in a letter of December, 1860, writes: "It has affected a large proportion of those brought under its influences; three children in one family, and an aunt, who only visited at the house, all died of it; the disease is most probably propagated, by a specific contagion." Dr. Jennings, of Malmesburg, England, writes of its contagiousness: "I have had such clear proof, that I do not hesitate to pronounce it of a contagious character; in the first case, under my notice, the disease was clearly contracted by nursing an adult who sank under it; two brothers of the deceased, residing a mile distant, contracted the disease, either from a casual visit, or by attending the funeral." M. Isambert declares, that "as to the contagious character of the disease, there can be no doubt, for many Physicians have contracted the disease." M. Empis, who has severely studied this subject, advocates the same view. Carmevale, Severinus, Nola, Lusitanus and others of the Seventeenth Century, declared its contagiousness. Dr. Edward Ballard, of Islington, England, has published the following interesting and suggestive case: "Jane J., æt. ten years, resided at Islington, with her mother, an aunt and three sisters. On May the 1st and 2nd, she was on a visit at the house of an uncle, whose daughter was kept at home, for what was supposed to be a cold. On the 2nd, this child (detained at home) manifested decided symptoms of diphtheria; the attack was slight and she recovered. On May 6th, a servant, in the same house, was taken sick, and died at the hospital, to which she was removed. Jane J., after remaining with

her cousin two days, returned home. She was immediately taken sick and died on May 9th. Her mother and a sister were both taken sick on the 11th. The sister, who slept with the mother, died on the 14th." Dr. Bard, of New York, considers the disease (suffocative angina) infectious. Daviot, Crichton, Monckton and a few others, have not, always, found the disease contagious. Dr. Rankin considers it "infectious to a limited degree." Dr. Wooster, of California, states that diphtheria, "in its manner of communication, is identical with variola, rubeola, scarlatina, and even typhoid fever." Dr. S. L. Bigelow, in a letter from Paris, to Dr. Warren Stone, of New Orleans, writes: "I believe it to be endowed with a highly contagious element; an observation founded upon the fairest observation of which I am capable, and by no means a theoretical convenience. If there exists a mediately contagious disease on earth, it is the angine counneuse." Dr. L. N. Beardsley, in describing the epidemic at Milford, Conn., states "that the disease was contagious is a fact which, we think, must have been apparent to every person, possessed of a discriminating mind." In the publications of the Sydenham Society, the contagiousness of diphtheria is strongly advocated; the evidence of the disease being propagated from person to person, and chiefly in the country, is convincing and most satisfactory. Dr. Peter states, that the contagiousness of diphtheria has been proved by its propagation from bed to bed; by its propagation in the same bed; from one side of the ward to the other; its propagation among patients confined to bed, more generally than among those not so confined, and its extension through large families. In Dr. Ballard's cases, out of forty-seven families, only fifteen remained healthy.

We have a very fair example, in the death of the lamented and gifted Professor Frick of Baltimore, Md., of the contagiousness of diphtheria. The disease was contracted, whilst performing the operation of tracheotomy, upon a negro woman at the Baltimore Infirmary. He complained next day of sore throat; the next day had a severe chill; on the evening of that day, he exposed himself, during a bleak March wind, at a funeral. During that night, he had a severe chill, and was then confined to his bed. He was attended by Dr. John Buckler, and as a last resort, had the opera-



tion of tracheotomy performed upon himself. The case was a very severe and painful one. It is well described, by his friend, Dr. Donaldson, of the same City. The evidence of contagion here is strong. There is also strong presumption of contagion, in the details of the fatal illness of Dr. Cooke, of Brooklyn, L. I., as furnished by Dr. Willard Parker, of New York City. The last and as satisfactory proof of the contagiousness of diphtheria, as has ever been presented, is furnished by Dr. J. B. Greeley, of Nashua, N. H. He thus writes: "The mother and four children, in one family, were carried off, one after the other, by this disease. A relative of the family, from a town eleven miles distant, was sent for, and assisted in nursing the children. After their death, she went home; ten days after, two of her children were attacked with the same disease, and two days after that, the mother was taken down. The mother and one of the children died. I am informed these were the first cases in the town." No one, on this accumulation of the most convincing and satisfactory evidence, can longer deny the contagiousness of diphtheria; the proof, thus given, is enough to satisfy the most skeptical and exacting. Whilst the disease is undoubtedly contagious, it certainly is not, however, always so. The practical deduction to be drawn, from all the evidence, is this, experience does not justify any panic or alarm on the subject of the contagiousness of diphtheria, whilst at the same time, it teaches that all unnecessary exposure is reprehensible. That though it can not be strictly considered dangerous, for friends and nurses to minister to the sick, it is certainly advisable, for those not maintaining such relations, to avoid communication with them. That, whilst those exposed, do not generally suffer, it is undoubtedly true that they do not uniformly escape.

## INCUBATION.

By a careful examination of all the French records, Dr. Peter found that the period of incubation lasted from "two to fifteen days, but most often from two to eight." Dr. Comegys, of Cincinnati, Ohio, writes (November, 1860,) that "during the incubative stage, in the cases seen by me, there seems to be a state of exhilaration, which may be denominated diphtheritic intoxication."

Some of the European writers mention the same peculiarity, although it should not be supposed, that this is common or general. The approach of the disease is, as a rule, gradual and insidious, and the health and condition seem very little impaired. Dr. Cotting, of Roxbury, Mass., says: "I have seen a child, six to seven years of age, playing in the melting snows of Spring, within twelve hours of his death." This slight and gradual impairment of physical and mental vigour is so insidious, in its course, as to commonly deceive the most watchful. It has been a chief characteristic of this disease throughout its entire history. Dr. Barbour, of Falmouth County, Ky., states that he has observed frequency of pulse to precede all other premonitory symptoms. The Medical Society of London were disposed to question the fact of an attack of diphtheria, being the result of an inoculation with diphtheritic matter fourteen days previously—assuming that the incubative stage was too long to render such a position tenable. M. H. Roger had at that time stated, that from actual cases the incubative period extended from two to seven days. The records of diphtheria in France, England and America, the cases cited by Drs. Peter, Ballard, Jacobi, Rumsey and many others prove that the incubative period frequently extends to the fourteenth and fifteenth days. Hatch, of California, has known it to extend to the twenty-first. It is not necessary to say more upon this subject.

#### DURATION.

Dr. Wooster states, in regard to the epidemics of diphtheria in California, that the duration is very uncertain, and there is no fixed characteristic in this connection. In most of the fatal cases, it may be definitely said, that death takes place in from two to six days; in these cases, death is usually caused by laryngeal, or bronchial complication. Death may take place, during convalescence, from asthenia. The duration of the attacks, where death does not take place, and where there are no complications or troublesome sequelæ, is from six to twelve days; where complications and sequelæ supervene, it is protracted to months, and in some cases, to more than an entire year. Some cases, where death does not occur, last not more than two or three days. In 120 cases that



occurred at Hopewell, Ohio, the average duration was eight days. This statement was drawn up by Dr. T. A. Reamy of that place. In the epidemic at New Carlisle, described by Dr. Meranda, "the average duration of fatal cases, was seven days." Dr. Wells, who has described the Wisconsin epidemic, states "that, when without complications, the disease ran through its stages in a few days. The false membrane disappeared in some cases, in two days, in others, from ten to fourteen days." Dr. Cötting, of Roxbury, Mass., found that after the seventh day, the crisis was past. From the records of the Canal Street Dispensary, New York, where over 200 cases of diphtheria have been treated, Dr. Jacobi states, that "cases of average severity take from five or six, to ten and twenty days to recover—the mild cases will get well in five or eight days." Dr. Cochran, of Iowa City, writes that "the duration of the disease varied from five to fifteen days, but generally, about ten or twelve days." The records of the French and English Physicians furnish very similar testimony. The duration of cases must necessarily vary; the testimony given will, however, enable us to approximate the truth.

#### RELATION OF THROAT LESIONS TO RESULT.

Dr. Greenhow, as the result of an extended experience, states, that though "the severity of the disease is commonly in proportion to the continuity and density of the exudation, yet cases sometimes occur, in which the membranous exudation is inconsiderable, and yet the general symptoms are of a very alarming kind." He has uniformly observed, that the pain and difficulty of swallowing afford no index of the intensity of the disease—it is frequently, in all epidemics that have occurred, slight in severe cases and severe in slight cases. Dr. Heslop, has found "prostration quite disproportionate to the amount of disease in the throat, coming on early and remaining, after the throat lesions had disappeared." Dr. Copeman, in his essay, declares "that the constitutional symptoms bear but little proportion to the local mischief." (According to almost universal testimony, since presented, Brettonneau's idea, that ulceration never occurred, is incorrect.) Wade,

of Birmingham, writes, that the patient not unfrequently dies, when the disease is to all appearances very slight. Dr. Rochester, of Buffalo, N. Y., in his letter of November, 1860, writes thus: "the throat symptoms are not always present—in one case, attended with great prostration, the exudation was only seen on the roof of the mouth; in another, the skin, at the verge of the scalp and behind the ears, was its principal seat, with febrile movement and much prostration." In the Wisconsin epidemic, "the throat symptoms bore no relation to the severity of the local affection." A writer in the London *Lancet*, in regard to their epidemics, thus writes—"the severity of the local phenomena, bears no relation to the severity of the general affection, nor to the character of the convalescence. There are cases, in which the local manifestation is from the first overshadowed. In some cases, where the throat manifestation was far from being intense, (yielding readily to treatment,) the constitutional symptoms were severe. In two of the fatal cases, the local symptom was early and easily checked, and was so mild, during its continuance, as to give but little annoyance, either to patient or Physician. In other cases, this state was reversed, and there were severe local symptoms, with no corresponding constitutional disturbance, and with rapid convalescence." Dr. Cotting testifies, that "the formation of the membrane does not always correspond, in amount, to the severity of the other symptoms." Dr. Jacobi observes, in regard to the cases at the Canal Street Dispensary, "a great number have come under observation, in which the local exudations were, by no means, in proportion to the character of the attack." Dr. Peter states, in regard to the French epidemics—"the amount of exudation does not indicate the severity of the disease, as fatal cases will frequently occur, where the membranes are few and small." No argument or reasoning, on these subjects, would avail anything, and we must furnish, what is demanded to prove the positions assumed—sufficient and competent testimony. It is evident, from what has been presented, that it is safe to say, there is no direct relation between the lesions of the throat, and either mild, or fatal cases, and where this relation does exist, that it is the exception, and not the rule.



## THE EFFECT OF HIGIENIC CONDITIONS ON THE COURSE OF THE DISEASE.

Whatever may be the effect of hygienic conditions, on the etiology of diphtheria, their influence on the course of the disease is undoubted. It forms of course no exception to the general law, in regard to the course of all diseases, that a strict study and practice of hygienic precautions, must contribute to the safety and welfare of patients and communities. It would be idle to quote statistics or furnish testimony for the enforcement of this patent and invariable truth.

