

**On diphtheria : its history, progress, symptoms, treatment, and prevention
/ by Ernest Hart.**

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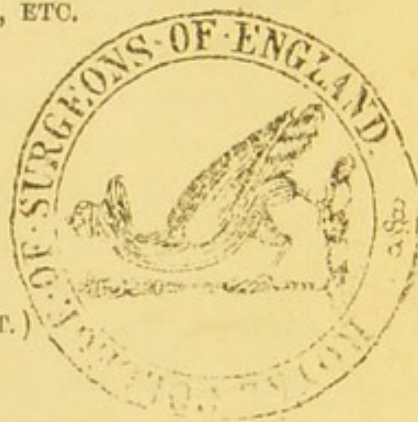
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ON
DIPHTHERIA:

ITS HISTORY,
PROGRESS, SYMPTOMS, TREATMENT,
AND PREVENTION.

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P R E F A C E.

PUBLIC attention has never been more forcibly aroused than by the serious disasters which have followed the course of diphtheria in this country. The general feeling of alarm is certainly not more than proportionate to the mortality by which it is occasioned; nor is it difficult to understand the reason for this profound sensation of grief and dread with which the public mind is oppressed. If diphtheria be far less fatal than cholera, than typhus, or than other pestilential scourges of our population, yet it has this peculiarity, which tends more than any other to fix upon it universal attention, and to excite deep sympathy for the sufferers: diphtheria acts with intensity in confined centres; it has the habit of seating itself in a small hamlet, a crowded school, or a numerous family, and, without passing beyond the limits of the small community, it inflicts therein a terrible loss. It is this concentration of violence, this total desolation of particular localities and individual homesteads, which gives to diphtheria a painful notoriety beyond that which is achieved by other deadly diseases. There are other circumstances which combine to surround it with an atmosphere of terror: its attack is insidious; at the first, almost unfelt. Occasionally its advent is ushered in by symptoms of a gravity proportionate to the common result: severe sickness or dangerous syncope announces the intensity of the poison which is at work. More often, the warning is conveyed by a sense of *malaise*, a slight difficulty in deglutition, which at other times would pass unnoticed; and the children attacked

continue their play or pursue their tasks without uttering the much-needed warning note of complaint. Here is another distressing peculiarity of this disease: it falls most heavily upon the young. Thus it will be seen, in the account given of the Boulogne epidemic, that of 366 deaths from this cause, 341 occurred amongst children under ten years of age. In the Lincolnshire epidemic, in the autumn of 1858, all the deaths at Horncastle, twenty-five in number, occurred amongst children under twelve years of age. It is thus that the concentration of the disease becomes more terrible: not only is it limited to one household, but to the young members only. Thus, in the Norfolk epidemic, six children died in one family. The same has occurred in numberless instances in London and throughout the country. Trousseau relates, that of a household of seventeen, fourteen were carried off in the epidemic of the Loiret. To lose one child under a reigning influence of general disease is a sad misfortune, but it is the common lot, and the mishap is too little to excite very general attention. But the frequency with which the whole of a family of children have been carried off in succession by this destroyer has not failed to produce a deep feeling of commiseration, which is renewed on the recurrence of every such disaster, and which is long associated with the memory of the desolate home.

This special endemic character is an important feature in the medical history of diphtheria, which needs especial consideration; and I have devoted myself especially to the investigation of its causes. I believe that the main causes will be found to be here pointed out, and what is more important, the remedies indicated.

Although there cannot be said to have existed any apathy on the part of medical practitioners in regard to the study of this disease, and though it has been sturdily and ably combated by zealous and devoted men wherever it has appeared, yet the profession have not, perhaps, on the whole, manifested that energy of research in tracing out its secrets, and that readiness to report their experience, which have characterized

