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READ BEFORE THE

New York Academy of Medicine, January, 1861.

By JAMES WYNNE, M.D.,

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A PAPER

ON DIPHTHERIA,

WITH AN ATTEMPT TO

Portray its History in the United States.

By JAMES WYNNE, M.D.

Diphtheritis; Diphtheria, from *Διφθέρα*, a tanned hide; Pellicular inflammation. Synonyms: Angina maligna, Angina gangrenosa, Angina pellicularis, Angina pestilentiel, Angina suffocante, Pharyngite couenneuse, Fr. Garrotillo, Spanish. Male de canna, Italian.

Diphtheria is a disease in which the dermoid tissue, as the mucous membranes especially of the throat and the skin, manifests a disposition to the formation of a false membrane. It usually appears in the form of an epidemic or endemic, but sometimes occurs in sporadic cases.

History.—The earliest medical records contain accounts of a disease that prevailed in Egypt, Syria, and other parts of the East, under the names of *Ulcus Ægyptiacum* and *Ulcus Syriacum*, in which many of the characteristics of diphtheria are clearly set forth. The most accurate account of the *Malum Ægyptiacum*, however, is that given by Aretæus, one of the ablest of the Greek physicians, who lived about the time of Galen, if not contemporary with him. His description clearly identifies the disease with the one which has unfortunately come to occupy so large a share of the attention of medical men, especially in France, during the present century.

Aretæus, in speaking of this affection, thus notices some of its peculiarities: "Ulcera in tonsillis fiunt, aliqua mitia, aliqua pestifera, necantia. Pestifera autem sunt lata, cava, *quodam concreto humore albo, livido, aut nigro sordentia.* Quod si concreta illa sordes altius descenderit; affectus ille eschara est, atque ita Græce vocatur, Latine crusta. Crustum vero circumvenient rubor excellens et inflammatio, &c."*

Cælius Aurelianus, who lived in Africa, speaks of an epidemic of *Malum Syriacum* that prevailed extensively in that country in his time.† Macrobus describes a similar visitation at Rome, A.D. 380. It prevailed as an epidemic in Holland in 1337; at Paris in 1576; and at Naples in 1618–19, where it numbered five thousand victims; accurate descriptions of which were given by Nola, Zactus Lusitanus, Marcus-Aurelius Severin, and J. B. Carnevale.‡ At this period Diphtheria was frequent in many parts of Spain, where it continued to prevail as an epidemic for forty years.§ In 1636 it manifested itself at Kingston, on the Island of Jamaica; in 1736 it visited Boston; in 1743 it returned to Paris, where it continued until 1748, accounts of which have been given by Malouin‖ and Chomel.¶ It appeared at Cremona in 1749,** and the same year in England, where its characteristics were noted by Fothergill and Starr.†† In 1770 it manifested itself at New York, and gave rise to a valuable monograph on the subject by Dr. Samuel Bard.

It was not, however, until its appearance at Tours in 1818, that it assumed the name of Diphtherite, by which it is generally recognized in England and the United States, at the hands of M. Bretonneau, whose investigations have largely contributed to the present fund of knowledge on this subject, and to whom the first connected and practical researches are due. Diphtherite made its first appearance at Tours in 1818, in the barracks of the soldiers, in the rear of the legion of La Vendée, and from thence spread to the surrounding quarters. The attack among the soldiers was usually a gingival diphthe-

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* Aretæus, De Causis et Signis auctorum et diuturnorum morborum. Lib. iv., Cap. 9.

† Cælius Aurelianus. Acutarum et chronicarum passionum libri quinque. Lib. iii., Cap. 2.

‡ J. B. Carnevale. De morbo strangulatorio affectu. Naples: 1620.

§ A. Tamayo. De morbo garrotillo. Madrid: 1622.

‖ Temoignages Historiques, p. 66.

¶ Chomel. Dissertation historique sur l'aspect du mal de gorge gangreneux qui a régné parmi les enfans l'année dernier. Paris: 1749.

** Ghisi. Lettre Medeche. Cremona: 1749.

†† Philosophical Transactions of the Royal Society. London: 1749.

ria, but as it spread into the city the larynx became the seat of the disease, and the gums were not largely affected. From Tours the disease slowly spread to La Ferriére, which it reached in 1824, where, out of two hundred and fifty inhabitants, twenty-one were attacked and eight died. In 1825 the communes north of Orleans were attacked; and in 1828 those south of Orleans suffered from this disease.

In 1821, M. Bretonneau presented a memoir to the Academy of Medicine, at Paris, on diphtheria, as it had prevailed at Tours, which was followed by several others in subsequent years. The whole of his laborious and exact researches were finally given to the world in his treatise entitled, "*Des inflammations speciales du tissu muqueux et en particulier de la diptherite, ou inflammation pelliculaire.*" From the period of its outbreak at Tours, diphtheria appears to have seldom or never been absent from one or the other of the departments of France, pursuing a very erratic course, both as to its mode of visitation and the intensity of its attacks, so that the annual reports of the French Academy of Medicine on prevailing epidemics seldom fail to note its existence in some portions of the Empire. The visitations, however, which have produced the greatest alarm, not only on account of their severity, but also because of the respectability of the victims, were those of Paris and Boulogne in 1855. The disease at Paris attacked both rich and poor, and while it carried off a large number of children, proved fatal to many adults, more especially those who were often in attendance upon the sick. Among these was the eminent medical writer, Valleix. That, however, at Boulogne was not only the gravest, but of the longest duration, continuing from January, 1855, to March, 1857. During this period it caused 366 deaths, of which 341 were of children under ten years of age. In this epidemic, as in that of Paris, no condition was spared; and, indeed, the attack seemed to fall with the greatest severity upon the children of the wealthy English residents, who, from their more favorable hygienic position, might be supposed to enjoy a comparative immunity from epidemic disease.*

Nor does its fatality appear to have been diminished in subsequent years, for in the report for 1858, read by Trousseau, 22d November, 1859, it is stated that diphtheria prevailed in 31 departments, and attacked 1,568 adults and 7,474 children; of these, 165 adults and 3,384 children died.

In England, the disease first presented itself in the south-eastern coun-

* Report of the Imperial Academy of Medicine for 1856.

ties nearly opposite Boulogne, in the early part of 1857;* and traveling from station to station, visited especially the ill-drained and marshy districts, and the neglected and unhealthy localities in towns. Some of the first cases occurred in the practice of Mr. Rigden, of Canterbury, at the beginning of the year. He describes "seven cases of diphtheritic inflammation of the fauces and tonsils, attended with considerable fever, depression and swelling of the tonsils, the fauces and part of the mouth being covered with a pasty lymph." From this point it gradually diffused itself through the eastern counties, fastening especially upon the marshy districts, in which the attacks were numerous, although the mortality was not in proportion to the number of cases. During the winter months of 1857, it had largely diffused itself through the county of Essex, causing eight out of twenty deaths, and enhancing the rate of mortality in Suffolk and Norfolk in the proportion of three to one. The disease appeared to lull during the summer, but in the autumn of 1858 it largely extended its boundaries, and became quite prevalent in the north midland counties. The county of Lincolnshire appeared to suffer more severely than any other in England, no less than eighty-two deaths being attributed to this cause. In the north-western counties it prevailed in conjunction with whooping-cough, and in Nantwich caused thirteen out of fifty-nine deaths. It was observed at Wigan, Liverpool and Hulme, as well as at Rosendale, in which latter place sixteen out of sixty-eight deaths were attributed to its influence.

Diphtheria prevailed at Lima, South America, in 1855, and again in 1858, and is very well described in the concise account given by Dr. Odriazala, a Spanish physician, resident at Lima. In 1855, it appeared in California, and prevailed extensively not only in San Francisco and Sacramento, but likewise in the various mining districts throughout the State. In Placer County it was quite prevalent, but among the districts which suffered most was that of Sonora. The number of cases was very numerous, and the deaths in the aggregate large, but there is no means of determining the relative proportion which they bore to the number affected. Dr. Blake states that at Cache Creek, about twenty miles from Sacramento, the children during 1855 and 1857 were almost decimated by this disease. At Cache Creek, it was principally during the spring and summer months that the disease showed itself; and Dr. Bynum, who had attended nearly two hundred cases, states that the affection always appeared more

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* Hart on Diphtheria, p. 1.

virulent after the prevalence of a north wind, which is a dry and cold one.