## CITY AND COUNTRY ATMOSPHERES.

We have seen that diphtheria prevails, with equal malignity, in Town and Country, and that some of the most fatal and extensive epidemics have prevailed, in the pure bracing air of the Country. Like many non-contagious diseases, it is frequently seen in the Country, as well as in the City, and, unlike contagious diseases, it does not seem to select for general, or most frequent prevalence, the great centres of population. It has not been observed, that City atmospheres under fair hygienic conditions, give increased malignity to this disease. Some of the most malignant cases have occurred in the retired and clean hamlets of England, and the history of the disease in every Country, is but a further illustration of this fact.

## AGE AND SEX.

Attacking persons of every age and sex, diphtheria may be considered as most generally attacking children. In California, from eighteen to twenty per cent. of the deaths have been among children; Dr. Hatch of that State has examined the records, in this connection. In Avignon, eighteen per cent. of the children were attacked, in a regiment quartered there, whilst only four per cent. of the soldiers suffered. In Albany, N. Y., of one hundred and eighty-eight fatal cases, one hundred and eighty-five were children. In Boulogne, of three hundred and sixty-six fatal cases, three hundred and forty-one were children. Brettonneau, Peter,

Trousseau, and others, in France, state "that the chief subjects of diphtheria were below ten years of age." Of one hundred and thirteen cases treated by Mr. Leonard, of Dursby, England, sixty-three were under ten years of age, and only seventeen above twenty years of age. It would appear, that the susceptibility to diphtheria diminishes very early in adult life. Greenhow states, that this is the case in regard to the fatality of the disease, it being much less fatal after puberty. In the Albany epidemic, Dr. Willard states that the cases, among females, were more fatal. In the statistics compiled, however, by Dr. Reamy, of Hopewell, Ohio, the reverse of this was true; he treated ninety-two boys and forty-three girls; average age of all cases treated, five years. Dr. Kersey, of Milton, Ind., states that of twenty adults, treated by himself, all recovered; whilst the disease was fatal among children. Dr. Odriozala states, that at Lima, Peru, "the black race has been as resistant to this angina, as to yellow fever."\* Children were the principal subjects there. In Wisconsin, in one hundred and thirty-three cases, twenty-six were adults, and one hundred and seven children; of the adults, there was one aged sixty-three. Dr. Jacobi states that, in his cases, "the male sex was in a slight, but decided majority; in two hundred and thirty-five cases, two hundred were of children under fourteen years of age; the majority of the two hundred cases presented an average of three years of age; cases under one year, are infrequent, and over nine or ten, proportionally rare." In twenty cases, seen by Dr. Alonzo Clark, of New York, the oldest case was not over thirty-six years of age. It would thus seem, that in diphtheria, children are chiefly attacked; the most susceptible period, being from two to five years of age; those under one year of age and those over fourteen, manifesting a decided loss of susceptibility; that boys are more frequently attacked than girls, whilst with girls the disease is more fatal; that it attacks the oldest, as well as the youngest persons; that the fatality of the disease and the susceptibility to it, rapidly diminish after puberty. This is all that is definitely known, in this connection.

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\*This is by no means the truth in regard to the epidemics in the United States.



## DISEASES AMONG THE LOWER ANIMALS, COINCIDENT WITH THE PREVALENCE OF DIPHTHERIA.

Dr. Greenhow states, that during the prevalence of diphtheria, "a new kind of epidemic, affecting the mouth, lips and nose, with aphthous ulcerations, and the teats and feet with vesicles and ulcerations (hence called the eruptive disease, or the foot and tongue disease) appeared among the cattle." The disease had almost entirely disappeared, until recently, when it has again prevailed very extensively, and often simultaneously with diphtheria. An epidemic, in which the lungs are chiefly implicated, called pulmonary murrain, or lung disease, and perhaps more appropriately named by Professor Gluge, of Brussels, exudative pleuro-pneumonia, likewise prevailed a year or two later than the preceding, among the herds of this country, and has never entirely disappeared; although, during the succeeding twenty years, there have been some periods, when it has very generally declined, and others, when it has prevailed in a more epidemic manner. One of the latter periods began in 1859 and still continues. What renders these cattle epidemics peculiarly interesting, in connection with the present subject, is the fact that, although at the time of their appearance twenty years ago, they were quite new to the existing generation of dairymen, farmers and Veterinary Surgeons (there being no record of their prevalence in this country, during, at least, the preceding half century) pulmonary murrain, preceded by an eruptive murrain, prevailed about the middle of the last century, just before the outbreak of diphtheria which then occurred. Towards the close of the first half of the century, when Fothergill, Cotton, Huxham, Starr and other writers were describing the diphtheritic epidemic, then prevalent, an anonymous member of the College of Physicians, and Drs. Brocklesby, Hurd and Layard wrote their accounts of the murrain, then prevailing epidemically among horned cattle. This may have been indeed a mere coincidence, but that the appearance of the eruptive and pulmonary diseases, among cattle, and of diphtheria, in the human subject, are in some measure attributable to the operation of a common cause, seems probable, seeing that several of the older writers, on morbus strangulatorius,

mention its coincidence, with certain diseases among cattle. Thus Ghizi says, there was a great resemblance between the epidemic angina which prevailed at Cremona in the years 1747 and 1748 and a disease, affecting the respiratory passages, at that time prevalent among oxen. Dr. Wall, speaking of the epidemic in England, about the middle of the eighteenth century, says "this disease has so great a resemblance to the epidemic sickness among cattle, that I am persuaded it is of the same nature. Severinus, who wrote in the seventeenth century, also mentions that a great mortality, among cattle, preceded the appearance of malignant sore-throat; and M. Malouin, in his account of the epidemic diseases observed at Paris in 1746, says that the disease among cows had already appeared in France, when children were attacked by epidemic sore-throat. Both eruptive and pulmonary murrain have, in many districts, prevailed contemporaneously with diphtheria. I have ascertained this fact, with regard to London, from several respectable butchers and less directly, through professional friends, with reference to other places. Mr. Williams and Mr. Dursby testify, that the mouth and hoof disease were prevalent, among cattle and pigs in that neighbourhood, during the Spring of 1859, about the time that diphtheria prevailed at Cam. At Birmingham, several of the Physicians informed me, on the authority of the butchers, that the mouth and hoof disease and pulmonary murrain had been very common among cattle, during the year 1858 and the early part of 1859. At North Walsham and Coltishall, in Norfolk and at West Bromwich, in Staffordshire, the mouth and hoof disease likewise prevailed among cattle, simultaneously with diphtheria in the human subject. Mr. Duncalfe, of West Bromwich, has favoured me with a memorandum, in which he states, on the authority of a farrier, that a disease, attended with cough, thirst, discharge of mucus from the mouth and nostrils, and inflammation of the lungs and trachea, apparently therefore a kind of influenza, had been very prevalent and often fatal among horses in that neighbourhood, since 1857.— A similar disease appears to have prevailed, in the vicinity of Talleshunt D'Arcy, in Essex; for Dr. Walker writes that a veterinary Surgeon had informed him, that a low form of influenza, often very rapidly fatal, attended with great difficulty of swallowing and a



refusal of food, had been common among mammals. Dr. Morris, of Spalding, also informs me, that a disease, accompanied with discharge from the nostrils and fœtor of breath was very prevalent among cattle, during the epidemic of diphtheria, in the human subject. He had also, himself, seen a horse affected with swelling of the glands about the jaw, in which the mouth and throat presented an appearance, similar to that of persons suffering from diphtheria. The horse died, but three others suffered and recovered. Influenza was also prevalent among horses, at Wolverhampton, about the time when the human population was suffering from diphtheria." It is well known, that during the prevalence of diphtheria in the New England States, the cattle epidemic was of the most fatal and destructive character. In the post-mortem examinations, that were made by properly constituted authorities, the lungs, trachea, and bronchiæ were found seriously affected and the report made was, that the disease seemed to be a form of pleuro-pneumonia. Since the disappearance of diphtheria, this cattle epidemic has disappeared also. During the epidemics, in New York, of diphtheria, cattle, that were kept confined, suffered from a disease of the mouth, tongue, hoofs and lungs. It has not given the same trouble, since diphtheria has ceased to prevail there epidemically. In Kentucky, where diphtheria has extensively prevailed, the cattle have suffered from a species of murrain, which affected chiefly the lungs and throat.

Dr. Goldsmith, of Oakland College, Mississippi, seems to think, that there is some connection between diphtheria and a disease that has extensively prevailed among the cattle, in his neighbourhood. "This cattle disease prevailed among the stock of our neighbourhood, whilst diphtheria was raging; it is certainly a coincidence, that the country adjacent to the plantation, on which 'the black tongue' prevailed, was most affected with diphtheria." In this cattle disease, there is great prostration; the mouth is sore and tender, with an abundant discharge from the salivary glands; the animal refuses to eat, droops and dies; the tongue becomes of a dark and ecchymosed appearance. Dr. Sanderson states that during the prevalence of diphtheria, a similar affection was observed among swine; on a post-mortem examination made, "there was intense

maxillary glands, and the mucous membrane of the fauces covered by a characteristic membranous exudation. Death was preceded by symptoms of suffocation." The coincidence of these diseases in the lower animals, with the prevalence of diphtheria, in the human subject, is most interesting, and is worthy of general and special examination.

#### COMPLICATIONS.

Greenhow states, that Dr. Wall saw diphtheria complicated "with scarlet fever, with small-pox, and, probably, also with measles." M. Lemaire mentions cases of incomplete amaurosis, not succeeding, but accompanying the disease. The constitutional condition, known as purpura, occasionally is seen in cases of diphtheria; Dr. Greenhow, Dr. Gull, Mr. Williams, M. Trousseau, and others, have reported such cases. Hæmorrhage, while it is general from the mucous surfaces, deserves to be considered as a complication. Mr. Clowes, of Stalham, England, has seen cases, where there was hæmorrhage "from the gums, fauces, nose, vagina and anus." These cases were associated with purpura. Mr. Ray has seen an eruption, "very like the roseoloid eruption of typhoid fever; there were no petechiæ, and the eruption was confined to the thorax, abdomen and back." Greenhow has seen erythema nodosum, in the course of diphtheria. Trousseau states, that the disease is frequently accompanied with an eruption of *rupia simplex*—albuminuria very commonly occurs, and Dr. Wade, of Birmingham, frequently saw instances of hæmaturia. The urine is frequently found to contain tube casts and renal epithelium. Wade states, that these tube casts are of three kinds, "small waxy casts, casts of similar size, but granular, and thirdly, ordinary epithelial casts." Wells gives an instance of genuine gangrene, as reported to him by Dr. Clark. Dr. Jacobi mentions that, in the course of thirty-two days, he diagnosticated, in the same case, "scarlatina, urticaria, measles and varioloid." Croup is the most frequent and most fatal complication of diphtheria; bronchitis and pneumonia frequently supervene; scarlet fever precedes, accompanies and succeeds diphtheria. We may classify the complications thus—croup, scarlet fever, tonsillitis, bronchitis, pericarditis, pneumonia, erysip-



elas, albuminuria, hæmaturia, hæmorrhage, purpura, measles, erythema nodosum, rupia simplex, urticaria, variola, varioloid, roseoloid eruptions, gangrene, etc. The most common complications are croup, scarlet fever, bronchitis, pneumonia, tonsillitis and albuminuria; the others are rare.