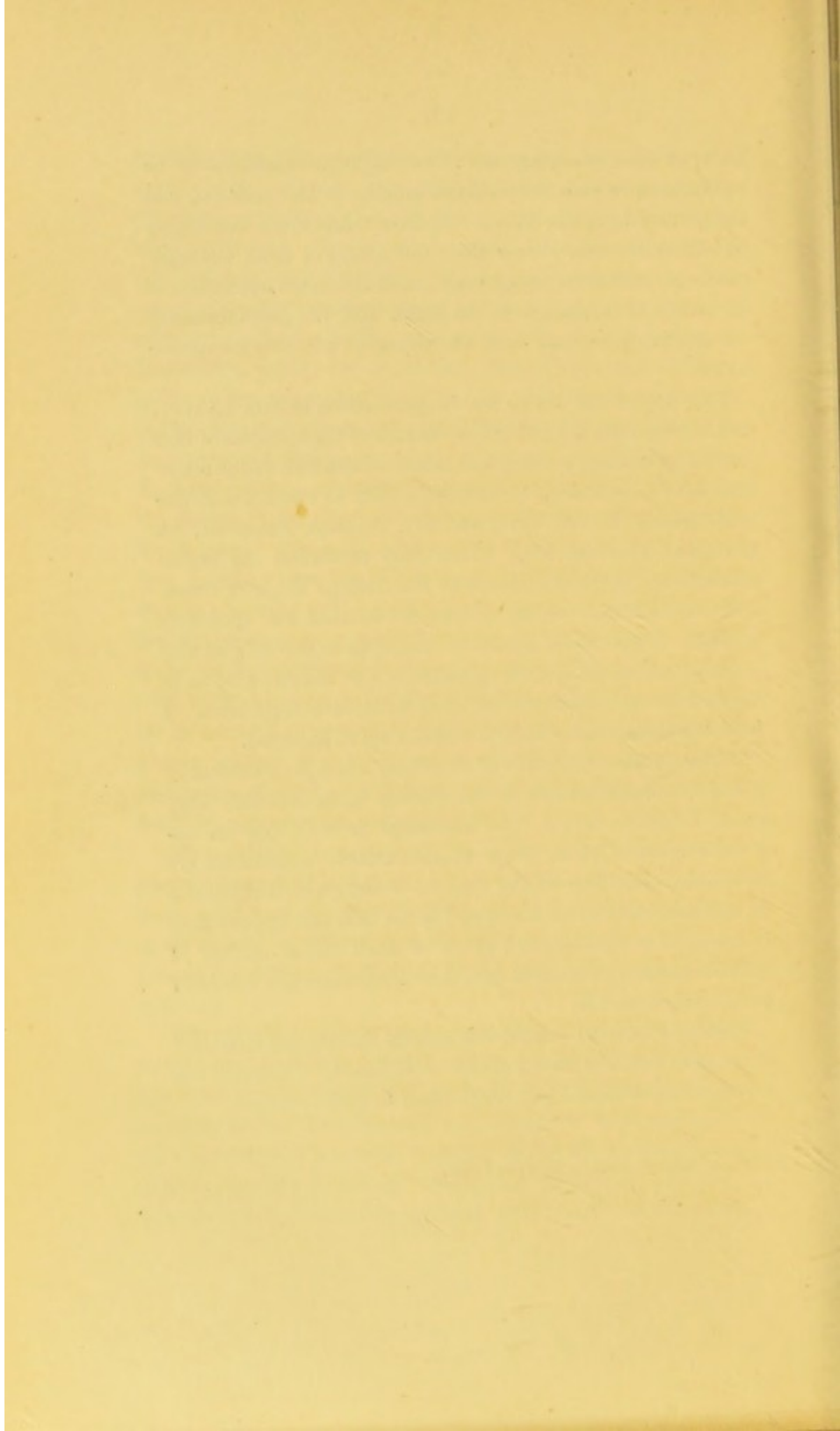
them on other occasions, and which might be considered to be commensurate with the scientific gravity of the question, and the profound popular alarm. Nothing tends more thoroughly to allay unnecessary fears than the sifting of facts, the separation of truth from exaggeration, and the exact estimation of the nature of the danger to be faced, and the great resources we can bring to bear with the object of effecting its annihilation.

This Report was drawn up for publication in *THE LANCET*, and in preparing it I had the advantage of the influence of that journal in opening up sources of information which might otherwise have been sealed. I have especially to thank the Registrar-General, Dr. W. Farr, and Mr. Stephen Hammick, for the great kindness with which they facilitated my search amongst the public documents of the General Register Office, and even allowed me, as it were, to forestall the Quarterly Report. I have been careful to mention, in the body of this Report, the names of those gentlemen who were so kind as to forward to me summaries of their individual experience. I hope that none are omitted to whom I am so indebted.

Although the difficulties of obtaining a complete account of the wide-spread ravages of the disease were obviously very great, I believe that I have succeeded in collecting an important mass of facts, from which valuable conclusions are deducible. Looking to the absence of any important labours on this subject in our literature, I trust that this Report may be thought seasonable, and prove of some public utility. I have summed up the more practical deductions in a few brief concluding sentences.

Finally, I have to acknowledge, with thanks, the liberality of the proprietors of *THE LANCET*, who readily authorized the reproduction of what I had contributed to their columns.

69, *Wimpole-street*, March, 1859.



ON

D I P H T H E R I A.