In regard to the conditions under which it appeared, Dr. Blake says it is usually stated, that "it generally prevails in low situations, and to a certain extent this is true; although the most fatal epidemic of the disease that came under my observation was at a mining village called Dutch Flat, situated in a hollow surrounded by hills, about 4,000 feet above the sea. There were thirteen children in the village, all of whom were attacked, and four died. At Grass Valley, which is similarly situated at an altitude of 2,300 feet, the number of cases was great, and the mortality considerable. It was chiefly, however, in the Sacramento valleys and in the valleys of the coast range that the disease was most prevalent."* The disease again renewed its attack in 1858, and is accurately described by Dr. Fourgeaud, in a "Concise and Critical Essay on the late Pseudo-membranous Sore Throat of California."

The most alarming as well as the most fatal outbreak of the disease in the United States occurred in Albany, in 1858. The first case occurred in the south part of the city, on the 2d of April of that year; the second on the 20th of April, in the same section of the town. From this time it continued to increase in numbers and severity. During the twelve months in which it reigned as an epidemic it attacked about two thousand persons, and caused one hundred and ninety-seven deaths; of which, but three were adults.

The first death from diphtheria reported from the office of the City Inspector, in New York, occurred on the 20th of February, 1859, in the practice of Dr. Maxwell; the residence of the child, who was 3½ years old, was in 38th Street, near 5th Avenue. The second death occurred at Manhattanville, on the 25th of February; on the same day, a third fatal case was reported from Stanton Street. On the 5th of March, the fourth case was reported from Vesey Street; on the 10th of March, the fifth from the lower end of 28th Street; on the 23d of March, the sixth from Grand Street, near the East River; and on the 28th of March, the seventh from Varick Street. During the month of April three deaths were reported; in May, three; in June, two; in July, two; in August, four; in September, five; in October, nine; in November, seven; and in December, ten. The whole number of deaths for 1859 was 53, of which 30 were males and 23 females. During the year 1860, the number of fatal cases considerably increased, and

*Transactions of the 3d Ses. of the Medical Society of California, p. 105.

the prevalence of the disease as reported at the various Dispensaries was largely augmented. From the 1st to 28th January, 1860, 14 deaths were reported by the City Inspector. For the week ending February 4th, 10 deaths; for that ending the 11th, 12 deaths; week ending 18th, 10 deaths; for week ending 25th, 14 deaths; for week ending 3d March, 19 deaths; for week ending 10th, 9 deaths; for week ending 17th, 13 deaths. The whole number of deaths from diphtheria in 1860 was 422.

Previous to the report of the cases above alluded to, some deaths from diphtheria were returned to the City Inspector, but were reported under the head of croup. The number included in this category it is not possible to determine, but it may be fairly inferred that they were not numerous. During the latter part of 1858 and the early part of 1859, a remarkable tendency to affections of the mucous membranes, especially of the throat, was observed, and this became so general as to constitute an important element in the medical man's daily practice. Nor was this confined to any particular part of the city, or class of persons, but seemed to pervade alike the habitations of the opulent, and the confined, ill-ventilated apartments of the poor. As yet, however, no diphtheria had been observed, and it was not until about the month of March that medical practitioners here and there, especially among the poor, observed a thin pellicular covering over the tonsils, interspersed here and there with white star-like specks, which gradually expanded in size, and in severe cases came to cover the whole of the tonsils, and extend over the other soft parts of the throat into the larynx on the one side, and the nares on the other. This film-like substance could be easily removed with the sponge in its earlier stages, but became dense and closely adherent as the disease progressed.

Reports of a similar diathesis have been received from every part of the United States; and in many of the larger places, as Boston, Providence, Philadelphia, Baltimore, Richmond, New Orleans, Cincinnati, Louisville, and St. Louis, as well as in the rural districts, well-marked cases of diphtheria have been observed, and in each the bills of mortality have been increased to a greater or less extent through its agency. Although the means of tracing the progress of this disease through the United States do not exist, yet a sufficient number of facts is known to establish that it has not as in England, and to some extent in France, pursued a progressive line of march, but has presented itself here and there in the most erratic manner, and without any apparent reason for choice in the selection of a locality, beyond

the general and wide-spread disposition to affections of the mucous membranes which everywhere prevailed, and for the most part still continues.

Sometimes, as in the case of the attacks at Albany and in some parts of California, the disease presented itself with great intensity at the beginning; but as a general rule its progress has been gradual, progressive, and chiefly confined to the ill-ventilated and densely crowded abodes of the poor. Whether the particular causes which have given rise to this disease are destined to terminate in a short time, or to progress in an increased ratio, it is not possible to determine. The language of Trousseau, however, in his report on tubing the larynx, made to the Imperial Academy of Medicine, may not be unworthy of consideration when calculating the chances of the increase or sudden subsidence of the disease in this country. "Those who for twenty-five years," he remarks, "have followed the epidemics of diphtheria which have stricken the capital, may satisfy themselves that the malady has, especially during the last twelve or thirteen years, not only considerably extended, but has assumed a much severer form. Up to 1846 diphtheria scarcely appeared in an epidemic form, and the cases of it which were observed in Paris presented all the characters so well described by Bretonneau in his treatise, and so clearly pointed out by Guersant, in the Dictionnaire de Médecine, where this meritorious practitioner confirms in every particular what the illustrious physician of Tours had seen. But in the year preceding his own death, Guersant had seen the grave form of the disease which a little later carried off one of his own children, and which more than ever in these last years has appeared in Paris, as well as some of the Departments, with a violence which forcibly reminds us of the epidemic of the sixteenth century."

The progress of the disease in France, as traced by this eminent practitioner, leaves room for the most lively apprehension as to its future in the United States, and seems to demand of medical men the most careful study of its phenomena and modes of treatment. Most practitioners, who have any experience in the treatment of the disease, agree that it is one with which they are not at all familiar, and that it now appears among us for the first time of late years. The writer has conversed with a number of eminent practitioners, in New York and elsewhere, who have been engaged in the active duties of their profession for a period varying from a quarter to half a century, and with here and there an exception, they have declared the disease unknown to them. The inference is fair that if these

gentlemen, whose position in the medical world is undoubted, have not met with the disease, it could not have prevailed in the country during the last fifty years, under any other name or modification of circumstances. This corresponds with the experience of British practitioners. "Certain it is," remarks Dr. Ranking, "that the surgeons of this district with whom I have been in correspondence on this subject, either in consultation or by letter, have one and all admitted that they had to deal with a disease which to them is perfectly new, and such I may state is my own conviction also."*

There are, however, a number of highly intelligent members of the profession who believe that the disease is one which is not unfrequent, and only becomes alarming under peculiar circumstances. Among these are Dr. Condie, and Professor Pepper, of the University of Pennsylvania. The latter, in his lecture published in the *Medical and Surgical Reporter*, says: "I have never met with it in this form, (epidemic,) though I have been familiar with the disease for more than thirty years, and there has never been a winter that I have not seen cases of it, and the present winter I do not find my cases any more malignant than usual, or more frequent."

Causes.—The experience in France, England, and the United States goes to show that this disease, like most epidemics, is largely dependent upon a depraved condition of the atmosphere. "Zymotic disease," says Dr. Hart, "is mostly bred by poverty out of uncleanliness, and diphtheria follows a general law of what may be called the pathogenesis of zymotic poisons in this respect. It takes up its abode by preference in the hovels of the poor, where the stagnant and pent-up air reeks with animal effluvia—where human beings and domestic animals 'pig' together; above all—and this is the centre to which all sanitary precautions should tend—where the poisonous cesspool and the unflushed privy taint the air with subtle effluvia, that seize their victims by the throat, and bring death with foul touch." These remarks are forcibly sustained by the prevalence of the disease at the present time in New York. Dr. Jacobi informed the Academy of Medicine, at its meeting on January 18th, that 122 cases had been reported on the books of the Canal Street Dispensary as occurring within the year, while many members of the Academy, engaged in a fashionable practice, had not met with a single case.† It is not, however, confined alone to this class of patients, but occasionally shows itself under cir-

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* Ranking on Diphtheria.