## CONVALESCENCE.

The convalescence in this disease is most remarkable and peculiar. It is very slow, tedious, interrupted, frequently complicated with other diseases, treacherous, unreliable and protracted. We do not think it advisable, or necessary, to give cases to prove this, as such a course would (if demanded) be only adapted to a volume, and not to a paper of this kind. In convalescence from diphtheria, we have, at times, existing the traces of the original disease, its complications, and the incipient symptoms of diseases, which form the not infrequent sequels of diphtheria. The utmost care and caution should be bestowed at this time, for relapses are very common and very fatal. The slightest exercise or imprudence is frequently the cause of great danger and death. Exercise, when the resulting anæmia and prostration from the disease are marked, is attended with great danger. Many persons have thus caused a fatal termination by heart-clot or by a return of the disease, when quiet and rest, until strength was regained, would have insured a safe recovery. During convalescence, the urine is frequently loaded with lithates; the appetite is very deficient; the prostration extreme and characteristic; the nervous system (even when paralysis, amaurosis and other nervous disorders do not supervene) deeply and seriously affected, and the muscular power almost destroyed. Here "non progredi est regredi."

## RECURRENCE OF THE DISEASE AND ITS SEQUELE.

We have seen that in diphtheria, relapses are very frequent; it is no less true, that occurrence of the disease, is by no means uncommon. Cases where the disease has attacked the same person twice, are frequently occurring; sometimes the disease returns a third time and even a fourth. In the earliest epidemic of diphtheria, in New Jersey, the disease

attacked the same person four times, in one year; the fourth attack proving fatal. The describer of this epidemic thus writes.— “ I have frequently observed, that once having the disease is no security against a second attack. I have known the same person to have it four times a year, the last of which proved fatal. I have known numbers that passed through it, in the eruptive form in the Summer season, that have died of it in the succeeding Winter.” Dr. Wynne states, that a persevering use of a tonic treatment he has found useful, in preventing a recurrence of the disease. The disease usually observes no tendency to recur at fixed periods; there is no periodicity generally manifested. Dr. M. H. Houston, of Richmond, Va., states that he has observed this phenomenon, and has successfully treated such cases, by the judicious administration of quinine. It recurs, from a three weeks interval, to intervals of many months in length. In some epidemics, relapses and recurrences have been manifested to an extent of twenty-five per cent. of all the cases attacked; this is, of course, higher than the usual percentage, which rarely exceeds ten per cent. “ Guersant performed the operation for tracheotomy twice, in each of two children, after intervals, between the two attacks, of eleven and twenty-one months.” It appears then, that there is usually no fixed interval, at which these recurrences are manifested. It may be said to extend from three weeks, to many months. Recurrences of diphtheria, unlike those of scarlet fever and some of the exanthemata, are usually more severe, than the first attack of the disease; the fatality, in such cases, being often very great. Many able observers have declared that an attack of scarlet fever, of diphtheria, or of many of the exanthemata, acted as a predisposing cause of an attack of diphtheria. With the exception of increased severity in the attack and the sequels, these cases present nothing of special importance.— The sequelæ of diphtheria are much more common now than formerly; indeed the early writers, on this subject, pay but a cursory attention to them. In recent years, they have been fully studied; Faure, Trousseau, Bouillon, Lagrange, Brettonneau, Blache, Gull, Kingsford, Sanderson, Greenhow, Reynolds, Wynne, Slade, Thayer and many others have devoted much time to their investigation.— A large monograph, by Dr. V. P. A. Maingault, deserves to be



especially noticed in this connection. His researches on paralysis, as a sequel to diphtheria, are voluminous and interesting. Maingault's description of the first appearances and effects of this kind of paralysis, is graphic and masterly: "Two or three weeks after all throat affection has disappeared, the first symptoms of paralysis show themselves; they are developed slowly; the patients may even have made considerable progress towards recovery, before they occur. The first thing noticed is a paralytic affection of the soft palate, characterized by a difficulty of deglutition and a nasal speech; phenomena that may entirely disappear, when the general muscular weakness shows itself. In some patients, there is sudden emaciation. Vision becomes imperfect and even complete blindness may supervene. The strength fails gradually; formication occurs in the extremities, accompanied by more or less severe pains in the joints. Walking becomes more and more impracticable, until the upright position is impossible. The paraplegia is then complete.—The upper extremities share this weakness; the head becomes too heavy and sinks on the chest; the muscles of the trunk are incapable of sustaining the weight of the body. Strabismus, distortions of the face, dibbling, defective articulation and paralysis of the bladder and rectum also supervene. There is an entire absence of fever; the pulse is small and is reduced sometimes to fifty; at the same time, the heart's action is tumultuous and there are anæmic murmurs. With these and other symptoms of defective innervation, the intellect remains intact, but the mental powers are sluggish.—The disease may proceed to a fatal termination, or, if it terminates favorably, the patient's strength returns gradually, and a cure is effected in a period varying from two to eight months." This is of course the type of a severe and serious case. The most common form of paralysis is that of the velum palati; this is quite common and is seen in almost all epidemics. It almost invariably precedes other forms of paralysis. The sequelæ may thus be stated: Paralysis of the velum and tongue; general paralysis; paraplegia; hemiplegia (rare); paralysis of the bladder and rectum; strabismus; amaurosis; paralysis of the iris and ciliary muscles; otalgia; formication; numbness; mal-articulation; pyæmia;\* spa-

\* Reported by Dr. Cooper, of San Francisco.

næmia; anæmia; hydræmia; abscesses; diarrhœa; loss of taste and hearing. As in most nervous disorders, the alternations in the manifestations of the paralysis may be very great. Sometimes one limb is attacked, and becoming much improved, the paralysis is next exhibited in another, or perhaps in the muscles concerned in deglutition. This may be preceded by formication, numbness, tingling, etc., and frequently these anomalous sensations succeed the manifestations of paralysis. Dr. Cooper, of San Francisco, saw "many of his patients die suddenly from pyæmia." Anæmia, spanæmia and hydræmia, are the most invariable sequels of diphtheria. Dr. Condie, of Philadelphia, had seen abscesses of the tonsils and salivary glands and diarrhœa, as sequels of this disease. Dr. Jacobi has seen cases where, in addition to loss of hearing, seeing, tasting and smelling, impotency ensued. He has seen one case in which "intelligence suffered in an equal degree" with the senses of seeing, hearing, etc. Dr. James B. Reynolds, of New York City, has contributed a valuable article on "paralysis, consequent upon the poison of diphtheria." He presents the records of seventy-seven cases.

The Epidemiological Society of London, in the report on diphtheria, does not, strange to say, allude to its sequels, while Chomel, of France, and Dr. Bond, of New York, seem to have been familiar with paralysis, as a sequel to diphtheria.

Dr. Reynolds quotes an interesting case of an American lady, who, while suffering from diphtheritic paralysis, went from Paris to London; the damp climate of this last City made her worse, and on returning to Paris, she rapidly convalesced.

Sometimes the muscles of the heart are paralyzed, and death suddenly ensues. One of the incipient signs of approaching paralysis, is the inability to pronounce the labial consonants, and a marked nasal pronunciation. Dr. Reynolds states that Mr. Dixon, of the Ophthalmic Hospital, London, could, with the use of the ophthalmoscope, find no lesion in cases of diphtheritic amaurosis; albumen was, at times, present, and then absent; in the worst cases of paralysis it was not manifested.

The intellect is very rarely affected in the sequels of diphtheria; Dr. Jacobi reports one case, and Dr. Ranney another; Dr. T. Gail-



lard Thomas reports a case, where there was much mental irritability manifested. Disturbance in the organ of hearing is comparatively rare. Impotency sometimes occurs. Occasionally the general paralysis is complete; it is often accompanied by a sense of coldness, and frequently by articular pain. We see cases both of myopia and presbyopia manifested, during the sequelæ of diphtheria. Dr. T. Gaillard Thomas, of New York City, reports an interesting case of myopia, attended with convergent strabismus, great muscular prostration, strongly marked paralysis of the velum palati and partial paralysis of the limbs. In the acute stage, he describes the fœtor of breath as having been so great, as to taint the entire atmosphere of the room. M. Maingault has described a typical case, which admirably delineates the course and history of diphtheritic paralysis; the details of the case afford a better conception of this peculiar condition, than could be possibly formed, from the best general description.

“Boy, æt. four years; living at home; of good constitution; large and well developed, and never having had any serious malady; was attacked with high fever, with extreme difficulty in swallowing, August 1st, 1858. Upon the third day, false membranes were observed upon the tonsils; there was little glandular enlargement, etc. The child was soon convalescing. Some days passed without anything particular to note, when suddenly the voice assumed a nasal tone, and liquids were ejected through the nose, while solids were swallowed without difficulty.— In spite of this complication, the little patient regained his strength; there was some appetite, and the digestion was good; little by little the nasal voice became less marked, and the deglutition of liquids easier. But in spite of a tonic regimen, and of assiduous attention, and though for fifteen days the throat was cured, yet the child became more and more feeble in the legs, falling frequently and walking with an unsteady and tottering step. This feebleness increased daily; soon the child could walk but a few steps, and only by holding on to the furniture; there was pallor and emaciation.

“September 7th.—The feebleness was so marked, that he could not stand upright, and if left without support, he would sink down in a mass; sitting, or reclining, it was with difficulty that he could

move his legs. The skin was flaccid; anæsthesia was so complete, in the lower limbs, that they could be tickled and pricked, without the patient being conscious of it; upon every other part, sensation was normal.

“Later: Child easily moves the arms; no strabismus; face pale and a little bloated; appetite diminished, deglutition easy, and only at rare intervals do liquids return by the nose; soft palate contracts well; obstinate constipation; pulse sixty, feeble and compressible; no bruits in the vessels of the neck; urine does not contain albumen. (Iron, quinine; frictions with flannel, impregnated with vapour of benzoin; sulphur bath every two days.)

“September 16th.—One month from the commencement of the paralysis.—In the lower limbs, the troubles of sensation and motion the same as stated, but the hands and arms seem to participate in the febleness of the legs; there is some tremulousness; sensibility diminished; continue same treatment.

“September 22d.—Same weakness in the legs, but febleness of the arms much increased; it is only with great difficulty that the patient can raise his arms to his head, using his hands with reluctance; he does not desire to play, and if he takes his play things, they immediately fall from his hands; he cannot feed himself.—The head reclines upon the chest; can be lifted, but immediately falls again. There is the most profound insensibility in the arms, back and chest; tickling and pricking cause no effect. Face is not affected; no strabismus; sight seemingly not affected; but little appetite; same obstinate constipation.