THE phenomena which have attended the introduction of diphtheria into this country have been such as to arrest the attention of all who are interested in the science and art of medicine, and of all who are concerned for the health of the community. The sudden development of a strange type of disease; the propagation of another organic poison, as active, as mysterious, and as deadly as that of typhus or of cholera; the introduction into our crowded towns and ill-drained villages of a virulent epidemic, which is at once distressing in its symptoms, rapid in its progress, intractable under careful therapeutic management, communicable by infection and by contagion, easily located, and acting then with severity in confined centres of population, giving brief and doubtful notice of its advent, but leaving terrible traces of its passage;—these are the circumstances which have marked the history of this epidemic in England, as they have distinguished similar visitations elsewhere, and which have given to its study the highest scientific and humanitarian interest.

It is of great importance to the epidemiologist to determine whether this disease be indeed one which has had its birth within the present century, and has been nurtured in the cradle of European civilization during our own secular epoch; or whether it be only a recurring morbid type, which has, in other times, and amongst other and earlier nations, been largely and fatally prevalent.

One practical fact is indeed well established—that it is a disease until lately unknown to the practitioners of this country, and not formally described by any of our older writers; the most experienced surgeons, when brought into the presence of diphtheric patients, find themselves called upon to combat an unknown enemy, and one whose mode of attack is new to them. Diphtheria is undoubtedly allied in some of its characters to scarlatinal angina (pultaceous pharyngitis), and to the angina gangrenosa, or malignant cynanche, which has more than once shown itself sporadically in this country—affections well known, and vividly described by Fothergill, Huxham, and other physicians. But it is separated from them by a line of demarcation, at least as strongly distinctive as that which divides diarrhoea, dysentery, and cholera. Diphtheria is a disease new to English practitioners, and little known on the Continent, except in France, to the present race of surgeons. It would appear, nevertheless, to have invaded various parts of the world, at long intervals of time; always committing the most serious ravages, and making itself dreaded, by whatever appellation it was distinguished. M. Bretonneau believes that it may be traced to an epoch more nearly cotemporary with Homer than with Hippocrates, and that it was known then as the terrible “*Malum Egyptiacum*.” He calls attention to the fact, that the combination of verdigris with honey, eminently prophylactic of diphtheric inflammation, is still preserved, since many centuries, in the Codex, under the title of *Unguentum Egyptiacum*. Ten centuries after this period appeared the careful description by Aretæus of the *Malum Egyptiacum*, which Bretonneau identifies with diphtheria. The most striking expressions in this elaborate description are those in which the tonsils are mentioned as being covered with “*quodam concreto humore albo*,” which is said to spread even over the tongue and gums: “*linguam etiam occupat et gingivas*.” This exactly describes the pathological peculiarity of the membranous deposit by which diphtheria is distinguished. Macrobius alludes to a similar epidemic in

Rome (A.D. 380). It appeared as a fatal epidemic in Holland in the year 1337; also in Paris in 1576.* Three centuries after, it raged in Spain, where it showed itself occasionally during forty years; and from the suffocative dyspnoea which accompanied it, it was known as the "garotillo." In 1618-19, it carried off five thousand victims in Naples, where it acquired the designation of "male de canna" (trachea).† The writers of the seventeenth century especially directed attention to the symptoms accompanying the extension of the disease from the pharynx to the air-passages. In 1740, the peculiarity of the pseudo-membranous concretion which lines the air-passages was indicated by Ghisi. A similar epidemic was observed by Dr. Bard, of New York, in 1771, who perfectly distinguishes it from angina gangrenosa, or pultaceous pharyngitis, and considers the pseudo-membranous patches to be the result of a concretion.‡ In 1761, Rösen described an epidemic in Sweden. In 1813, Dr. Bell mentions having witnessed a somewhat similar invasion in America. Bretonneau asserts that Queen Hortense (1809-10) suffered for many months from the effects of gingival diphtheria, and that her first-born succumbed to laryngeal diphtheria. Reviewing the history of the deaths of Washington and of the Empress Josephine, he attributes them to the same cause.

Such are some of the indications which medical literature affords of the prior invasions of formidable epidemics similar to that which has lately entered this country. The accounts thus rendered are not, however, of so exact a character as to afford us much practical information, or to yield to the inquirer many useful precepts for prophylaxis or for treatment.

The first connected and practical researches upon the nature of diphtheria are due to Bretonneau on the occasion of the disastrous outbreak at Tours, described by him in his "Traité de

* *Inflammations Spéciales des Membranes Muqueuses*. P. Bretonneau, Paris, 1826. *Témoignages Historiques*, p. 66.

† *Carnevale de Epidemico Strangulatione Affectu*.