† Bulletin of N. Y. Academy of Med. for 1860, p. 6.

cumstances apparently least favorable for its development, and among these was the child of the Secretary of the Academy, who unfortunately became a victim to this malady. Dr. Jacobi's experience is, that the average mortality is not so great as the reports of epidemics would lead us to believe. Of 500 cases, he has lost but 30. In cases attended with a high fever, cerebral symptoms, intense headache and earache, convulsions, small, frequent pulse, foul smell from the nostrils and mouth, the result was usually fatal. It is but just to remark that at the other Dispensaries the disease has not presented itself in the same numbers as in that under the charge of Dr. Jacobi, and in some but very few cases were observed, amid a large amount of other disease. This might be accounted for either by supposing that it had become localized as it progressed, or that cases were reported as diphtheria at one dispensary which were not considered so at another.

The case of the 75th Regiment of Infantry of France furnishes a remarkable example of the localization of this disease. This regiment, which had been located in three separate garrisons—at Bordeaux, Angoulême and Rochefort—were ordered to rendezvous at Avignon. The three battalions were engaged in a fatiguing march during the months of April, May and June, and reached Avignon in July, when they were placed in a part of the ancient Palace of the Popes. From the 14th of August to the 31st of October, 1853, the regiment was nearly disabled by an attack of diphtheria. The effective force of the regiment consisted of 1,686 men, of whom 200 were attacked, as follows:

Of	77 officers, . . .	5	were attacked.
	22 children, . . .	4	"
	134 sub-officers, . .	10	"
	110 workmen and musicians,	5	"
	1,343 corporals and soldiers,	175	"

During this attack a battery of artillery stationed at Avignon entirely escaped; and, with the exception of a few isolated cases among the inhabitants of the town, the disease was exclusively confined to the 75th Regiment.

Diphtheria seldom occurs sporadically, but usually prevails as an epidemic, and sometimes, as has already been shown, with the most alarming fatality. Its history shows it to be amenable to the laws which regulate zymotic diseases generally, and that its chief abode is among the crowded, ill-ventilated dwellings of the poor—by far the greater number of its victims being selected from this class of society.

General Causes.—During its prevalence, affections of the mucous membranes appear to be more prevalent than under ordinary circumstances; clearly manifesting the presence of some general pervading agency, which, conjoined to local causes, is competent to develop the disease.

Age.—Children are more liable to attack than adults. M. Bretonneau states a case in which the false membrane had enveloped a considerable part of the pharynx in an infant but fifteen days old.* This is a remarkable exception, the greater number of cases occurring between the ages of one and ten years. The age of five or six, however, is that in which the child appears to be most predisposed to an attack.

Sex.—Boys are more liable to attack than girls, in a slight degree. Valleix's observations lead him emphatically to adopt this conclusion. Rillet and Barthez are of the same opinion, and believe the susceptibility of boys to the disease is especially marked from eight to ten years.† This, however, is subject to variations, as in some instances the number of girls attacked has exceeded that of the boys.

Temperament.—Dr. Bouillon-Lagrange, who observed the disease in the *Department de Seine-et-Oise* in 1857 and '8, treated seventy-three cases. Of these, there were of

Lymphatic Temperament	50
Sanguineous	11
Lymphatic-Sanguineous	7
Bilious	5
	73

There were of	feeble	constitution	26
"	strong	"	30
"	middling	"	17

Twenty-one exhibited scrofulous traits. In point of healthy or unhealthy locality, 52 were in healthy situations and 21 in those not so. Of these 73 cases, 23 died and 50 were cured.‡

Hygienic Condition.—With occasional exceptions, as in the instances of the outbreaks at Paris, in 1855, and Boulogne, in the same year, those children who possess feeble constitutions, or are surrounded by the concomitants of depraved hygienic influence, for the most part become the victims to this disease. It is therefore usually found in those parts of the town inhabited by the poor, and seldom invades the

* Bretonneau on Diphtheria, p. 36, obs. 4.

† Traité Clinique des Maladies des Enfans, vol. ii., p. 256.

‡ Gazette Hebdomadaire de Med. et de Chir., vol. vi., p. 361.

well-ventilated districts occupied by the more opulent. *Humidity*, and especially *humidity conjoined to a depressed temperature*, are supposed to exercise a decided influence in the development of diphtheria. The observations of Ghisi, at Cremona; of Bretonneau and Gendron, at Tours; of Chomel, at Paris; Ferrand, at Chapelle-Véronge; of Trousseau, Bourgeois, Lespines, and André, in France generally; of Ranking and Hart, in England; and of Fourgeaud, at San Francisco, and Willard, at Albany, go to establish the great dependence of the disease upon this condition of the atmosphere.

The conclusions of the French Commission are anything but satisfactory on this point: "it is impossible" they say, "to fix any period for its duration or mode of attack. Insidious in individual cases, it is equally so in its march; a first case may appear and be immediately followed by several others, or these may appear at long intervals. It is but slightly obedient to meteorological conditions."

Is it contagious?—The opinion of authors is varied as to its contagiousness. Jurine and Bricheteau do not believe that it is susceptible of transmission in this method; while Wichmann, Boëhmer, Field, Rasen, Guersant, Bretonneau and Miguel contend for its contagiousness. Rillet and Barthez believe that if contagious, it is far less marked in this particular than most eruptive diseases.

M. Penant, who observed the epidemic in Vervius, France, in 1853–4, and whose report was pronounced by the Commission on Epidemics, of the Academy of Medicine, the best that was presented to them, took particular pains to mark the progress of the disease. The number of inhabitants in the arrondissement of Vervius, in 1853, was 1,073, of which 855 were males, and 848 females; of this number 68 were attacked with diphtheria; of these, 10 were adult males, 13 adult females, and 45 children; of the 68 cases, 34 were males, and 34 females; 20 were under 5 years; 12 between 5 and 10; 13 between 10 and 15, and the remainder above this age; of the 34 cases among females, 17 died; of the 34 among males, 10 died; total, 27; of these, 13 died before the age of 5; 10 between 5 and 10; 3 between 10 and 15, and 1 above that age. The disease appeared at first in separate and isolated parts of the commune, invading successively or simultaneously a certain number of houses, sometimes near, at others more remote, often attacking but a single individual, and as frequently manifesting itself in several members of the same family. The first cases were isolated, and referred by M. Penant to some epidemic constitution of the atmosphere, of which he does not pretend to give any account. After the disease became firmly located, he is im-

pressed with the belief that, under the influence of bad air, confined apartments, and uncleanly habits, the disease is susceptible of propagation from individual to individual; in proof of which, he cites the case of a female who carried her own infant several times into a room occupied by a number of patients laboring under diphtheria. The infant was shortly after attacked, and soon died.

M. Perrochaud, in his account of the fatal epidemic which prevailed at Boulogne, says that the proofs of contagion were so manifest that no medical man pretended to deny them. He cites the case of a single school in which 17 cases occurred. In contradistinction to these, Dr. Pichenot mentions the case of a child who was accustomed to trample with its bare feet upon the shreds of false membrane ejected in vomiting, without contracting the disease. He remarks that this is an isolated and remarkable example.

The Committee of the French Academy on Epidemics say: "We do not hesitate to declare diphtheria contagious. It appears to us incontestable, and the epidemic of 1858 furnishes numerous examples that the contact of a healthy individual with one sick of diphtheria is one of the causes of the development of the malady."* The only well-authenticated cases of this kind which have come to the knowledge of the writer in the United States are those of the late Professor Frick, of the University of Maryland, and Dr. Cooke, of Brooklyn.

Dr. Donaldson thus describes Dr. Frick's last illness:

On Tuesday, 20th inst., 1860, he performed at the Infirmary the operation of tracheotomy upon a negro woman, who was sinking from epidemic diphtheria. From early childhood he had shown a peculiar susceptibility to idiopathic poisons. He never attended a case of scarlet fever that he did not suffer with his throat. So in this instance; in attempting to save the life of this poor creature he apparently at least inhaled the poison, and the next day complained of soreness about his throat. That night he had a severe chill, notwithstanding which in the afternoon he went to the funeral of a friend, and stood in the grave-yard on the damp ground with his head uncovered, when there was blowing a chilling March wind. That night he had a severe chill, with increased swelling and pain about the throat; and the next morning, Thursday, when his uncle and friend, Dr. John Buckler, was called to him, already the foul disease had taken a firm hold on him, and the membrane, characteristic of diphtheria, was forming. The agony of deglutition was so great that it was almost impossible

* Transactions of the Imperial Academy of Medicine, 1860.

to accomplish it. Friday and Saturday were days of intense agony. He went from chair to chair, from bed to lounge, trying every position that might bring breath, and with it ease.* At his own urgent solicitation, tracheotomy was performed, which gave but temporary relief, and he died on the following Sunday.