“October 2nd.—One month and a half. The state of the patient is a little better; the legs are less feeble; can stand upright and take a few steps; uses his hands somewhat easier, but no sensibility.

“October 10th.—Strength returning; can remain a long time upon his legs, but his walk is difficult, dragging his feet along the ground; the arms have recovered their action; the head is held up quite well, but insensibility persists. From this period, the troubles gradually diminished in intensity; in order to hasten recovery, electricity was used, but on account of the great alarm produced, it was renounced; sensibility obtuse, but contractility normal.—Convalescence continued; strength returning; walking better;



emaciation continues and appetite poor; pulse fifty and feeble; no bruit in cervical vessels.

“November 24th—Over three months. Sensibility still obtuse in feet and hands; child can take long walks.

“Patient seen for the last time in the month of March, seven months from the commencement of the paralysis; pallor persists; embonpoint not yet returned; appetite capricious; easily fatigued; no symptom of paralysis; recovers.”

We have avoided giving cases, on account of the space occupied by them, but this is so suggestive and graphic, that, with a few abbreviations and omissions, we have presented it. Of course it is not a type of the majority of convalescents, but only of those who suffered severely from paralysis; even then, the anæsthesia in this case is more than usual. Sometimes, the paralysis is more extended, and we have strabismus, distortions of the face, etc., and frequently the period of convalescence extended over a longer period of time. Dribbling of saliva, constipation, involuntary discharge of urine and fæces are sometimes manifested. The intestines sometimes suffer, and it is difficult to overcome the resulting constipation. Maingault records a case where no action of the bowels could be procured for twenty-three days. The genital organs and the power of virility are frequently affected most seriously, and this condition exists, long after all symptoms of paralysis have disappeared. The muscles of respiration are seldom affected, and those of the heart very rarely. Sometimes, there is hyperæsthesia in one part of the body, whilst anæsthesia exists in another. Again, we find neither entire hemiplegia, nor entire paraplegia, but partial examples of each, in the same patient; a right arm, and a left leg, or vice versa, being simultaneously affected. Trousseau states that the paralysis is often erratic; moving from one part of the body to another. In diphtheritic paralysis, the prognosis is always favourable. In seventy-seven cases, examined by Dr. Reynolds, of New York City, there were only nine deaths. “Two by masses of meat entering the trachea; one from convulsions; one with kidney disease; one from starvation; one from apparent syncope, the result of depression.” Albuminuria is often present in these cases; there are no peculiar symptoms

or invariable results which characterize its presence, or mark its absence; when in large quantity in the acute stage of the disease, it is a grave symptom; in the convalescent condition, it more generally coincides in its presence with severe results; but not always. It does not always, as is claimed by many, coëxist with amaurosis. Anæsthesia has been so complete, that sparks of electricity have been drawn unconsciously, from the soles of the feet. "M. Trousseau was for a long time under the impression, that the loss of power was dependent on inflammation of the coats of the nerves supplying the parts affected, and was led to this conclusion from the fact, that the palate and pharynx are more affected, than the system generally; this view has been abandoned, and he now attributes the results observed, to the effect of the diphtheritic poison on the system, through the blood." A somewhat similar view has been advanced by Dr. Gull, of England. Finding, in one case, that the membranes of the brain and cord were in a state of suppurative inflammation, he suggested that the original seat of the disease being near the cervical portion of the spinal cord, the paralytic symptoms may arise, from an extension of the disease from the fauces to the cord. This view is not here advocated, yet it would be well to examine the cervical portion of the cord, in all cases, where death supervenes, after the occurrence of paralysis from diphtheria. The phenomena manifested are undoubtedly due, to the action of the diphtheritic poison upon the nervous system through the blood; were the positions advocated by Trousseau and Gull in the least tenable, we should have paralysis occurring during, or immediately after, the acute stage of the disease; or after cases, in which the throat had severely suffered. It is known that the facts in this connection are frequently the reverse of this; paralysis occurring many weeks, and sometimes months after the acute stage of disease; often, where the throat has scarcely suffered in any respect; and not at all, where the throat has suffered severely.

Dr. Whitney, of California, states that in the sequels of diphtheria, he has found the urine not only albuminous, "but containing blood corpuscles, fibrinous and epithelial casts and cells, and crystals of lithic acid."

Dr. Faure, of Paris, writes, "the legs can no longer carry the body;



the arms lose their power; the soft palate dangles like a dead curtain; swallowing and even breathing become almost impossible; the pupils are dilated; vision much impaired; sensation diminished, sometimes lost, or replaced by formication; in some, parts of the body become œdematous, in others gangrenous; others are subjected to repeated faintings. Reason flashes through the dull stupidity and a wandering smile lights up now and then the vacant countenance." This continues until the health is slowly and gradually regained. Dr. Faure is the first, of the French Physicians who turned their attention to the sequelæ of diphtheria.— Dr. S. D. Gross, of Philadelphia, in an autograph letter, writes that he saw a case of diphtheritic paralysis which involved the motor nerves of the right side of the face and also of the lower and upper extremities, which were all in a state of anæsthesia." Dr. Kersey, in the Indiana epidemic, saw cases of "partial idiocy," as the result of diphtheria; this condition is sometimes seen, but, almost universally, mental torpor (which passes away, when convalescence is established) is mistaken for idiocy. Dr. Meranda, in the Ohio epidemic, saw cases of presbyopia. Cases have been seen in England, where, as a result, from diphtheria, the fingers and arms have been covered with blebs of serum. Graëfe, in Germany, and Jobert, in France, have described epidemics of diphtheria, where the chief sequel was ophthalmia. Greenhow has seen, as sequels, gastrodynia, dysentery, diarrhœa, general squinting, otalgia, deafness and abscess, with the varied and general manifestations of diphtheritic paralysis. Herrera, who described the Spanish epidemics of the seventeenth century, mentions that paralysis of the muscles of the throat was a frequent sequel. Sloughing of the tonsils and loss of the uvula and portions of the soft palate have been seen, but very rarely. Dr. Morris, of Spaulding, England, saw one such case. Dr. Greenhow states, that he has never seen albuminuria as a sequel, but very commonly as a complication of diphtheria. Uræmia, he states, has never been observed, in connection with the albuminuria of diphtheria. It has never been seen in diphtheria, so far as our immediate experience extends. In all of the epidemics in England, anasarca has never been seen as a sequel of diphtheria, uncomplicated with scarlet fever. Aphonia is often seen. Dr. Gull has published,

in the London Lancet, a case where there was total loss of power in the phrenic nerves and where the diaphragm was, consequently, unmoved in respiration; the breathing was entirely thoracic; there was blueness of the lips and tracheal rales; case ended fatally.—Trousseau mentions an instance, where a woman, immediately after parturition, was seized with diphtheria; on the tenth day she commenced convalescing; albumen was now seen in the urine; on the twenty-fifth day, liquids could not be taken, and the woman nearly strangled, in her efforts to swallow solids; about the fortieth day, improvement took place; on the fiftieth day, delirium and convulsions, as a sequel, ensued; under the use of musk this condition passed off; paralysis now complete, involving bladder and rectum; complete anæsthesia; under the use of electricity and syrup of sulphate of strychnia, improvement was again manifested; large quantity of albumen present, but no disturbance of vision; erratic paralysis, showing no important lesion of nervous centres; final recovery. Mr. Dixon, of the Ophthalmic Hospital, London, states that the impairment of vision is due to the loss of adjusting power or to paralysis of the ciliary muscles; in presbyopia, resulting from diphtheria, the difficulty will be removed by using low convex glasses; in myopia, thus resulting, concave glasses are to be used. (Mr. Dixon states, that presbyopia in the aged, when not the result of disease, is more frequently due to a loss of adjusting power, than to any change in the lens.) In diphtheritic presbyopia and myopia, the impairment of vision is due solely, or at least chiefly, to this loss of adjusting power, and can easily be corrected, by the use of the proper kind of glasses. These are the most common of the sequelæ of diphtheria, and indeed all, that we have been able to learn.

#### PROGNOSIS.

Hippocrates tells us, “that the best Physician seems to be, he who knows how to know in advance;” and the testimony of ages has proved both the truth and wisdom of the remark. The advice of the father of medicine, on this important subject, will never lose its value. “Examine the countenance of the patient, to see if the physiognomy is like that of a person in



health, and especially, if it preserves its natural expression. This is its most favourable state, and the more it departs from it, the greater is the danger." In the simple form of diphtheria, where the constitutional disturbance is slight; the exudation circumscribed; where there is no headache and no croupal complication; where the patient is healthy and not recently the subject of some exanthematous disease; where there is a fair hygienic condition, both public and domestic; where the exudation is light-coloured, thin and clears off early and easily; where there is not much discharge from the nostrils, and not much fœtor of breath; where there is no bronchial, or pneumonic complication; where there is no albuminuria, or if present slight; where there is, particularly, an absence of hæmorrhage from the mucous surfaces, an absence of vomiting or diarrhœa; where there is not much swelling of the salivary glands; where there is but little dysphagia, no dyspnœa and no orthopnœa, the prognosis is usually good.

When the larynx escapes, the case should be closely watched, for under this condition, the patient's calmness and quietness may deceive the most experienced and vigilant. Trousseau, Bretonneau, Lemoine and others attach much importance to an escape of the nostrils from the exudation; in their experience, where the contrary is the case, the result is always doubtful. There is a form of dyspnœa which specially deserves mention here, for it may occur, when the danger is not as great, as might be supposed. Dyspnœa sometimes occurs in diphtheria, when the lungs, bronchiæ, trachea and larynx are totally uninjured. The nostrils in such cases, are plugged with a viscid matter, whilst the tonsils and uvula are much swollen, and while dyspnœa is manifested there is certainly nothing of the kind of danger, that ensues when the respiratory passages below the rima glottidis are implicated. When dyspnœa occurs, without the symptoms of croup, or the signs of bronchitis, or pneumonia, and where it is not evidently the result of a fatal prostration, it will be found almost invariably resulting from this condition of the nostrils, tonsils and uvula. Dr. Stephen Monckton, of England, has found that "a lax pupil and feeble pulse" betoken a state of great danger. The report of the Lancet Commission is, "that in simple diphtheria, the prognosis is

favourable; in diphtheria with croupal symptoms, it is very unfavourable, and in malignant diphtheria it is most unfavourable." The prognosis, in diphtheria, should be guarded and only given with great care and reflection. The disease is so treacherous and danger so often lurks, where it is unseen and even unsuspected, that the Physician can not be too guarded in expressing an opinion as to the result. Such reservation, or reticence, in this disease, betokens wisdom and efficiency and not ignorance, or indecision. Patients frequently die, when to all appearances they are doing perfectly well. A child is playing listlessly about the room, complains of fatigue, lies down, and without any symptoms foreshadowing the result, passes calmly into the sleep of death. Dr. Barbour, in describing an epidemic at Falmouth, Ky., relates a case, "where a little boy of ten years of age, sat up and whittled a stick the most of the day and, in the evening, put on his coat and drew on his boots, a few moments before he died." Dr. Minot reports the case of Mr. Gardner, of Boston, who after an attack of diphtheria, during which he was not confined to bed, walked out with his attending Physician; "on returning to the house, he expressed a wish to lie down, and Dr. Adams accompanied him to his chamber; he had hardly thrown himself upon the bed, when he started up, in a paroxysm of suffocation, and fell back dead." Such cases, and a long list that might be given, should teach the Physician that, in diphtheria, reticence is the part of true wisdom.