‡ *Researches on the Nature, Causes, and Treatment of Suffocative Angina, &c.* By Samuel Bard, M.D. New York

la Diphthérite," 1826. Since that time the disease has established itself firmly in France, and has prevailed at intervals with fatal severity in various parts of the country. It has been carefully studied by Bretonneau, Trousseau, Guersent, Isambert, Chomel, Andral, Rilliet, Barthez, Bouchut, Empis, and many others; the epidemics of Tours, Blois, Orleans, Paris and Boulogne having furnished opportunities for observation but too frequent and ample. It is in selecting the most characteristic and important researches upon these epidemics that we obtain the most valuable insight into the nature and difficulties of this disease, and are enabled to contrast its previous characters with the phase of development which it now presents in this country. It was in the rear of the legion of La Vendée that the disease was introduced into Tours. The epidemic broke out in the barracks amongst the soldiers who resided there, and from them spread to the surrounding quarters. Amongst the soldiers diphtheria of the gums was the most frequent form; the air-passages were rarely affected. In this form the malady was at first mistaken for a malignant phase of scorbutic disease. The proportions of those affected with gingival diphtheria to those attacked with the laryngeal form stood as nine to one. As it spread, however, into the city, the gums were preserved, and the laryngeal variety made numerous victims, especially amongst the children. It is here that we recognise the identity of the epidemic with that which now prevails in England. The children so attacked complained first of slight pain in the throat; deglutition was somewhat interfered with, the little patients, however, rarely suffering much at the onset. If the throat were examined, it was seen to be somewhat reddened and inflamed; soon a yellow-grey patch covered the tonsils, the base of which was red and swollen; the cervical and submaxillary glands became tumefied and inflamed; the yellow deposit spread rapidly over the soft palate, the mouth, and the pharynx. The leaden aspect, the tottering step, the dull eye, bore outward evidence of the rapid progress of the disease; while a hoarse cough, a change in the *timbre* of the voice, extreme fetidity of

the breath, and greyish-black investment of the pharynx and soft palate, testified especially to the severity with which the air-passages were implicated. The frequent small pulse soon gave evidence of pressing danger, confirmed by the accession of suffocating dyspnoea, by aphonia, by the livid pallor of the countenance, by the brief agonies of a struggle, soon succeeded by a deathly peace.* From Tours the epidemic spread to La Ferrière (1824), where, out of 250 inhabitants, twenty-one were attacked, and eight succumbed. It manifested here that tendency to endemic localization which it has so often shown since then, and it was confined to that village alone. Shortly after (Nov. 1825) it attacked Chenusson, where it maintained the same characteristics. Chenusson is a hamlet containing fourteen or fifteen houses; by the 1st of January, 1826, seventeen persons had been attacked by the epidemic throat disease, and not one had escaped death. After those who were seized with it were brought to the General Hospital, of twelve who were admitted, three died.† From this time it continued to traverse the departments of France, passing mainly from the southern littoral districts towards the centre. It did not seem possible to ascribe its visitations to any particular climatic or meteorological conditions; for 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 amidst marshes; while elsewhere it seemed to select marshy and ill-drained districts, and to spare those which were in better sanitary condition.‡ Again, while in the year 1825, a year remarkable for its extreme dryness, the communes north of Orleans were laid waste by diphtheria, it made as many victims in the damp and warm year 1828 in the country south of Orleans. In this year, M. Trousseau saw

* See the cases described by Bretonneau in his *Mémoires*, read to the Académie Royale de Médecine, 1821.

† Bretonneau, *loc. cit.*

‡ *Dict. de Méd.*, en 25 vols., vol. x., p. 392.

thirteen individuals die out of seventeen in one farm, all being attacked with diphtheria. It is rather, therefore, in respect to the similarity or to the differences in their symptoms that it is at present profitable to study the epidemics of diphtheria which have prevailed in France than in respect to their chronological order.

The epidemics which appear most closely to resemble those which have occurred in this country are those of Paris and of Boulogne in 1855. The epidemic of Paris was one of great severity, attacking both rich and poor, chiefly expending its force on children, but carrying off also adults, and particularly those who were in frequent association with the sick, either as nurses or as medical attendants. Amongst the latter was the well-known physician, Dr. Valleix. An excellent account of the symptoms is given by Dr. Isambert,* to which we shall have occasion to refer. But of all the epidemics of diphtheria, the gravest and the longest in duration was that of Boulogne, which, from January 1855 to March 1857, was the cause of 366 deaths in the city; 341 of those who were carried off being under ten years of age. It is of especial interest to us, because it would appear that the English in Boulogne were the greatest sufferers. At the time of the outbreak, no physician of the city remembered to have been called upon to treat a case of angina, of any kind whatever. The symptoms are described† as having been very insidious from the onset. They presented an unusual modification of the ordinary characters of the disease. Vomiting was the first signal of the attack in a great number of cases; so that when a child was seized with nausea, it was to be considered as having fallen under the influence of the epidemic. False membranes were very apparent in almost all of the cases, and if the surgeon were called in early, he frequently witnessed the whole process of their evolution. Then a single patch of lymph was seen,

* Des Affections Diphthéritiques, et spécialement de l'Angine Maligne observée à Paris, 1855, etc. Dr. Isambert.