The following account of Dr. Cooke's case was furnished by Professor Willard Parker, who was his attending physician:

I was requested to visit Dr. Cooke, of Brooklyn, December 16th, 1860. He was a man of active habits, in full practice, aged about 60, but seemed not more than 50; he had never been sick before. About two weeks before I saw him he had been called to attend a severe case of diphtheria. After a few days' attendance, he complained that he had contracted the disease. He became feverish; his throat was very sore, and swollen; he lost his appetite, and complained of great prostration. He saw some few patients at his office, and attempted to go out to attend to some business, but soon found himself too weak to walk. On the 14th his brother, a physician, urged him to give up business and take care of himself. He was unwilling to yield to this advice. On the 16th the Dr. saw his brother again, and found him so ill that he determined to remove him to his bro her's residence in New York. After the removal, I saw the patient at about 10, P. M. The features of his case were very unfavorable. He was in bed; skin hot and dry; pulse 120, small and feeble; respiration indicative of exhaustion; tongue thickly coated; throat sore, swollen, livid, and all the parts covered with an inspissated mucus; neck on right side tumid, and pain in the right ear; no appetite, but thirsty for water; the bowels had been acted upon by blue pill and other cathartics; kidneys acted well. Prescribed at once gargle of pure brandy and tr. capsisi, quinine, brandy and water, beef tea. 17.—My patient seemed to feel better; pulse had diminished in frequency, and was fuller; bowels were somewhat tumid and irritable; the stimulating and tonic course was pursued. 18.—Remained about the same. 19.—Contrary to advice, the patient got out of bed and visited the water-closet, and became exceedingly *prostrated;* he was not permitted to make the attempt to rise again. The pulse ranged from 120 to 130, and was irregular; the tongue became *very dry* and black; he could lie only on the back; the skin was dry and parchment-like to the feel; there was a general œdema; vibices on the ears. 20.—The urine was examined, but contained no albu-

* Gross' American Medical Biography, p. 834.

men. On the 21st, 22d and 23d, he continued to grow weaker; no subsultus; mind clear; evacuations became involuntary, and the respirations indicated the most profound prostration. He sank, and died on the morning of the 24th. I never witnessed such prostration in the worst cases of ship fever. In this case there was no petechiæ, no delirium, but vibices on the ears and back, and a general œdema.

The appearance of the disease at various and remote parts of the American Continent about the same period of time, and the absolute impossibility of communication between the first cases of the disease in the various places where it has manifested itself, clearly establish the fact that its introduction into any locality where it has appeared is not due to contagion. The writer is inclined to the belief that under certain favorable conditions, after being introduced, it is susceptible of transmission by contagion.

Symptoms.—Diphtheria is frequently attended with very slight constitutional disturbance, at the commencement of the attack, even where the disease is destined to a fatal termination. The patient is often so little affected, that, with the exception of some slight difficulty in the act of deglutition, he exhibits no evidences of disease, and it is with difficulty that the parents can be brought to consider this symptom as one of much importance, or the child in very serious danger.

After a short interval, however, one of the tonsils, seldom both, becomes specked with a yellowish-white deposit, which, when seen at this early stage, presents the appearance of small whitish stars in the midst of a ground of what appears to be a transparent layer of mucus, but which really is the true diphtherial membrane, through which the body of the tonsil, often of an increased redness, is distinctly seen. These spots, small at first, rapidly enlarge, the membrane loses its transparency, and if not speedily arrested, spreads over the soft parts of the palate, both tonsils, the uvula, and involves the larynx, and sometimes the trachea and bronchial tubes.

Usually, even in slight cases, the local symptoms are preceded by some constitutional disturbance. There is a feeling of malaise, pain in the head, often extending to the neck, lassitude, and more or less fever. In the mild form the tongue presents a thick creamy coat, through which a few papillæ are visible; the uvula, the velum-palati, and pharynx are of a bright red color, and the tonsils swollen, and specked with the filmy deposit already described, which is generally closely adherent to the mucous membrane, although in some cases it is easily removed in its early stages by the application of the sponge probang, which is often coated with the new-formed deposits.

This membranous exudation may extend over the whole palate, but in mild cases rarely does; nor is its color much deepened, or the odor emitted offensive or fœtid. The submaxillary glands are slightly swollen, but do not attain the size which they acquire in the severer forms of the disease. Under favorable circumstances, or the application of judicious treatment, its progress is here arrested. The membrane ceases to spread, and slowly becomes detached from its connections; the mucous membrane loses its red color; the glandular swellings subside; the pulse diminishes in frequency, and the patient becomes decidedly convalescent.

The disease, however, does not always present itself in this form, but is ushered in by rigors and often vomiting, under whose influence the patient becomes so prostrated that it soon becomes obvious that the system is oppressed by a powerful poison. This condition is characterized by a high fever, a pungent skin, a rapid and feeble pulse, great difficulty in deglutition, hurried respiration, flushed countenance, and congested lips; the tongue becomes loaded by a yellow or dirty brown coat; the soft palate and pharynx assume a deep erysipelatous redness; the tonsils become greatly swollen, and the ash-colored membrane, nearly continuous and spread over one or both tonsils, extends to the uvula and the posterior walls of the pharynx. As the disease advances, these symptoms increase in severity; the breathing becomes more hurried and stertorous; the swallowing, which at first was but moderately impeded, becomes so difficult and painful, that the child is with great difficulty induced to take either food or medicine; the saliva flows from the mouth, and often a foul and acrid discharge from the nares. Should the little patient be induced to swallow, food or drink will be violently ejected, and a paroxysm of great intensity, in which the child will gasp for breath, and with great difficulty recover itself, will ensue.

The case has now reached a point which portends the most unfavorable results. The false membrane has seized upon every visible part of palate and pharynx; the discharge of sanies mixed with blood, which issues from the mouth and nose, has become exceedingly offensive; the glands of the neck become enlarged and tender; the voice hoarse and indistinct; the pulse more rapid and feeble; and the poor patient, restless and embarrassed for want of breath, tosses about or lies on his back in a semi-comatose state; in most cases the medical attendant is apprised by a croupy respiration, when the membrane has invaded the larynx and trachea, at which time symptoms of asphyxia present themselves; the countenance becomes livid, the skin cold, the

pulse feeble or gone, and the patient, either distressed for want of breath, anxiously awaits the moment when death shall relieve him of his sufferings, or rapidly sinks into an asthenic or comatose condition.

The croupal anxiety and suffocation are inimitably painted by Aretæus in the following passage:

"Tussis spirandique difficultas enascitur, et modus mortis quàm miserrimus accedit. Pallida his seu livida facies, tristior autem cùm tonsillæ comprimuntur. * * * Cumque decumbant, surgant, aut sedeant, decubitum non ferentes. Quod si sedent, quiete carentes, iterum decumbere coguntur. Plerumque recti stantes obambulant nam quiescere nequeunt. Inspirato magna est—expiratio verò parva. Raucitas adest vocisque defectio. Hæc signa in pejus ruunt, cum subito in terram collapsis anima deficit."

The patient is usually enabled to be up for several days after the invasion of the disease, but is finally confined to bed in grave cases by extreme prostration. There is often, indeed, great danger in assuming the erect position under these circumstances, as is evidenced in case of Dr. Cooke. Death by syncope in the advanced stage of the disease is not an unfrequent result upon any extraordinary exertion, and an aggravation of the grave symptoms is quite common.

These descriptions exhibit the mildest and most obstinate forms of the disease, between which it may present itself in every variety of intensity; at times yielding easily to medicine; and at others, although apparently attacking the patient with less force, proceeding slowly but surely to a fatal termination. The prognosis should therefore be always guarded, because it is not always possible to predict the effect of remedial agents, or the hidden force with which it may at any period develop itself.