Where in the sequel, paralysis ensues, the prognosis is favourable; in seventy-seven cases, reported by Dr. Reynolds, of New York City, only nine proved fatal; two of these died from masses of meat entering the larynx and one from starvation; so that six in seventy-seven is more properly the indication of the result. Age is a very material consideration, in determining the prognosis; the greatest number of deaths occur in children, and between the ages of one and six; next, between six and ten; after ten, the mortality is singularly and strikingly lessened.

Anæmic and scrofulous children are very liable to the disease, and it is, with them, particularly fatal. A strumous taint is very unfavourable. Dr. Jacobi states, in regard to the fatality of the disease, that in "five hundred cases, we have not lost more than



thirty;" he mentions the case of a girl, of three years of age, recovering after the appearance of blood, pus and albumen in the urine; there were tubercles in the lungs. Dr. Jacobi states, that the pieces of membranous exudation which are at times discharged, and which cause a grave prognosis, when, to the surprise of the Physician, the patient recovers, will frequently be found to come from the posterior nares; his attention was called to this, by a Physician, who, during an attack of diphtheria, "brought up these cylindrical tubes," but found that they came from the nares. Dr. Greenhow states, that when the membranous exudation becomes thick, brown, or black, he has usually found the result unfavourable. (Mr. Coleman, of Wolverhampton, has found pain in the cardiac extremity of the stomach a fatal symptom.) In regard to albuminuria, it may be definitely stated that, although a grave symptom, at all times, it is not necessarily fatal. It is wanting, frequently, in severe cases; and largely manifested in many that recover. The condition marked by the supervention of purpura is always unfavourable. Delirium is exceedingly rare, but always an indication of great danger. Mr. West furnishes an interesting case, showing the treacherous character of convalescence, and the extreme liability of the Physician to give an incorrect and premature prognosis; and, most especially, where this is favourable. The case is that of a woman, who declined entering the hospital at Birmingham, but continued to attend, as an out-door patient, walking a mile daily, for this purpose. "The throat improved in appearance each day; but, notwithstanding this amendment, she became weaker, and returning home, tired, on the third day, she took some food and went to bed. She appeared very drowsy during the remainder of the day, was disinclined for exertion; refused nourishment and continued in a dozing condition, until morning, when she asked for breakfast. Whilst being lifted up to receive it, she fell back fainting and died." Dr. Greenhow, after giving the particulars of a case of diphtheria, shows, at its conclusion, how very suddenly and unexpectedly death sometimes makes its appearance: "22d; continues better in all respects; appetite returning. Notwithstanding my earnest recommendation yesterday, she was sitting on a sofa downstairs, at the time of my visit, and her friends could scarcely believe that danger was immi-

ment. She died suddenly the same night." This was a case of a young girl, who, on the 15th of that month, seven days after her being attacked with diphtheria, had walked a distance of "nearly a mile" to see her Physician. From the fact that when paralysis ensues, it is usually erratic, the inference is, that the nervous centres have suffered no serious lesions.

The unfavorable symptoms, in diphtheria, are severe chill, followed by high fever, headache and vomiting; where the swelling of the salivary glands and the discharges from the nostrils are excessive; where the exudation is thick and dark coloured, attended with extreme fœtor of breath, and showing a disposition to extend; where croup, bronchitis, or pneumonia supervene; hæmorrhage from the mucous surfaces; purpura; excessive albuminuria; great swelling of the cervical glands; coolness of surface, with complaints of heat; obstinate diarrhœa; dyspnœa, depending on trouble below the rima glottidis; extensive membranous exudation, about the nostrils; petechiæ; extreme frequency of pulse; laxity of pupil; scarlatinal complication; where the exudation is tenacious and shows no disposition to exfoliate; where orthopnœa is manifested, with restlessness and many of the usual symptoms, preceding death.

Where the patient is under ten years of age; of scrofulous habit; the subject of an attack of scarlet fever, or of any of the exanthemata; where the hygienic condition, public, or domestic, is bad, etc., the prospect of recovery, with any of the conditions just specified, is still farther impaired. Of course, the reverse of these symptoms, or their absence, will induce a favourable prognosis.

*Mortality.*—The mortality, in this disease, is very varied; depending much on the character of the disease, whether malignant or non-malignant, and in a very great measure, upon the treatment adopted. If the disease is non-malignant, the mortality is slight under the worst circumstances, and if it is malignant, the mortality is very great, under circumstances the most favourable. Treatment in this disease, influences the mortality to a great degree, whether the disease be malignant or otherwise. Thus, an unfortunate Physician, at Chapelle Vêroux, lost exactly sixty patients, in sixty cases, and another at Tunbridge Wells, in four hundred cases, did not lose one. Of course there may have been much difference in the



type of the disease prevailing, but it is not reasonable to suppose, that the difference could have been indicated, in these results. There is one instance recorded, of the mortality in a Physician's practice, during the same epidemic, having been diminished one-half, by a change of treatment. This single fact is more expressive, than all the arguments that could be advanced. Where the sixty cases were all lost, the treatment was the same in all; bleeding, blisters, leeches, with the use of calomel, and purgatives. Where the cases were all saved, the treatment was exactly the opposite.— Three-fourths of the deaths are caused by the supervention of diphtheritic croup. The difference in the reported mortality is due, chiefly, to two causes: difference in type and difference in treatment. A true anti-phlogistic treatment will often bring, to a fatal termination, the mildest case of genuine diphtheria. In North Adams, Mass., there were eighty-five cases and no deaths; in West Stockbridge eighty-one cases and eight deaths; in Menomenee, Wis., one hundred and thirty-three cases and four deaths; in Orange, Conn., fourteen deaths in the first fifteen cases. In Albany, N. Y., there were two thousand cases and one hundred and eighty-eight deaths; in Edinboro, Dr. Creighton treated forty-five cases and lost five; in Providence, R. I., there were five deaths in eight cases; in Pittsfield, Mass., three deaths in six cases; in Petersfield, Eng., one death in every ten cases; in Lima, Peru, one in six; at Chateau Chinon, forty-five deaths in one hundred and fifty cases; at La Ferté-sur-Amance ten deaths, in one hundred and twenty cases; Tunbridge Wells, no deaths in four hundred cases; at Cache-Creek, sixteen cases and no deaths; Chapelle-Véroux, sixty deaths in sixty cases; Hopewell, Ohio, five in one hundred and twenty cases; New York City, thirty deaths in five hundred cases; \* Milton, Ind., five deaths in eighty-four cases; New Carlisle, Ohio, seven deaths in one hundred cases; in South-Onandaga, ten deaths in eighty cases—with many other places, where the number of deaths has been given, but the proportion of recoveries omitted.— Of course these figures do not express the number of cases of diphtheria that have existed, at the places named, but the proportion of deaths occurring in the practice of respectable Physicians,

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\*Dr. Jacobi.

in regard to this disease. It will be found, on examination, that no deductions whatever can be made from the statistics furnished; as the mortality in this disease varies interminably; depending on the type of the disease, its treatment and locality, etc.\*

#### IMMEDIATE CAUSE OF DEATH.

The immediate cause of death, in diphtheria, in three-fourths of the cases, is attributed to the supervention of croup. Most of the statistics show, that this is about the proportion of cases destroyed, by the supervention of this disease.

Dr. Peacock, in an autograph letter, thus writes: "I believe the cause of death to be generally the constitutional and not the local condition." This is of course excellent authority, but the facts and statistics in this disease show, that this is an error; the patients in diphtheria do not often (that is proportionally,) die from the constitutional complications.

Dr. Cain, of Charleston, S. C., who has seen much of this disease, writes that "the immediate cause of death, in all the cases which have fallen under my observation, is asphyxia, from occlusion of the larger, or smaller air tubes." There can be no doubt, but that many deaths, that have been attributed to croup, were caused by this condition.

Gangrene of the throat has been at times, though rarely, a cause of death. Dr. Kersey, of Milton, Ind., Dr. Odriozala, of Lima, Peru, and a few others, record such cases.

Pneumonia, bronchitis and croup, are the most frequent complications of diphtheria, and consequently produce death, in a large number of cases; next to croup, these diseases should rank, as the proximate causes of death. Edema of the lungs is mentioned, by Dr. Jacobi, as one of the causes of death in his cases. Asphyxia, from the exfoliation of the membranous exudation, about the rima glottidis, is another cause.

Where tonsillitis, attended with the formation of abscess, supervenes, death is sometimes caused, by the sudden rupture of the abscess, and asphyxia produced, by the entrance of pus through the rima glottidis. Dr. Minot, of Boston, relates a case (Mr. Gard-

\*Mortality, 410 in 4,109 cases—being an average in all of these cases of 10 per cent.



ner's) of this kind. Dr. L. N. Beardsley, of Millford, Conn., and Dr. Reynolds, of New York City, give cases where death was caused by starvation, from implication of the œsophagus. Syncope, from nervous depression, convulsions, diseases of the kidney, have each been the immediate cause of death, in diphtheria. Dr. M. L. Linton, of St. Louis, Mo., writes, "most of the cases that I have seen terminated fatally, by throat symptoms." In the forty-five cases related by Dr. R. W. Crighton, of Chapel-en-le-Frith, nine died: six from asphyxia; three from asthenia. Asthenia is the most common cause of death, after the acute stage of the disease has passed: being the result of intense anæmia, or hydræmia; or from irrecoverable prostration of nervous influence, whether occurring primarily, or secondarily. Pyæmia has been mentioned as a cause of death in diphtheria. Blake, of California, states that "the most common, anatomical, cause of death is the enlargement of the cervical glands; this is also the opinion of Dr. Wooster, of that State. The intemperate use of food, when in a weak and exhausted condition, seems to have been the cause of several deaths; the shock, here, on one of the chief nervous centres, may explain such a result. It may possibly be only a coincidence, but many deaths are recorded as having taken place, just after the indiscreet use of food. Undue exertion (when prostrated) has been a proximate cause of death. Patients cannot be too carefully warned against the indiscreet use of food, or against undue exercise.