† M. Trousseau. Archives Gén. de Médecine, 1857.

more or less limited, which gradually extended itself, while swelling and redness of the pharyngeal region supervened; in attacking fresh parts, the diphtheric patch tended less to progress towards the larynx than to invade the whole of the pharynx and the nasal fossæ. M. Trousseau, in the paper in which he affords this description, remarks that this epidemic resembled less those which M. Bretonneau observed at Tours than the epidemic which prevailed in Paris in 1855. It had the same characters as those which have been seen since in this country. Some rare complications presented themselves; amongst others, meningitis, and various gastro-intestinal affections. These, also, we have seen here. The state of the respiration does not appear to have been the subject of any special researches. The convalescence was long and difficult, thwarted by many accidents, and prolonged by the extreme debility which Dr. Faure especially indicated as a characteristic incident. Besides this, some cases were observed of paralysis of the soft palate, and many in which the recovery was delayed by that invincible disgust for food which affords so serious an obstacle to the efforts of the physician. This description is due in great part to M. Perrochaud, of Boulogne. M. Trousseau, however, expresses his regret that the examination of the false membranes was not made more carefully, and the mode of propagation to the nasal fossæ noted. For it is certain that in severe cases of diphtheria the nasal mucous membrane ought to be the object of the most careful attention. In this view, which is abundantly supported by English experience, M. Bretonneau concurs in his later writings. The diphtheric condition of the posterior nares easily escapes attention, but it cannot be neglected without incurring imminent danger of seeing the patient sink under its effects. Hence, in all accounts of epidemics of diphtheria, it is highly important that the influence of the disease, when seated in the nostril, should be carefully detailed.

It is for this reason that an account rendered by M. Lemoine of an epidemic observed at Nièvre deserved to be

especially noticed. The disease did not attack the larynx; it showed itself first in the usual manner. Forewarned as to the imminence of the danger, M. Lemoine adopted the wise precaution of examining each day the children who attended a district school placed under his care. He found that the enlargement of the glands very often preceded the production of the false membrane; and in many cases, having learnt this, he was enabled to avert the formation of the membrane, or at least greatly to modify it. The practical value of such an indication is very great. It is especially surgeons placed as he was who may be enabled yet further to verify the observation, which may then be of the highest diagnostic importance. M. Lemoine found that when the false membrane attacked the nostril rapidly, the prognosis was very grave; so also when the disease set in with convulsions.

In the department of the Haute Marne, the diphtheria had a yet more marked predilection for the nasal fossæ; it appears to have attacked this region at the outset in more than one case, determining then severe epistaxis, which increased the debility by loss of blood. This epidemic was observed and described by Dr. Jobert.

Finally, there was only one part of France, situated in the further side of the country, in the Pyrenees, which was affected by a really croupal modification of diphtheria, and which was here invariably marked by laryngeal suffocative dyspnœa.

The excellent account of the epidemic attack of croupal diphtheria at Avignon, by M. Lespiau, deserves especial notice, as being one of the most perfect monographs which have been given to the profession on the subject.* This epidemic broke out amongst three legions of the 7th Regiment, at Avignon. It lasted from the 14th of August, 1853, to the end of October of the same year. It attacked 195 soldiers out of a mean strength of 1656. It attacked 4 children belonging to the regiment out of 22; and 5 soldiers out of 110 who lodged in

* H. Lespiau: Relation d'une Epidémie Diphthéritique qui a sévi sur le 75^e de ligne.—Mémoires de Médecine et de Chirurgie Militaire, 1854.

the town away from the barracks. The law of preference for children rather than adults held good here, since of the one 18 per cent., and of the other only 4 per cent. suffered. The communicability of the disease, both by infection and by contagion, was well illustrated. Thus, between the 18th of Aug. and the 14th of Sept., 12 diphtheric patients were sent from the hospital infirmary to the Hôtel Dieu d'Avignon. Diphtheria then broke out amongst the fever and other patients in the ward: 8 were attacked; of these, 5 succumbed. It was found that the mortality was very great amongst those who were attacked with diphtheria at a moment when they were labouring under other diseases; in fact, nearly all died. Amongst the others, the mortality amounted only to 6 per cent. One of the gravest symptoms was the feeling of constriction about the larynx: with one exception, all who complained of this symptom died. In this, as well as other epidemics, the local application of strong caustics was of the highest service.