Duration.—When diphtheria runs its course without complications, it seldom proceeds beyond the seventh, eighth, or ninth day. The result of M. Bretonneau's extended experience is, that its usual period of continuance is six days. When, however, it is complicated with croup, or scarlatina, or measles, its duration is much more uncertain; M. Bourgeois has known it, when associated with other diseases, to continue eighteen days. Dr. Ranking says that its duration is very variable; he has known it to prove fatal in forty-eight hours from the first seizure, and to continue for two weeks or more, and finally to prove fatal long after all active symptoms had subsided, either from pure exhaustion or the supervention of other lesions.*

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* Ranking on Diphtheria.

False Membrane.—When the mouth is examined upon the first day of the pseudo-membranous deposit, the parts destined to become the seat of the disease present the appearance of pieces of flesh, bleached by contact with boiling water; soon after there appears on the tonsils, the uvula, or the soft palate, small vesicular points of a lardaceous appearance, formed by the dissolving of the epithelium, which may readily be confounded with the minute yellow patches soon to appear. The membrane is almost invariably developed primarily upon one or the other of the tonsils, but not always, as the uvula is sometimes the original seat of the patches.*

Ordinarily, at the moment of formation, or soon after, the false membrane appears under the form of a white or a yellowish-white spot, rarely gray, quite circumscribed, a little projecting at its centre, and surrounded by a circle of lively red. Sometimes the false membrane is semi-transparent, and forms a slight pellicle, which envelops the tonsil, through which the surface of this gland is partially visible; but it soon loses this transparency and becomes of a yellowish-white color, extending itself to the subjacent parts with greater or less rapidity, according to a variety of circumstances, and especially on the kind of treatment which has been adopted.† After the false membrane has developed itself upon the tonsils, it usually extends to the soft palate, the uvula, and finally to the pharynx, with greater or less facility, regularly involving these different parts in the order here indicated. This is not invariably the case, for sometimes it is developed simultaneously in several distinct points, which finally converge the one into the other, and finish by forming a continuous surface. While it is thus enlarging its boundary, the false membrane acquires an additional thickness by the crossing of successive layers, so that it is not composed of one single fold, but of many, which present a varied appearance, dependent upon the place occupied by them: sometimes appearing like a deep ulcer, with a yellow base; at others, enveloping the uvula as a finger by a glove, and on the palate having the semblance of a deep hollow.‡

The period between the formation of this membrane and its dislodgment is very variable—usually from one to six days. In the early part of the disease, after being detached, a new membrane forms

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* Relation historique d'une epidemic de diphtherapathie, Gaz. Méd., 1846, p. 178.

† Id., loc. cit., p. 391.

‡ Rilliet and Barthez. Maladies des Enfans, vol. i., p. 252.

in its place, and this may be habitually reproduced several times. When the membrane is cast off spontaneously about the sixth or seventh day, its place is seldom supplied by a new deposit; and about the tenth day the patient is convalescent. When the case terminates fatally, the original inflammation extends to the air-passages, and not unfrequently to the nasal cavities, which likewise become the seat of a pseudo-membrane; greatly augmenting the sufferings of the patient and the gravity of the disease, whose termination is heralded by the fœtid, sanious discharge from the nostrils, and symptoms of angina, which speedily supervene.

When the termination is hastened by the supervention of gangrene, the pseudo-membrane loses its consistency, is easily detached, changes to a grayish color, frequently mixed with bloody spots, and is coated with a sanious fluid, which flows from the mouth and nostrils, and emits a very fœtid odor. The flow of blood in these cases is sometimes considerable, and not unfrequently covers the lips and nasal cavities; in which latter the flow is often arrested by the formation of clots.

Whatever may be the time at which the false membrane becomes detached, it generally exhibits the subjacent tissues diminished in size, and of a redness more or less intense in color. This diminution in size is especially noticeable on the tonsils and uvula. The false membrane does not always occupy the same seat. MM. Rilliet and Barthez have given the relative proportion of cases in which the membrane was observed by them in various positions, as follows:

Upon the tonsils alone, ...	6
Upon the tonsils and some part of the soft palate, . .	4
Upon the tonsils, the velum of the palate, and the pharynx, .	6
Upon the tonsils and the pharynx, ...	5

Enlargement of the Submaxillary Ganglions.—The enlargement of the submaxillary ganglions, usually accompanied by an inflammation of the throat, is a symptom so universally present, that M. Bretonneau has seldom failed to notice its presence in any of the numerous cases that came under his own personal observation. It makes its appearance from the first to the fifth day, and is always attended with a marked aggravation of the local symptoms. The seat of the enlarged glands is usually at the angle of the lower jaw, in the neighborhood of the apophysis mastoid.

Symptoms as Observed by Others.—Dr. Pichenot, who noted the progress of the epidemic in the Commune of Creusery, in 1855, in his

report to the Académie de Médecine at Paris, thus describes the usual progress of the disease:

"The affection begins by a sort of general malaise, yet not sufficient to hinder the child from its ordinary play. In a short time, however, a difficulty of deglutition is experienced, and an undetermined pain in the neck and head. Usually there is no appetite, the mucous membranes of the mouth and nose are dry, the tonsils augmented in volume, and the patient refers to the ears the sense of pain felt in deglutition. In a short time all these symptoms are increased in intensity; vomiting and pain in the abdomen soon follow, accompanied either with constipation or diarrhœa. The pulse is frequent, irregular, and depressed. The voice is altered, the respiration painful and croupy, and a cough follows the attempt to drink, or even to open the mouth. The tonsils press upon the folds of the soft palate, and their surface is injected with a thick grayish deposit. But it is upon the mucous membrane of the posterior portion of the throat that the "diphtheritic plaques" usually present themselves, and their grave condition here almost invariably presages grave and rapid disease, and not unfrequently a fatal termination. The pain in the head and neck now becomes augmented, the respiration more difficult, the face œdematous, and the maxillary glands tumefied, and sensitive to pressure.

Its march is very rapid. In the space of from three to five hours, the papular eminences of the throat become covered with a floculent, transparent veil, of white appearance. Generally, not more than one-half of the guttural cavity is at first invaded. The remainder of the mucous surface of the throat, the uvula, and the nasal cavities not being affected by the membrane, which soon loses its transparency, augments notably in thickness, and degenerates into the true diphtheritic membrane, of a gray or yellowish color.

The false membrane is not always continuous, and I have seen several times the tonsils, and the pharynx, in whole or in part, recovered from the membranous deposit while it was progressing upon the soft palate. The membranous fold is easily separated by traction, the use of caustics, and often by nature, when it appears circumscribed by a red circle. In all these cases it returns again very promptly, but is less thick, and is often reproduced upon a surface, which exhales a fœtid and sanious liquid. In some very rare cases, the membrane never falls, but is slowly reabsorbed. The voice becomes nasil; the mouth, which rests open, and the nostrils, exude continually an ichorish fluid, which becomes more fœtid as the disease progresses, and thickened with the

exfoliated shreds of the false membrane. The head, neck, and chest often present a uniform plane, in which the swelling is considerable. Respiration and deglutition are rendered almost impossible, by the increased size of the tonsils and the invasion of the false membrane; the prostration is extreme; the patient is not able to raise his head; the pulse becomes imperceptible, the extremities cold, the intelligence almost always intact, the lips cyanosed, the eyes vitreous, and death comes to terminate the frightful spectacle.

Such are generally the symptoms when the case terminates fatally. During the first four months of the epidemic, death occurred from the second to the fourth day of the disease, and life was rarely prolonged beyond the sixth. Upon the decline of the epidemic, the progress of the disease was more tardy, and frequently extended to the tenth day."*

Dr. Fourgeaud, of Sacramento, says, "The disease begins in a very insidious manner, by a little engorgement or inflammation of the soft palate, pharynx, and one of the tonsils. At this period the patient complains but little; there is often no fever, or it is very moderate. The pain in the throat is much slighter than in the usual forms of sore throat; so slight, that the little patients go about playing as if nothing was the matter. In some exceptional cases, the fever and inflammation about the pharynx are considerable from the beginning. The characteristic signs of the invasion soon follow. They consist in small portions of white or yellowish lymph deposited on the palate, the tonsils, and the posterior part of the pharynx. The cervical and submaxillary glands become swollen, and the pain in swallowing and opening the mouth is occasioned more by the engorged state of the glands than by the internal secretion of lymph. These deposits go on increasing in size more or less rapidly, and in violent cases in a few hours the whole cavity of the throat is covered by them. Generally, one side is more affected than the other, and the glands corresponding with the parts affected are more swollen than those of the opposite side."