The depression from obstinate vomiting, from diarrhœa, from hæmorrhage, have all been the proximate cause of death. We would thus classify the causes which have, proximately, induced death—croup; pneumonia; bronchitis; membranous exudation extending into the trachea and bronchiæ; asphyxia from various causes, as exfoliation of membrane, or rupture of abscess, or implication of the nares and tonsils; asthenia; gangrene; pyæmia; hæmorrhage; heart-clot; convulsions; syncope; Bright's disease; pericarditis; intemperate use of food, under prostration; undue exercise; diarrhœa, etc.

This disease has claimed many illustrious and prominent persons as its victims. Brettonneau regards the death of Josephine as due to diphtheria, and that of Washington has been attributed to the

same cause; in recent years, it has caused the death of Senora Stéphanie, Queen of Portugal; MM. Gillette and Valleix, distinguished Physicians in France; Drs. Frick, of Baltimore; Cooke, of Brooklyn; Adams, of Boston, and others. The disease has been quite fatal, during the last few years, in Philadelphia, Cleveland, and many parts of Kentucky and Virginia.

#### TREATMENT.

The treatment of this disease is simple and is easily described; the indications being few and prominent. It may be divided into two forms: the constitutional and the local treatment.—In the constitutional, we first endeavour to arrest the zymotic and septic changes, rapidly taking place in the blood, and then to keep the patient alive, by the most rigorous sustaining treatment possible, whilst the effects of the disease are either being developed, or are passing away. In the local treatment, the object is to destroy and circumscribe the membranous exudation; to prevent its extension; and to remove, in every way possible, the physical and sensible evils, resulting from its presence. In no disease is judicious treatment more important, in none is injudicious treatment more fatal and reprehensible. Let the anti-phlogistic treatment, in its early signification, be adopted, and the Physician who lost sixty patients in sixty cases, would not long be mentioned as the singular example of professional consistency and misfortune. The old lines, that were wont to bring the smile of approbation and satisfaction to the disciples of Galen, Sydenham, Gregory, and others, would, if adopted in diphtheria, be soon regarded as the death warrant, conveniently arranged in metre—

“ He soon returned—his skill applied—  
 From the vein, flowed the crimson tide;  
 And as the folk behind him stand,  
 He thus declared his stern command:  
 At nine, these powders let him take;  
 At ten, this draught; let the phial shake;  
 And you'll remember, at eleven,  
 Three of these pills, must then be given;  
 This course you'll carefully pursue,  
 And give, at twelve, the bolus, too;  
 If he should wander, or consciousness lack,



Clap this broad blister on his back ;  
 And after he has had the blister,  
 Within an hour apply the clyster.  
 I must be gone—at three, or four,  
 I shall return, with something more. ”

Such treatment may appear astonishing and impossible, yet the history of the mortuary list, in diphtheria, shows that it is far from being unknown and unfamiliar.

#### LOCAL TREATMENT.

The local treatment of diphtheria is very simple; some prefer an escharotic, as nitrate of silver in solution, or in stick; the mineral acids either alone, or as used by Brettonneau, one part of hydrochloric acid to three parts of honey; others again use milder means, as insufflations of alum (reduced to an impalpable powder,) either simple or previously roasted; some again, exhaust the catalogue of stimulants, capsicum, turpentine, etc.; others find good results from the mild, or strong astringents, as vinegar, or tannin, or tincture of iodine, while a few use a simple disinfecting lotion, as the chloride of soda, lime or zinc; the chlorate of potassa in solution, or the mechanical mixture of levigated charcoal and water. We will, in this connection, insert a communication of practical interest, from Professor John T. Metcalfe, of New York City.

“ In the treatment of diphtheria, I believe that all sound practitioners are agreed, that it is of prime importance to do every thing, calculated to nourish and sustain the patient, whilst administering such medicines, as tend to correct the spanæmia, so frequently, if not universally recognized, as one of its most striking features. In common with many others, I have relied mainly on the tincture of the sesquichloride of iron, for internal administration. Nor has my experience failed to convince me of its excellence. It has the superiority over the chlorate of potash, in not disagreeing with the stomach, when properly diluted, and of not producing the exhausting diarrhœa, which I have known to occasionally follow the use of the salt. My object, in addressing you this note, is not to speak of the general medication in diphtheria, so much as to call attention to the fact, that, in five cases, I have found great benefit,

from a topical application, of which I have seen no published recommendation. In the Winter of 1859-'60, a Student, of the University College, suffered from an exceedingly severe attack of the disease. There were all the well marked constitutional symptoms, with swelling of the lateral cervical glands and abundant patches of exudation on the tonsils, uvula, roof of the mouth and posterior pharyngeal wall. This gentleman was a son of Dr. Webb, of Hempstead, Long Island. As a probably fatal prognosis had been made in the case, the young man's father had come to New York, bringing with him, a vial containing a mixture of the bromide of iodine, in mucilage, or syrup of gum arabic; two drops of the former to a fluid ounce of the vehicle. This he said, he had heard, was a good antiseptic, and might prove useful in his son's case, as there was the usual foetid character of the breath. Drachm doses of the medicine were taken internally, at intervals of several hours, and with a camel's hair pencil, it was applied frequently to the patches of exudation. It certainly acted as a disinfectant; but it was followed by a remarkable change, in the appearance of the membranes. Within twenty-four hours, they had entirely broken down; disappearing in spots entirely, and leaving the mucous membrane red and smooth, where the white exudation had formerly existed. Within the next eighteen hours, the fauces and palate were entirely freed from all pellicular matter, and the patient subsequently recovered.

The next case, in which I used it, occurred in a lad, of thirteen, who had, two years previously, suffered severely from scarlet fever. The diphtherial exudation was extensive, the constitutional symptoms very grave, and the angina of the most marked type. To test the the remedy, in question, I applied it to the left tonsil, which was hypertrophied very considerably, and completely covered with exudation, having very much the appearance of white chamois skin soaked in water. In twelve hours, the edges commenced to loosen and, in twelve more, the whole mass was coughed out; leaving a very red and a bleeding surface, under its former place. This patch measured a line and a half in thickness and was an inch in length, by three quarters of an inch in breadth. Exudation had commenced to form on the uvula, when the application was made to the



tonsil. It soon ceased to spread, and was but ephemeral. In the last case under my care, a girl of thirteen, whom I had attended seven years before, with well marked scarlatina, the exudation involved the tonsils, and spread to the uvula, after the third day.—The bromide of iodine at once checked the factor of breath, and, in twenty-four hours, caused a complete disappearance of membrane, both from the tonsils and uvula. I omit the details of the other cases, as they are not of such a character, as to make a different description necessary. The topical application consisted of four or five drops of the bromide of iodine, to the fluid ounce of gum syrup, well applied to the diphtherial patch every two hours.—There is nothing unpleasant to the taste, or in the smell of the tincture thus prepared, notwithstanding the very disagreeable nature, in both these respects of the pure liquid. It is well to continue its use, until the mucous membrane shall have resumed its normal appearance.” As the bromide of iodine is not officinal, we subjoin the mode of its preparation, for those who are not able to procure it conveniently. Saturate an ethereal solution of bromine, with metallic iodine. The different works on chemistry and the ordinary pharmacopœas do not contain any notices of the bromide of iodine. Griffin, in his “*Chemical Recreations*,” states that “bromides of the other metals may be procured, by the addition of hydrobromic acid to a solution of their salts.” The method given will be found simple and practicable. Lugol’s iodine caustic is as convenient and perhaps as efficient, as the bromide of iodine. It is an excellent disinfectant and produces an exfoliation of the membrane, just as readily. It may be used of full strength, or diluted, according to the judgment of the Physician. It is made, by adding to two ounces of water, an ounce each of metallic iodine and iodide of potassium. It is not unpleasant to the patient; does not produce the ash-coloured marks, caused by the nitrate of silver; is very stringent and is an excellent disinfectant. The chloride of zinc will be found an excellent application, either to the fauces or the nostrils; it has not the disagreeable smell of some of the chlorides and is very efficient, as a disinfectant. For destroying the factor of breath, we know nothing more excellent, than the use of an ordinary charcoal troche. They can be constantly used, with none

of the intervals, during which the patient and nurses are made to suffer from the absence of a disinfectant; they are always far more acceptable to the patient than gargles, lotions or injections; compounded with some favourite spice, they correct the existing foetor and afford, in exchange, a pleasant aroma; and they are accessible to every one. We do not wish to give a detailed statement of the endless remedies, that have been used, either in the local, or constitutional treatment of diphtheria; such a course would be useless and, when completed, would be more of a curiosity, than an assistant to the reader. "The favourite prescriptions of favourite Physicians" may serve to give a useful hint, but fixed formulas are both unnecessary and injudicious; and each practitioner had far better adjust the proportions, of prescribed remedies, to meet the exigencies, or peculiarities of each particular case.

The application of blisters to the throat, is not advisable in this disease; they rarely do good and frequently produce diphtheritic exudation on the skin, with painful and dangerous sloughing. This will be found true, in the use of blisters, on any part of the person, in this disease. Leeches are also unsafe; the hæmorrhage is difficult at times to control; is very prejudicial and injurious to the patient; and the leech bites, after being covered with diphtheritic exudation, frequently become foul and painful sores. The different poultices, and fomentations, and sinapisms and fumigations had best be avoided; they are "more honoured in the breach than the observance," and the patient will be just as safe and far more comfortable without them. Where the cervical glands are much swollen and the integuments hot, tense and painful, these applications do very little good; they generally dampen the bed or body-clothes of the patient, distract the attention of the attendants and annoy the patient. Where this swelling does not become absolutely painful, nothing is required. Where there is much tension, pain and heat, however, a mixture of equal parts of glycerin, tincture of opium and chloroform will be found useful—a little cologne, or some favourite perfume may be added, if desired. The lubricating and softening effect of the glycerin, with the anæsthetic effect of the laudanum and chloroform, will be found very acceptable to the patient. If heat is agreeable, by covering the application, a slight



rubefacient effect will be produced; if cold is preferred, remove the covering from the part and the evaporation of the chloroform will sufficiently produce this effect. Unlimited use of ice may also be allowed; this will often be grateful to the patient, and is a valuable adjuvant in the treatment of the disease. Dr. A. Snead, of Richmond, Va., has used this remedy with much satisfaction and success. In regard to the membranous exudation on the fauces, there are many modes of treatment. If the lunar caustic be used, in stick, care should be taken that this does not break and a portion of it escape into the pharynx, and thus into the stomach. Fatal results have ensued, from carelessness in this respect. If the caustic in solution, is used, it is always painful and distressing to the patient; portions sometimes enter the glottis, or the nares, producing very unpleasant results. If this application were specially or specifically demanded, let it be applied of course, regardless of the pain or the consequences; but is it so demanded? Will not many other applications answer equally well, if not better? Again, the nitrate of silver produces, on the tissues affected, a characteristic effect, or deposit, which it is almost impossible to distinguish from the membranous exudation, and which renders it almost impracticable, to determine the comparative increase, or decrease of this exudation—a result which it is desirable to reach, at every inspection of the fauces. The prognosis and treatment are often influenced, by the conclusion which this inspection produces. Dr. Alonzo Clark, Dr. J. S. Wellford, of Richmond, Va., and others, think it unnecessary to apply the escharotic to the exudation, already formed, but only to circumscribe it, by drawing, with the escharotic, a circle around the diseased locality. Many of the French, English and American Physicians, however, think differently, and attach a direct importance to the destruction of the membrane itself. Dr. F. B. Watkins, of Richmond, Va., who has treated this disease, with the most gratifying results, has usually adopted this course. If there is any truth whatever, in the views taken, by MM. Bouchut, Jodin and others, in regard to this being a parasitic formation or in the declarations of Laycock, of Edinboro, that it is a fungus growth (the *oidium albicans*); or that it is, in part, an accumulation of microscopic algæ, etc., it is evident, that it can not be too completely

destroyed. We do not so regard it, however, but consider the exudation a fibrinous mass. As it is certainly possible and conceivable, that sporules, algæ, fungi, etc., may occasionally be present, as there is no real harm in destroying the exudation and no important reason for not doing so but the avoidance of the silver deposit on the tissues, the annoyance, alarm, etc., the destruction of the whole membrane if attempted, should be rare, but completé. Rodet has discovered a mixture, which will always neutralize the syphilitic virus, when brought in contact with it, and yet not produce cauterization. It is usefully applied to the membranous exudation of diphtheria, and is thus made—

R.—Aquæ Fluv., grs. xxxij.  
 Ferri Perchlorid.,  
 Acid Citric,  
 Acid Hydrochlo., } a. a. grs. iv.