Finally, we would notice an epidemic observed by Dr. Santlus,* at Hadamar, in 1853; and a similar attack at Werstersbourg, in 1847. He has miscalled it croup. Its nature is very obviously diphtheritic — “a white, creamy membrane occupied the whole of the pharynx.” The interesting feature of this epidemic was that it was often accompanied at the commencement by a miliary exanthem, which appeared on the arms, clavicular region, and at the borders of the axilla. This has occurred more than once in England; and this eruption has been commonly but erroneously described as that of irregular or suppressed scarlatina, with which it has nothing in common.

In conclusion, we can only find space to mention the occurrence of a terrible epidemic of diphtheria at San Francisco, in the autumn of 1856, which persisted through part of the following year. It had all the typical characters of pharyngeal diphtheria. Dr. J. V. Fourgeaud† has published a

* Santlus: Epidemics of Croup.—Journal für Kinder krank, 1854.

† Diphtheria: a Concise, Historical, and Critical Essay on the late Pseudo-Membranous Sore-throat of California, 1856-7. Sacramento, 1858.

monograph on this epidemic. He describes the mortality amongst children, in several counties around the Bay of San Francisco, as having "assumed an appalling character." "Few children," he says, "attacked by it recovered." He placed his main reliance on muriatic acid as an agent for local cauterization, and, like Bretonneau, he had full reason to be satisfied with its action.

Amongst the most instructive deductions which may be obtained from the review of these various epidemics, is the observation of the identity of the disease preserved through many transformations of its seat and symptoms—attacking sometimes the gums, especially at others the pharynx, soft palate, the larynx, and bronchial tubes, or the nasal fossæ. It preserves always the distinctive characters of diphtheritic or membranous inflammation, and calls for the same system of treatment.

It was observed of diphtheria in France, and it is equally characteristic of its course in England, that it did not obey any known climatic or meteorological laws. It descended upon Tours in the rear of the Legion of La Vendée; it broke out in crowded and ill-ventilated barracks, and it spread throughout the town. It visited alternately the open hamlets of the rural departments, and the crowded courts of the great cities. It raged in Orleans and in Paris—through the Sologne and in the Loiret. It reached the sea-side, and fell with violence upon the infant population of the city of Boulogne. 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 the summer months lent fresh force to its destructive attacks—soon it raged with greater violence in the winter months, and during the cold season. Was a connexion 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. It has been no less careless of the limitations of heat, cold, dryness, and moisture, since it

has established a camp in this country. Brighton has not escaped; Hastings has been visited; 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 on 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 appeared to lend it fresh vigour, and the heat of the dog-days, or the severe frosts and sleet of winter have fostered its strength, yet moderate temperature has not greatly abated its influence, and it has struck a blow here and there through all the seasons. So, also, M. Trousseau found, in investigating the tables of mortality of various villages that had suffered from this scourge, that the first periods of decrease coincided with the commencement of the winter; further on, with the rainy periods of the spring; and elsewhere, with the dog-days. Of such cosmic influences, indeed, it can only be said at present, that seasons of excessive alternation of temperature, or of the barometric condition of the air, favour the development of diphtheria, yet it has appeared in mild and equable summer months.

What shall we say, then, of this epidemic? Shall we sum up its characters in that fluent and facile form of speech which defines such aberrations as anomalous? This is no other expedient than that by which we shift the burden of ignorance from our own shoulders by bringing an accusation of disorder against natural laws. It must be a shallow and a false epithet, often as it has been employed in such a case, and conveniently as it closes a discussion by concealing the weakness of the inquirer. The anomaly can only appear from a want of power to discern a deeper harmony. The progress of disease—the march of an epidemic—does, of necessity, follow a law no less fixed and immutable than that which presides over the revolutions of the globe and the orbital precession of the planets. If it ad-

vances, it is because it is impelled by influences that are not to be resisted, or is attracted by the conditions of the locality towards which it tends. If it explodes with violence in any one station, it is because it finds there abundantly the fuel which excites it to violence. And it must always be borne in mind that the predilections and the revulsions of disease are neither capricious nor capable of transformation. It is always attracted and it is always repelled by the same circumstances; nor can they undergo mutation or conversion.

Failing, therefore, to find a satisfactory key to the etiology of diphtheria in the study of meteorological or cosmic conditions, we must look at the facts which these epidemics offer in relation to individual and hygienic circumstances which affect them directly or as predisposing causes.