Dr. Blake remarks, that "the first effect produced by the poison is evidently on the nervous system. Drowsiness, prostration, or oppression is manifested by infants, or complained of by adults; and when the disease is prevailing, this desire of children to sleep at other than usual hours should awaken our suspicion. The pulse is acceler-

* Rapport sur les Maladies qui ont Règne en France en 1855. Mémoires de l'Académie Impériale de Médecine, vol. xxi.

ated from the first, but generally soft and typhoid; although in some cases it is for a few hours rather hard. The temperature of the skin is raised, although seldom harsh or dry; and frequently moist, or even covered with profuse perspiration. There is seldom any pain; rarely headache or backache. The tongue is usually coated, edges red, papillæ prominent. The appetite may remain good, and the digestion unimpaired. If we examine the throat, we may find, even within twelve hours after the occurrence of the first slight symptoms, the tonsils covered with a gray pultaceous exudation, which rapidly extends upward into the nostrils, and downward towards the larynx; and again, we may detect only a redness of the tonsils, and a small point of exudation, two or three days after the commencement of the disease, and at a time when the symptoms of general prostration had become alarming. Again, cases may present themselves in which the general symptoms and the anatomical lesions proceed *pari passu;* but in almost every case that I have seen, I have considered that death was the result rather of the action of the poison on the system, than from obstruction of the larynx. In from twelve to twenty-four hours after the formation of the false membrane, we generally find the cervical glands enlarged; and in severe cases, this enlargement may afford a serious obstacle to respiration and deglutition."*

Prof. Thayer, in his excellent essay, says:

"The most noticeable feature in the pathology of diphtheria—and the most important in view of the prognosis and the treatment—is that which may be called the blood-poisoning, that condition of the blood evinced by the hæmorrhage, and by the adynamic symptoms which appear at one stage or another in nearly all the cases. In ordinary cases these symptoms appear after three or four days; in those of the greatest malignity, they are visible at the outset; in a certain proportion of cases which recover, they become more manifest during the convalescence than previously. The condition of the blood must be judged from the results, for we have not, I think, any analysis of it in diphtheria; but there is little doubt that there is more or less disintegration of the red corpuscles, and that the malignancy of the disease is in proportion to the extent of this destruction. Whether or not this constitutes all the visible changes in the circulating fluid, it is evidently rendered unfit for healthy nutrition by a putrescent poison. If the coexistence of renal disease with diphtheria, or its occurrence during the convalescence, should be established hereafter as an occasional

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* Pacific Medical and Surgical Journal, August, 1858.

fact, it will furnish another evidence of a peculiar blood-poisoning. Several observers have reported single cases in which the urine was found to be albuminous, while others have failed to find albumen in repeated examinations."

Sequelæ.—Those who recover from severe attacks of diphtheria are often feeble for months afterwards. Anæmia is especially a characteristic of convalescence; besides which, nervous affections of a peculiar kind often ensue; among these are impairment of vision, deafness, want of action in special muscles, and partial paralysis. Faure, who is quoted by Dr. Slade, in his prize essay, says, "Very remarkable disorders show themselves also within the throat, for the velum is completely paralyzed, and hangs like a flaccid, lifeless curtain, which interferes with speech and deglutition."

Anatomical Lesions.—The post-mortem examination usually discovers the tonsils, uvula, and pharynx draped in a dense false membrane one or two thousandth parts of an inch in thickness, of a yellow or whitish-yellow, and sometimes of a gray color. It is usually found as adherent to the pharynx and soft palate as the mucous membranes ordinarily are. The tonsils, which are rarely entirely enveloped, are covered with portions of the membrane, through the apertures in which the substance of the gland appears. The pharynx is often inclosed in a fold of this membrane, which presents the appearance of a yellow cloth; sometimes continuous, and sometimes broken; frequently tinged here and there with a gray hue, which has led to the belief that it was in a state of gangrene. This false membrane is composed of several folds, superimposed the one upon the other, and lies directly upon the mucous membrane. In its chemical characteristics it resembles false membranes of the larynx generally. The fœtid odor, which is so intolerable during the last days of the disease, is not observed in the body after death. The mucous membrane, which lies in contiguity with the pseudo-membrane, ordinarily preserves its usual consistency and character, and is not, as has sometimes been imagined, superseded by it. On the contrary, it is found adherent to the parts usually covered by it in a condition but little changed from its normal character, except when it has become involved in the inflammatory action developed in the contiguous soft parts. M. Bretonneau remarks: "Des ecchymoses peu étendues, ainsi qu'une légère érosion des surfaces sur lesquelles la durée du mal s'était prolongée sont le plus graves altérations de tissu."

It sometimes happens that the tonsils are found in a swollen and rough condition, with an irregular appearance, in various portions of

which an ulcerated surface is exposed amid the surrounding folds or patches of false membrane; in which case, the mucous membrane will have become greatly altered, or altogether absent, allowing the false membrane to repose directly upon the muscular fibres of the ulcerated gland. The same observation is true in regard to the ulcerated surfaces upon the soft palate, the pharynx, and the larynx, and is especially so in relation to that part of the pharynx which comes into immediate connection with the œsophagus. It must be borne in mind, however, that although primary pseudo-membranous inflammation sometimes terminates in ulceration, it is far from being an ordinary occurrence; while, on the contrary, in a secondary condition it is not unfrequent.

When the termination of diphtheria is by gangrene, its seat is usually in the tonsils. When this is the case, the body of the tonsil exhibits a little cavity of variable extent, usually situated near the centre of the gland, partly filled with a greenish, sanious fluid, and partly with the remnants of the gland, converted into the same greenish-colored substance, with the fluid with which it is associated. The walls of this small cavity are injected, softened, and emit a fœtid and gangrenous odor. Much more rarely the pharynx and the soft palate are the seat of gangrene; in which case, they become soft, friable, covered with a greenish sanies, and emit the unpleasant fœtid odor peculiar to the gangrene of the tonsils.

A lesion which is regarded by M. Bretonneau as almost always present, is a tumefaction of the submaxillary ganglions, especially those situated near the angle of the inferior maxillary bone, in which position they often acquire the size of a walnut. At the early stage of the disease, they are uniform in their increase, soft to the touch, and of a light rose color; while at a later period they assume the color and consistence of the kidney.

Portions of the false membrane lining the back part of the throat are often seen divided into small patches—soft, bleached, of a light gray or greenish color, and dispersed in small fragments, from the tonsils to the pharynx. When found in this condition, they are bathed in a purulent fluid, fragile, and of so little tenacity that it is impossible to separate their folds, or even to raise them intact from the surfaces on which they are found. In cases like these, the intermediate parts are red, inflamed, and often covered with an abundant deposit of pus.

Diagnosis.—It is not a difficult matter generally to give a correct diagnosis in diphtheria, especially when the practitioner is cognizant

of the fact that a false membrane has been or is forming. The diseases with which it is possible to confound it are angina maligna and croup. In the first of these affections, the medical man has the general symptoms of scarlatina to guide him, and especially the eruption, which is absent in diphtheria. In scarlatina, the tonsils are of a bright red, resembling the juice of the strawberry, and the membrane which covers them is simply inflammatory; while in diphtheria, the hue is deeper. The exudation in scarlatina is white, opaque, cheesy, and easily furrowed; while in diphtheria it is yellowish, tenacious, and not easily impressed by the action of a hard body. The inflammatory action in scarlatina is observed at the beginning in all the soft parts of the throat; while in diphtheria it almost invariably shows itself at the commencement upon the tonsils. As the disease progresses, diphtheria manifests a tendency to invade the air-passages, which is not one of the characteristics of scarlatina.

The main distinction between croup and diphtheria is to be found in the part affected. In croup, the trachea is primarily the seat of diseased action; in diphtheria, it is only reached after the disease has made considerable progress. In croup, the earliest symptom is stridulous breathing; while in diphtheria, the primary symptoms are chiefly observed in the organs of deglutition. In croup, the false membrane on the tonsils is not present; in diphtheria, it is an invariable symptom.

Complications.—Diphtheria may manifest a disposition to the formation of a false membrane in other parts than those primarily affected, as the skin, the mucous membranes of the nose, the ears, the lungs, and the anus; or it may prevail coincident with other affections, as influenza, bronchitis, measles, scarlatina, erysipelas; or it may be affected by a particular epidemic condition, in which it becomes complicated with hæmorrhage of the nose, skin, and mucous membranes of the intestines or lungs, or a typhoid type of disease.