This may be applied, with a camel's hair pencil. The tearing away of the exudation, from the mucous tissue, is entirely useless, and frequently causes tedious and painful ulceration. There can be only one advantage gained by this removal, and that is, to lessen the chief cause of foetor of breath and the unpleasant sensation, produced by the dangling of this mass about the fauces. The dragging away of the entire membrane, with forceps, leaving a sore, tender and bleeding surface, certainly, seems a most inexplicable proceeding. This only removes the chief manifestation of a certain pathological condition, and does not tend, in any way, to alter, ameliorate, or remove it. Where the membrane is evidently loose, it may be gently removed, but otherwise it is best to leave nature to produce the exfoliation. It should be recollected that a chief characteristic of this membrane is its repeated renewal and reformation.

When the nitrate of silver is used, in solution, the strength may vary from twenty to sixty grains of the salt, to an ounce of distilled water. When the case is seen early, before exudation has taken place, or, if so, to only a limited extent, it may be useful to apply the caustic; but, even then, iodine caustic, bromide of iodine, tincture of the sesquichloride of iron, or the perchloride of iron, may be as well used. The grey deposit of silver will often be found objec-



tionable, and calculated to mislead. Whatever is used had best be so diluted, or weakened, as not to cause much pain to the patient. The medicines just named, when sufficiently diluted and sweetened with a little honey, or syrup, will be found to make useful and efficient gargles. In making these gargles, we may select from a long list of efficient agents: tannin, capsicum, myrrh, alum, borax, tincture of sesquichloride iron, the mineral acids, acetic acid, etc.; these may be variously mixed and changed and proportioned to meet the desire, or fancies of the practitioner. It will be found convenient, in applying different preparations to the fauces, with a pencil or brush, always to use an ordinary tongue depresser. When the swelling of the cervical glands and general tumefaction render this impracticable, the same agents may be applied, in a diluted form, by means of a syringe. When the membrane has entirely disappeared, it will be best to use some astringent application, or gargle for the fauces, as these parts are usually left in a lax and weak condition. The inhalations of the vapour of water, as this is poured upon "quick lime," have been used with much apparent benefit. If this vapour were "atomized" by some of the apparatus recently contrived for this purpose, good results might reasonably be anticipated. Lime juice has recently been used very happily, being given in large quantity, and still more recently fumigations with sulphur have been extravagantly eulogised.

*Constitutional Treatment.*—When called to see a case, if the disease has existed but a short time, if no purgative medicines have been taken, and if, above all, there is a clear and undeniable indication for it, a single dose of calomel, followed by some mild aperient may be judiciously given. If possible, it is best to avoid all depressing agents and agencies, for the chief feature of this disease is a tendency, under the best management, to prostration. Unless the use of mercury be clearly indicated, it had best be avoided rigidly; when it is used once, it is most advisable to abandon it, during the course of the disease. General and local depletion, vesicatories, sinapisms, etc., should all be avoided. After the use of a single dose of calomel and an aperient, the patient's strength had best be husbanded in every possible way. As soon as the fever has disappeared, or begins to disappear, he had better be placed on one, or both of two

agents which are peculiarly demanded, for his welfare; these are the tincture of the sesquichloride of iron and the chlorate of potassa. The scientific reason for giving chlorate of potassa in this disease, is that being a highly oxygenised salt, it tends to highly arterialize the blood, and thus to counteract the tendency to capillary stasis, with all the physical and physiological evils, resulting from a blood not sufficiently oxygenised and not sufficiently stimulating to ensure functional health and activity. Nitric acid would, in a measure, have the same effect, as this acid carries a large amount of oxygen, imperfectly held together. Both the salt and acid are good carriers of oxygen to the blood and tissues. The first remedy, originally proposed in this disease, by Dr. Heslop, of Birmingham, has by general consent been selected, as the chief and most reliable agent, in the treatment of this disease. In the prevention of spanæmia, anæmia, muscular and nervous weakness and depression, albuminuria and prostration, the salt seems to be especially applicable and efficient; when these conditions are manifested, it is equally reliable and valuable, for removing them.—When the chlorate of potash and the tincture of the sesquichloride of iron are used, the following will be found a very convenient formula, although any formula will answer—

R̄.—Potassæ Chlorat., ʒj.  
 Acid Hydroch. dil., ʒij.  
 Ferri Sequichl. Tinct., ʒiij.  
 Aquæ Fluv., ʒxij.

S.—To take two tablespoonsful every hour.

Where the chlorate of potash causes diarrhœa, it had better be omitted. If, with good nourishment, the patient seems to be still losing strength, the iron may be doubled, in the prescription just given. Where, on the contrary, there is headache, fever, and restlessness, the iron had better be omitted, or diminished for a short time. In preparing the formula mentioned, add the acid to the salt; as soon as this assumes a yellow colour, and fumes of chlorine arise, add the water; by this means, the decomposition is arrested and the free chlorine held in solution.

Sometimes, either at the first visit, or afterwards, symptoms of croup are seen, and there is a universal disposition to give, for the



relief of these, a prompt emetic. It would seem to be a wide-spread impression, that, during the act of vomiting, exudations, or membranes, are expelled from the larynx, or trachea; the truth in regard to this is, that such a result is a physical impossibility. During the act of vomiting, the rima glottidis is firmly closed, and if this were not the case, vomiting would be impracticable. The mechanism of vomiting, when made the subject of reflection, demonstrates that the giving of emetics, for the expulsion of membranous exudations from the larynx, is not in accordance with the teachings of physiology. The mechanism of vomiting is as follows: a full inspiration is taken, the diaphragm is depressed, and the rima glottidis closed; the abdominal muscles now contract and the stomach is compressed between these muscles and the depressed and firmly contracted diaphragm; the rima glottidis is rigidly and firmly contracted, to maintain the diaphragm in this position, and the contents of the stomach are fully and thoroughly ejected. When the diaphragm descends, after a full inspiration, and the abdominal muscles are then contracted, it is manifest, that if the rima glottidis is not firmly closed, we shall have expiration simply, and not emesis. In addition to this, it is a well-known anatomical fact, that the lips of the glottis are covered by an exquisitely sensitive mucous membrane; that the least irritation of this is immediately reflected and that the constrictor muscles (the arytenoid muscles) of the glottis, firmly contract, closing fully and firmly this aperture.

If the preceding mechanism of vomiting is incomplete, it is evident, as soon as the least portion of the contents of the stomach are brought into contact with this mucous membrane about the glottis, that the constrictor muscles, of this aperture, fully and efficiently close it. It will thus be seen, that it is impossible for emetics to cause, directly, the discharge of membranous exudations, from the larynx and trachea. The effects of these medicines may and do produce that condition of the system, where, from the resulting relaxed state of the tissues, this exudation may be loosened and afterwards expelled, by another act—that of coughing; but if we have to rely upon coughing for the removal of these membranes, (as they cannot possibly be expelled by vomiting) is it not the best and proper course, to cause this lax and relaxed condition of the

tissues, by a less violent and painful process; can it not be better, more constantly and persistently accomplished, by the use of expectorants? We leave the answer of this question to every one disposed to reason in regard to it.\* If croupal symptoms supervene early, then it will be proper to treat them promptly; to commence the administration of mild and judicious expectorants, avoiding those, that are harsh and prostrating; to produce a derivative effect by a simple aperient; to make immediate use of the warm bath, and to institute inhalations, of the medicated vapour of lime-water, etc. If the patient continues to become worse, and the symptoms are threatening, the question of tracheotomy (promptly, if in any way used) must be immediately considered and solved. Without going into the laboured details of statistics, on this subject here, it will be proper to say, that the general testimony and result in France, England and America is prejudicial to its use. Success is very rare, and the fatality attending it very great. Trousseau, who has had a very large experience in this, his favourite operation, now declares, that there is one indication which entirely forbids its use and that is, where diphtheria is present, or there is even a diphtheritic tendency manifested. No one has had so large an experience in this operation, with special reference to this particular disease, and his testimony should certainly receive earnest consideration. Even where performed very early (as early as would be justifiable) the condition of the system, in diphtheria, is such, as to make tracheotomy almost certainly fatal. There is a total loss of constitutional elasticity and resiliency in this disease and under the most favourable circumstances, it is often difficult to resist, or prevent the constant tendency to a serious and persistent asthenia. It is a question which after all had best be determined, by the circumstances attending each particular case. It should be borne constantly in mind, that few cases where tracheotomy has been practised, under the most promising circumstances, have recovered. It has its enthusiastic advocates, chiefly in the French school, where, however scientific, progressive and energetic its members, history teaches that conservatism is a forgotten word, and that the disposition to start-

\* It is not denied, that the succussion of vomiting may detach membranous exudations; this is possible, but whenever exudations are thus detached, they can only be removed by coughing or violent expiration.



ling display and attractive innovation are frequent and paramount. Still tracheotomy is the final chance of rescue from death; it can scarcely, under many circumstances, lessen the chances of recovery, and may rescue the patient from an inevitable death.\* Testimony and the record are against the operation, on the other hand; and it certainly adds to the patient's trials and suffering. These are the facts—each Practitioner must decide.

When this croupal condition exists, it has frequently been treated by catheterism of the larynx; this operation has been performed, to a great extent, in France, by M. Loiseau; even to the superseding of all other treatment. In addition to American experience with this subject, it will only be necessary to say, that the committee (MM. Béhier, Monneret, Roger, Seé and Barthez) appointed by the French Academy, reported very unfavorably, in regard to it.