And it is mainly in the study of domestic conditions, individual constitution, and hygienic arrangements, that fruitful results are to be expected. Zymotic disease is mostly bred by poverty out of uncleanness; and diphtheria follows a general law of what may be called the pythogenesis 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 toward which all sanitary precautions should ever 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 their foul touch. The extreme tendency to limited action which marks these epidemics, and which was fully illustrated in the French epidemics, as it has been also in the English, indicates the presence of domestic predisposing causes, amongst which we rank these obnoxious nuisances as of prime activity.

But although poverty and dirt have been the ordinary concurrents, they have not been the exclusive conditions of development for diphtheria. Zymotic in its nature, it tends to fasten upon whomsoever is debilitated by previous disease, or

by a constitution naturally feeble and artificially effeminized, or whose vitality is lowered by the depressing influences of luxury, indolence, inactivity, and the habitual defiance of physical and hygienic laws, which is so frequent an element in fashionable life. Hence individual causes come into play, and introduce this associate of the poor into the palaces and mansions of the great, which they so often fringe. Diphtheria finds there its victims pale and anæmic, or grossly sanguineous and unhealthily excited. It strikes especially the lymphatic, and in some families, M. Bretonneau and Prof. Trousseau opine,—as in the Beauharnais family,—there is an element of hereditariness which invites the attack. This must certainly be accepted as no other than opinion. The military life has been said to predispose to it, since on several occasions, as in Tours and Avignon, epidemics have burst out amidst a legion, and proved fatal. The familiar defects of barracks in all sanitary and hygienic necessities will sufficiently explain this predisposition.

But the experience of the French epidemics has made abundantly clear one very important fact in the history of diphtheria, which has not yet been so clearly eliminated from the observed facts of the English epidemic. It may be very clearly shown from the evidence collected that contagion plays the principal part in the propagation of diphtheria. There is in this country a great deal of scepticism as to the contagious character of this disease; but the mass of evidence to prove it is overwhelming. Thus Bretonneau has collected some crucial cases. One is that of M. Herpin, surgeon to the hospital at Tours and professor at the school. A child seized with diphtheria, who had transmitted the disease already to its nurse, was placed under his care: at one of his visits, by access of cough, part of the diphtheric matter was ejected from the mouth while the process of sponging the pharynx was being performed, and it lodged on the aperture of the nostril of M. Herpin. Occupied with his task, he neglected for a moment to remove it. A severe diphtheric inflammation of the part en-

sued, which spread over the whole nostril and pharynx. Extreme constitutional disturbance occurred, and the prostration was so severe that convalescence occupied more than six months.* Dr. Gendron, of Château de Loire, received on his lips a shower of tracheal diphtheric exudations expelled by a young patient during an access of coughing. Laryngeal diphtheria set in with urgent symptoms. Prompt measures saved him. In 1826, M. Bretonneau was summoned by the Minister of War to the Ecole Militaire: four pupils and one sister had died. After his arrival the throats were daily examined. Sixty cases occurred; but prompt medication averted the course of the disease, and no deaths ensued. But a boy affected with frost-bites of the foot happening to use a bath that had been employed for a diphtheric patient, his great toe became forthwith the seat of painful diphtheric inflammation. Next, M. Lespiaü relates the instance of a soldier, during the epidemic of Avignon, who used the teaspoon of a diphtheric patient, and contracted in consequence buccal diphtheria; and of another, who was attacked with diphtheria the night after sleeping with a patient.† We cannot recall, at this moment, our authority for a case in which a boy in hospital, treading on the sputa of a diphtheric patient, contracted cutaneous diphtheria of the foot.‡ These facts, however, are more than sufficient to prove the theory of contagion for this disease. Yet it is to be noted that Professor Trousseau failed in the endeavour to infect himself and two of his pupils by diphtheric matter; and that Dr. Harley was not more successful in some recent experiments with this view on various animals, made with exudation taken from a patient of Dr. Walshe, at University College Hospital. M. Bretonneau goes so far in this matter as to declare that the above facts, and the other details which he

* Bretonneau: Sur les Moyens de Prévenir le Développement et la Progrès de la Diphthérie. A. G. M.: Jan. 1855, pp. 14.

† H. Lespiaü: Mémoires de Méd. et de Chirurgie Militaire, 1854.

‡ See also a paper on Diphthérie Gangréneuse chez une Nouvelle Accouchée Transmission de la Mère à l'Enfant: par Ch. Mahieu. *Moniteur des Hôpitaux*, p. 1038, 1856.

possesses of the epidemic of the Indre et Loire and its surrounding districts, justify the assertion that the atmosphere cannot transmit the contagion of diphtheria, which is only transmissible by inoculation. In this opinion, however, he stands, we believe, alone: neither Professor Trousseau nor M. Isambert rejects infection at a distance as one of the means of propagation possessed by diphtheria. And in contrast to the cases of M. Gendron and M. Herpin, it should be said that, as to the unfortunately fatal attacks of M. Blache and M. Valleix, there is an entire nullity of testimony to a contagious origin.