Prognosis.—When diphtheria is confined to the tonsils, it usually terminates in a restoration to health; but when the false membrane extends to the nasal cavities or the larynx, especially if accompanied with grave constitutional symptoms, the patient is placed in imminent peril. Even in favorable cases, the prognosis should be given with much consideration.

Treatment.—The practitioner has three important indications to fulfill in the treatment of diphtheria:

1. To arrest the spread of the pseudo-membrane.

2. To alter the character of morbid action, upon which the formation of this membrane depends; and

3. To sustain the patient until these shall have been accomplished.

These necessarily involve both a local and general treatment.

The local treatment consists chiefly in the application of caustic and astringent substances, in one form or another, to the affected part. Of these, the most usual are nitrate of silver, either solid or in solution, powdered alum, chloride of lime, chloride of soda, sesquichloride of iron, and hydrochloric acid.

M. Bretonneau almost invariably employed the last of these remedies as a local application in his own practice, with the most marked success. The hydrochloric acid may be employed very nearly of the strength of the dilute acid of the shops, or considerably reduced in strength—dependent upon the severity or mildness of the attack. The best method of applying it is to moisten a small sponge attached to a probang or a camel's-hair pencil with the fluid, and while depressing the tongue with the left hand, to carry the brush forward with the right, until the fauces are reached, when those parts of the tonsils, uvula, or soft palate on which the membranous deposit appears, may be moistened with the fluid, and the instrument withdrawn. The hydrochloric acid should be applied not only to the membranous surface, but to the parts immediately surrounding it, by which means the spread of the membrane is often arrested. The application should be renewed several times a day. Care, however, must be taken not to apply it of too great strength, or too often at the onset of the disease, especially if the symptoms are not of an aggravated character; otherwise the local disease may be enhanced, by the unnecessary injury inflicted upon the surrounding parts. The symptoms often appear momentarily aggravated by the local application, which is not unfrequently followed by an attempt to dislodge the membrane by vomiting. Should this latter result follow, the tonsils and palate will appear as if shrunken in substance, and spotted here and there with a few drops of blood upon the surface formerly occupied by the membrane.

When this does occur, the application may be renewed directly upon the surface of the gland, in order to arrest the almost invariable disposition of the membrane to renew itself upon the abraded part. As the disease progresses, and the membrane extends towards or into the pharynx, the difficulty in making local applications becomes greatly enhanced; but the practitioner should not hesitate, for fear of inflicting temporary pain, from thoroughly exploring and

covering the parts affected with the solution of hydrochloric acid. For the purpose of effecting this, it is often necessary to place the head of the patient upon the knee of an assistant, and with a spatula to depress the tongue and the lower jaw firmly at the same time, by which means a view of the whole fauces may be obtained, and an opportunity afforded of making a thorough application of the local remedy.

Nitrate of silver has been warmly recommended by Trousseau, Guersant, and Valleix, in France, and was the application almost universally resorted to in England at the commencement of the epidemic in that country. The usual mode of using nitrate of silver in England was in solution. Dr. Kingsland advised a solution of 16 grains to an ounce of distilled water; and Dr. Hart, 30 grains to an ounce of distilled water. The mode of its use resembles that of the hydrochloric acid.

When the local application of nitrate of silver is made in a solid form, care should be taken that it does not slip from the holder, or break, as in such an event it might fall into the stomach. Such an accident actually happened to M. Guersant; fortunately, however, the stomach rejected it; but this might not always occur, and few medical men would be willing to take so hazardous a risk. Dr. Hauner, of Austria, considers nitrate of silver as the very best local application to the diseased surface, and advises its use in a solution of from a scruple to half a drachm, to an ounce of water.*

Subsequent experience did not confirm the good opinion entertained for nitrate of silver among the English practitioners, and many who were at first loud in its praises came to disuse it altogether. A substitute for this was found in the sesquichloride of iron, which is recommended by Dr. Ranking as being very efficacious in its effects upon the false membrane. He advises its use in the form of a gargle, of the strength of two drachms to eight ounces of water, to be applied to the throat by means of a brush.†

In the United States, opinion appears to be divided as to the best local application. Dr. Blake, of Sacramento, has found the greatest benefit resulting from an application of strong hydrochloric acid; a view in which he is sustained by Dr. Bynum and Dr. Thomas, both of whom have had much experience in the treatment of the disease.‡

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* Œsterrischische Jahrbüch für Kinderheilkunde, 1859, vol. ii.

† Ranking on Diphtheria.

‡ Transactions of the Third Session of the Medical Society of the State of California, p. 108.

Prof. Comegys, of Cincinnati, is in the habit of applying nitrate of silver, either in substance or strong solution in water. Sometimes, when the ulcerations are deep, he touches them with strong nitric acid, by means of a brush. In some cases he has employed with considerable benefit inhalations of tannic acid dissolved in sulphuric ether, applied by means of a cloth wetted with it, to the mouth.* The formula is:

℞.—Tannic acid, . . . f. ℥ij.
Sulph. ether, ... f. ℨj. M.

Dr. Jacobi, of New York, who, as physician to the Canal Street Dispensary, which treats a large number of German children, has had a very large experience, says:

"The local treatment consists of cauterization of the membranes and surrounding parts with the solid nitrate of silver, or with strong or mild solutions of the same salt in water, (℥ss-j.: ℨj.;) of gargles, consisting of solutions of (or applying in substance) astringents, such as tannic acid, alum, sulphate of zinc, or claret wine; in gargling with, or applying, such medicinal agents as are known to have some effect on the constitution and tissue of the pseudo-membranes, as chloride of potassium, chlorates of potassa and soda, diluted or concentrated nitric or muriatic acids, liquor of sesquichloride of iron, etc. Astringents will prevent maceration, render the exudation dry and hard, and alter the consistency of the surrounding hyperæmic and œdematous tissue. It will thus prevent, sometimes, the extension of pseudo-membranes to the neighborhood of the parts already affected, and in some cases may accelerate the expulsion of the membrane as a whole. We have thus seen the best effects from tannic acid, either applied directly to the parts by means of a curved whalebone probang, or dissolved in water as a gargle (℥ss-ii.: ℨ i.) Of the tinct. sesquichlor. iron we have seen no particular effect. Cauterizations with nitrate of silver we have found to be generally of very little use when applied to the pharynx. Its effect is superficial only; it will form a scurf, but will destroy nothing. Destruction of the parts cannot be effected except by forcing the caustic into and below the membrane; this can seldom be done in the pharynx of children, and for this reason cauterization is unavailing at this point, but will prove beneficial, we believe, by confining the process of exudation to its original locality. In cutaneous diphtheria cauterization may be exercised to its full extent; but as these cases are generally attended with extreme prostration, the

* Proceedings Cincinnati Academy of Medicine.

general treatment will prove both more necessary and successful. If cauterization is to be resorted to, we generally use, and with good effect, more or less concentrated muriatic, or acetic, or nitro-muriatic acid. Where, however, cauterizations are made, great caution is necessary not to mistake afterwards the result of the caustic for pseudo-membrane. This remark is particularly applicable where nitrate of silver has been used."

Alum, chloride of lime, and calomel are sometimes recommended. When their use is deemed advisable, they may be applied by dipping a brush or the finger in the dry powder, and carrying it directly to the affected part, or blowing them through a quill.

Prof. Metcalfe advises the use of the bromide of iodine, in the form of two drops to an ounce of the mucilage, or gum-arabic, as a topical application. He also gives drachm doses of this mixture internally, with the happiest results.

When there is a considerable accumulation in the nares and behind the velum, the *débris* and foul secretions may be removed, and much temporary relief obtained, by an injection of an infusion of chamomile with a few drops of creosote, which may be best effected by a laryngeal syringe. The syringe of Dr. Warren, of Boston, answers a very good purpose for injecting fluid either into the nares or below the epiglottis. It, however, is liable to the objection that it is likely to produce irritation, by coming in contact with the irritable portion, exactly at the opening of the glottis, which is found, by the researches of Prof. Horace Green, to be the seat of sensibility, instead of the epiglottis, as has heretofore been supposed. The common glass syringe, with either a curved extremity or a straight one—dependent upon the part to be reached—answers all ordinary purposes, and possesses the advantage of being easily obtained at the apothecaries, and is of slight cost.