Where the tonsils are enormously hypertrophied, and the uvula so enlarged, as to jointly produce dangerous dyspnœa, partial ablation may be adopted. Dr. Orton, of Binghampton, N. Y., who has seen a very large number of cases of diphtheria, writes, that the bi-chromate of potash has been very beneficially used by him, as an emetic, expectorant, and alterative; he writes very enthusiastically of this remedy, and seems to regard it, almost, as a specific. Whether calomel should be used when croupal symptoms supervenes, must be left to the judgment and experience of the Physician. It of course has its advocates: Brettonneau, Guersant, Rilliet, Barthez, and others, in France; Watson, Brown, Evanson, Maunsell, Tweedie, Connolly, in other sections of Europe; Wood, Condie, Meigs, and many in this country, are in favour of its use. It is proper to say here, that many prominent Physicians, of great experience, and deservedly held in high esteem, rely chiefly upon the use of calomel, not only when croup supervenes, but throughout the course of this disease. Dr. F. Deane, of Richmond, Va., and others, offer testimony in this connection, which all who are prudent, conscientious and just in practice, should impartially receive and accord to it the respect which a long experience eminently justifies. It should be carefully recollected, that though croup may supervene in diphtheria, it is not, in the least, (so far as

the constitutional condition is concerned,) similar to idiopathic croup. In idiopathic croup, the blood has not been affected and poisoned; the disease is sthenic, the exudation is that of true croup, and the prostration is always secondary, or succeeding the dyspnœa and caused by it. In the croup, supervening in diphtheria, the blood has been poisoned; the disease is asthenic, the exudation is not that of idiopathic croup, and the prostration is primary; preceding the dyspnœa and, though increased, yet not caused by it. It seems strange that the same remedy should be applicable, under opposite circumstances. We should certainly use mercury, if at all, very guardedly in croup supervening after diphtheria has existed sufficiently long to induce its characteristic depression and prostration. It is proper to see that constipation is never allowed to exist, in diphtheria; either in the acute stage, or in convalescence; the tendency of the disease is to produce this condition, and it should always be prevented. Where the disease is slowly producing prostration and the fever is disappearing, (as will always be the case in uncomplicated diphtheria,) the most vigorous measures should be instituted, for sustaining the strength of the patient. The iron should be increased in quantity, and, where no tendency to diarrhœa exists, the chlorate of potash, also. Quinine alone, or in combination with iron, should be freely given. Animal broths, beef juice, eggs, alcoholic stimulants, as far as can possibly be borne, porter or ale, etc., should be plentifully administered. Where diarrhœa exists, port wine (with some vegetable astringent, kino, krameria, catechu, etc., if necessary,) should be substituted, for wine, brandy, or ale. All stimulants should be liberally used, and nutriment administered constantly. This is an important part of the treatment, and every precaution should be adopted, to see that it is faithfully and energetically carried out. The patient will, most commonly, manifest a disposition to avoid this part of the treatment—being without any appetite and indisposed, even, to the exertion of eating. Nutriment may be administered in small quantities, at short intervals, if the digestion is weak and much impaired; if not, the intervals may be longer and the quantity greater. Where tumefaction of the jaws, throat obstruction, etc., exist, the nutriment may be administered by injection; in part, if possible, or



entirely, if necessary. It is well to recollect, that nutrition under such circumstances is very slight; that absorption is feeble and unreliable; and, if forced to have recourse to such an alternative, that the material should be freely and often used.

We come now to speak of albuminuria. This, when manifested, usually occurs in the early stages of the disease. It is necessary to recollect, that the tests for albumen, in urine, should be severally applied; or, that at least, two of the tests should be used. Heat alone, or nitric acid alone, will not be sufficient. When the urine has its normal acidity, it will not coagulate on the application of heat. In diphtheria the urine is frequently neutral, and has been so alkaline in character, as to change, to blue, a piece of litmus paper, that has been reddened by contact with an acid. When neutral or alkaline, heat may cause a cloudy precipitate; when there is no albumen present, this precipitate is composed of phosphates. Again, nitric acid may cause a precipitate of lithic acid, when there is no albumen present, and error again be the result. The better way will be to add the nitric acid to the urine, and then to apply heat; if albumen be present, it will be coagulated by the acid, but will not be dissolved by the heat; if albumen be not present, the cloudy precipitate of lithic acid, caused by the nitric acid, will be dissolved up, on the application of heat, and the urine will become again clear. M. Solon's work may be conveniently and profitably consulted in regard to the different causes, producing albuminous urine; it would be inappropriate, here, to go into an examination of these causes.

When albuminuria exists, the tincture of the sesquichloride of iron will be found to be the best remedy for removing, or controlling it; it will be found highly useful, also, where there is purpura; or a tendency to hæmorrhage. M. Aubrun claims to have cured thirty-five out of thirty-nine cases of diphtheria, by the internal use of the perchloride of iron. He gives two minims of the iron, in two drachms of water, every five minutes during the day, and every fifteen minutes through the night, with milk (and nothing else for nourishment) at libitum. "On the third day the membranes begin to soften and become detached." The sesquichloride, as ordinarily used, will accomplish all that preparations of iron can

effect. A solution of the chlorate of potash, with a minim of hydrochloric acid, for every grain of the salt, may be used during the fever, or when the iron produces headache and restlessness.— Dr. James Bolton, of Richmond, Va., has used the muriate of ammonia with success and satisfaction. When symptoms of paralysis supervene, the different preparations of strychnia are used; these may be injected hypodermically; electricity should be locally applied, and tonic treatment generally should be immediately and persistently adopted. With this, may be instituted passive motion, and a daily routine of artificial exercise.

Time, and above all other things, change of air, must be relied upon for the removal of the nervous sequelæ of diphtheria. The most obstinate, and apparently hopeless cases recover promptly, under a change of climate and surrounding circumstances. When the acute stage has passed, there is every prospect of recovery; for the mortality, from the sequels of the disease, is quite limited. The resulting asthenia and anæmia are very conspicuous and persistent; lasting sometimes for more than a year. Let it be carefully recollected, that the slightest imprudence in exercise is frequently fatal; the recumbent position should be observed, until convalescence is fairly established and then slowly and gradually abandoned. Natural exercise should be cautiously resumed and fatigue rigidly avoided. Hyposulphite of soda, in five grain doses every three hours, is now a favourite treatment in Europe.

#### AUTOPSIES.

The chief peculiarity, attending the autopsies in diphtheria, is the membranous deposit, found lining the air passages. Sometimes it is seen only in the larynx, but it is often found, extending from the rima glottidis, to the minute ramifications of the bronchiæ. Its appearance is quite varied; from a soft, thin, pul-taceous mass, to a dense, thick and coriaceous membrane. It has been seen (in Charleston, S. C., such a specimen was presented to the Medical Society) plugging up the entire larynx and trachea.

The brain, heart, lungs and abdominal viscera are usually found healthy. The blood, thin, dark and liquid. Sometimes, the lungs exhibit the condition manifested in pneumonia; they have been seen



to exhibit the changes, peculiar to each of the three stages. Evidences of bronchitis are also seen. These results are of course only seen where the disease has been complicated with some of the inflammatory affections of the lungs. Cases are examined, where no changes have taken place; death being the result of asthenia; the blood, however, even in such cases, is liquid and dark. Contrary to the declarations of M. Empis and others, that the exudation is not found, where there is no exposure to the air, M. Guersant states that the membranes have been found, by himself, in "the œsophagus, stomach and intestines." It will be recollected, that Dr. Goldsmith, of Oakland College, Mississippi, states that, in the epidemic of diphtheria, described by himself, the exudation had been found in the intestinal canal.

In the New Jersey epidemic, and in England, the subject was frequently covered with purple spots. Sometimes the kidneys are found deeply congested and again with the changes peculiar to Bright's disease. Dr. Oliver, of Boston, Mass., records a case, where "the left cavity of the pleura contained about two ounces of serum." The exudation is found in all of the mucous passages and tissues; the vulva; vagina; internal coat of the bladder; the œsophagus and intestines; the stomach; the entire auditory canal; \* the fauces; nasal and respiratory passages; on the conjunctiva; the buccal cavity; on wounds, etc. In death from convulsions, the blood vessels of the brain have been found ruptured. In the fifty-two post-mortem examinations, of Brettonneau, the exudation was found in the larynx and trachea, in fifty-one cases. Abscesses have been found in the tonsils, and also between the pharynx and vertebræ. Post-pharyngeal abscess, however, is rare. The membranous exudation is frequently found on the vocal cords, and this is unquestionably the most common cause, for the aphonia so often manifested, and for the croupal sounds frequently heard. Dr. Greenhow reports a few cases, where the kidneys, though apparently healthy, were deeply diseased, both in their cortical and medullary structures. The chief peculiarity, however, revealed in the autopsies of diphtheria is the varied manifestation, of its characteristic membrane.

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\* Dr. Remington, Philadelphia, Penn.

## SUMMARY.

We have thus seen—

That diphtheria is a zymotic disease; peculiar, separate and specific.

That its pathology proves it to be a distinct disease.

That its anatomical and physiological relations appertain to no other disease.

That it is both epidemic and sporadic, in its prevalence.

That its etiology is obscure and in no respect understood.

That its symptoms and course render its diagnosis and differential diagnosis simple.

That it is often contagious; but not so always.

That its duration, in the acute stage, is from three days to three weeks, and when its peculiar sequelæ ensue, that the disease may persist for many months.

That hygienic influences seem not to affect the cause of the disease; but that they do affect its course and result.

That its relation to age is marked and direct; that children are its most frequent subjects and its most frequent victims.

That its complications are numerous and most of them dangerous.

That there is no direct relation, between the throat lesions and the result.

That it is peculiarly apt to recur; and that convalescence from its attacks, is slow, tedious, treacherous, relapsing and interrupted.

That there seem to be diseases, coincidently occurring in the lower animals, during its prevalence. That its sequelæ are peculiar and such as are not seen after any other disease.

That its mortality, when uncomplicated, is not serious; but that its frequent complications render the mortality severe.

That the chief cause of death is laryngeal implication, and next to this asthenia.

That the prognosis can seldom be satisfactorily made.

That, in no disease, does treatment more generally influence the result.

That the autopsies prove (what is indicated by the pathology, the



anatomical peculiarities, the symptoms and the sequelæ) that diphtheria is a zymotic, distinct and specific disease.

After a careful analysis and patient tillage of this field; after freely consulting all familiar with its cultivation, we now offer, to our fellow-labourers, the results of the harvest: "Corn from the sheaves of science," with the stubble, produced to sustain it.

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In an Essay of this kind, it would have been impracticable to give a "footnote" for each fact stated, or each authority cited.

We have preferred, in this manner, to acknowledge our obligation to those writers and gentlemen, whose labours and courtesies have afforded us valuable and constant assistance.

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"The albuminuria which sometimes accompanies diphtheria allies to those maladies which result from purulent infection." West





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