For correcting the fœtor of the secretions, the chloride of soda, in the proportion of one drachm to six ounces of water, may be used with much benefit. Dr. Ranking suggests, on the supposition of the presence of some vegetable parasite, the use of sulphurous acid and hyposulphate of soda, in the form of a saturated solution.* "The power of the latter," he adds, "in destroying the fungoid growth of favus, as well as the oïdium which infests the vine, I have myself experienced; and I strongly recommend it, provided the vegetable origin of diphtheria be confirmed by further observations."

Much relief is often afforded by inhalation, especially after the sec-

* Ranking on Diphtheria.

ond or third day of the attack. An excellent means of fumigation is to pour boiling water upon catnip, or the leaves of any similar plant, with the addition of a little vinegar, and to allow the patient to inhale the fumes, either by inclosing the head under a blanket, or by applying the mouth to a tube connected with a close vessel containing the materials from which the vapor is generated. The immediate effect of fumigation is extremely grateful to the patient. Dr. Gurdon Buck advises the addition of Labarroque's solution of the chloride of soda, in successive portions of a tea-spoonful each, to the liquid used for fumigation. Mr. C. T. Hodson recommends the inhalation of boiling water, to which has been added a table-spoonful of chlorinated lime.

General Treatment.—The general treatment must be regulated by the type of the disease. Shortly after the appearance of M. Bretonneau's treatise, a great variety of treatment was recommended by different practitioners, all, however, with a view to arrest inflammatory action. Leeches to the neck, counter-irritation, especially by means of blisters, active mercurialization, and purgative medicines furnished the basis of most of the plans advised. Calomel, especially, obtained great celebrity, and was at one time considered as the most effective remedy in arresting the progress of the disease. It was first prescribed by Dr. Conolly, who was residing at Tours, at the appearance of the disease; and was so efficient in his hands, in minute doses, as speedily to find favor with the French practitioners. But, whatever may have been the success attendant upon its administration at that time, it is now found to require great caution in its use.

Blisters are contra-indicated, and so far from furnishing relief, tend to increase the danger, by assuming an unhealthy, and frequently sloughy, appearance. The bites of leeches often give rise to passive bleeding, extremely difficult to arrest, which greatly reduces the already exhausted energies of the patient. Everything, in fact, which tends to lower the powers of life, or induce prostration, should be sedulously avoided, in the type of disease which at present prevails; and certainly differs from that for which Bretonneau, Conolly, and other medical men in France at that period were called upon to prescribe.

The type of the disease as it now prevails exhibits a tendency to extreme prostration from the very beginning, and requires a tonic treatment to sustain the patient. The most effectual method of accomplishing this is by means of quinine, the various preparations of iron and steel, stimulants, in the form of brandy, milk punch, and

wine whey, and a generous diet, consisting of beef-tea, Liebig's extract of meat, and a strong decoction of coffee. Sulph. quinine may be administered in grain doses, conjoined to two grains of the sulph. of iron, repeated as often as the symptoms appear to require—usually every three hours. It is well to alternate this remedy with doses of chlorate of potassa, which appears to exercise a beneficial influence upon the disease of the mouth and throat. Chlorate of potassa may be given in doses of from five to ten grains, in distilled water, or a bitter infusion. Prof. Barker, of New York, advises the chlorate of potassa, in doses from ʒss. to ʒj. The chloride of soda has been recommended with the same intention, but does not appear to be equally efficacious with the chlorate of potassa.

The tincture of the sesquichloride of iron has met with much favor among the English practitioners, as a tonic. Dr. Ranking gives it the preference to other tonics, although he frankly admits that it matters but little which of this class of medicines is used, provided the strength of the patient be sustained. "Personally," he remarks, "I give the preference to the tincture of the sesquichloride of iron, not only from the inference drawn from the analogy of its unquestionable usefulness in the more asthenic forms of erysipelas, but also from the positive evidence of its benefit derived from the experience of several gentlemen in the country, amongst whom I may mention Mr. Dix, of Smallburg; Mr. Prentice, of North Walsham; and Mr. Cowles, of Stalham; each of which has had unusual opportunities of testing its advantages." The tincture of the sesquichloride of iron may be administered in doses of from eight to sixteen drops, in a little water.

Whatever may be the success or ultimate failure of this remedy, its first introduction into the treatment of this disease is undoubtedly due to Professor Thomas P. Heslop, of Queens College, Birmingham, who, after repeated trials in his own practice, brought it to the attention of his clinical class at Queens Hospital and the Medico-Chirurgical Society of Queens College. His own success appears truly astonishing. "I have given in this disease," he says, "to an adult twenty-five minims of the London tincture of the sesquichloride of iron every two, three, or four hours, and have conjoined a few drops of dilute hydrochloric acid. I have also applied daily, sometimes twice a day, by means of sponges, a solution of hydrochloric acid, but little weaker than the dilute acid of the London Pharmacopœia, and have always enjoined the regular use of weak gargles of the same acid. This, with the constant administration of stimulants, beef-tea,

milk and jellies, has constituted my treatment; and I repeat here, what I have already stated in other quarters, that since I have become aware of the value of this medication, nearly ten months, I have not lost one case." An excellent formula for administering a combination of chlorate of potassa and the sesquichloride of iron is: Chlorate of potassa, from 8 to 20 grains; tincture sesquichloride of iron, 10 to 25 drops; rose-water or orange syrup, one drachm; water, four ounces. Where there is difficulty in administering medicine, the bulk may be reduced by omitting the water altogether, and increasing at pleasure the amount of syrup. The success which has attended the use of this remedy in England warrants a careful trial of its merits at the hands of practitioners in the United States.

Where the disturbance of the secretions appears to indicate the use of mercurial preparations, and they are not positively contra-indicated by the depressed state of the patient, calomel may be administered, in doses of one-tenth of a grain, mixed with sugar, and placed dry upon the tongue. Dr. Bigelow has found this remedy valuable in the disease as it prevails at Paris; and Mr. Thompson was equally successful with it at Launcestown, England. Dr. Anderson, of New York, and Dr. Briggs, of Richmond, have employed calomel with marked benefit. It is a question, when calomel and chlorate of potassa are administered conjointly, whether the effects of the potassa do not entirely annul those of the calomel. Dr. Bigelow, as the result of some very recent observations, says, that although it may retard or prevent the specific effects on the salivary glands, it does not in any way modify its action upon the secretions. It may be well, however, when the effect of the calomel is important, to intermit the use of chlorate of potassa for twenty-four hours, or to alternate the use of these medicines at wide intervals between the administration of the two.

Emetics are serviceable when portions of the detached membrane are lodged in the throat, without being expelled, or when the disease is making rapid progress, and threatens to invade the larynx. The action of the emetic in this instance is frequently to detach the pellicle and dislodge the pseudo-membrane. At the same time that the membrane is thus ejected, the throat is relieved of the foul secretions which might otherwise be received into the stomach, to the great detriment of the patient.

But, whatever treatment may be adopted, the fact should never be lost sight of, that the system is laboring under the influence of a powerful and most depressing poison; and it matters but little, so far as the constitutional treatment is concerned, whether this poison be at

first local, and afterwards disseminated through the system, or is from the beginning of a general character, and incidentally developed in the mucous membranes of the air-passages. In the performance of her functions in the elimination of this poison, Nature requires to be sustained, not only by the free use of the tonics already indicated, but by a liberal allowance of the most concentrated and nutritious articles of diet, in which beef-tea, milk, eggs, brandy, wine, and coffee stand prominent. When there is difficulty in swallowing, not only these articles of diet, but quinine, may be introduced, by means of injections; a resort to which should not be deferred until it is impossible to administer medicines by the mouth, but whenever the difficulty of swallowing becomes at all a prominent feature in the complaint. Injections should not be administered in greater quantities than two ounces at a time, and should not be often repeated; otherwise they will give rise to a local irritation in the rectum, which will prevent their retention. One or more drops of tinct. opii, according to the age of the patient, will greatly aid in the retention of the injection.

After the violence of the disease has been checked, a continuance of the tonic treatment should be persevered in for some time, not only to prevent the sequelæ liable to follow, but a recurrence of the attack, which often reappears after an interval of several weeks, especially when the patient is exposed to those depressing influences which are too frequently attendant upon poverty and uncleanliness.