The wide influence of transmission by contagion is, however, a fact as unquestionable as it is significant. Not only does it explain partly how it happens that the ravages of the disease so frequently include the whole of a family, but it suggests a most important precaution, and one which we believe to have been greatly neglected hitherto. The isolation of the patient is a matter of the first importance. The child affected should be at once removed from the society of all others—if possible, from their vicinity; a strict quarantine should be observed, and all domestic utensils and vestments used should be kept apart. It cannot be doubted that amongst the poor the community of goods, and the scanty supply of necessaries, tend to carry disease from one to another of the household, and thus to increase the severity of their affliction.

There is one particular form of diphtheria which, from its persistence and superficial site, peculiarly favours transmission by contagion, and was very freely noted in France, though very little has been seen or heard of it here—viz., cutaneous diphtheria, a most interesting variety, and one which it will certainly be profitable, therefore, briefly to notice in connexion with the French epidemics. Cutaneous diphtheria was never developed unless when the epidermis was raised or removed, and the skin thereby approximated to the condition of a mucous membrane. Thus, in the progress of an epidemic, leech-bites, blisters, fissures of the breast, excoriations of the scrotum, of the hairy scalp, of the nose, vagina, and other

various wounds, might become the seat of diphtheric inflammation;* and this Professor Trousseau has seen, "not in a small number of isolated cases, but amongst several members of almost all the families of the same village; so that we cannot be too much astonished that so common and so grave a malady should so long be permitted to pass unnoticed."† When a wound is attacked by diphtheric inflammation, it becomes painful, foetid, and discoloured; serosity pours from it in abundance, and a grey, soft coating soon covers it with a layer of increasing thickness; the edges swell, and become violet. The wound remains often obstinately stationary for months. Sometimes it spreads. Then around it an erysipelatous blush is seen; pustules form, become confluent, burst, and leave apparent a diphtheric patch, which spreads even from the head to the loins.‡ The surface of the pellicular concretions becomes bathed in serosity, softens, blackens, breaks down, and putrefies. A terrible odour exhales. The skin has the aspect of gangrene, but falsely; it is a much less dangerous condition. The same condition obtains, we may observe, in the pharynx, and a personal inspection of the last Quarterly Reports of all the Registrars of England, which we owe to the great kindness of the Registrar-General, has satisfied us of the vast amount of confusion prevailing as to the distinctions between diphtheria and putrid sore-throat due to this circumstance. The aspect of gangrene is due to the peculiar characters of the exudation—characters which we have more than once verified microscopically—and which are of the first pathological importance. The exudation of diphtheria is an aplastic concretion which does not become organized or vascular, but remains as a foreign body, and, if not removed or expelled, putrefies. Here is an essential distinction between this exudation and that of croupal or serous inflammations. It of itself establishes the pathological distinctiveness of diphtheria.

* Robin. Diphthérite des Plaies. Bulletin de Thérapeutique, 1847.

† Dictionnaire de Médecine. Loc. cit.

‡ Mémoire sur la Diphthérite Cutanée. A. G. G. t. xxi.

There are, however, other specific characters which appear, on casting a *coup d'œil* over these records of diphtheric attacks, to combine to prove its specific character. The origin of the malady; its propagation by epidemics; its sporadic outbursts; its special habits of location; the constancy of the diphtheric lesion—that is, the identity in character of the diphtheric concretion; the catholic facility with which it develops similar conditions in the mucous and dermic tissues; the intensity of general and premonitory symptoms compared with the trifling amount of local injury; and finally, the manner and rapidity of death declare diphtheria to be a disease of really toxic essence.

The French epidemics offer many other points of infinite interest, upon which it might be desirable to dwell; but our space will not allow a further development of the questions which arise in studying them in detail. We have touched upon all those leading points which they illustrate more fully than do the epidemics observed in England. We shall next enter upon the discussion of the epidemic diphtheria lately and still prevailing in this country.

The materials do not exist for obtaining an accurate and complete history of the rise and progress of the present visitation of diphtheria in this country. Still less are there any reliable accounts of earlier epidemics. We have alluded to the descriptions of epidemic visitations of “throat disease” by Home, Fothergill, and Huxham. But it is impossible to read these with any analytic care, and to criticize their details with impartial judgment, without arriving at the conclusion that if, indeed, any diphtheric malady be there implied, the looseness of the wording does not allow the isolation of the characteristics of this morbid condition from the vicine but distinct maladies which were evidently the main subjects of observation, and which are known as angina gangrenosa, or putrid sore-throat, and pultaceous pharyngitis. The same source of error and confusion has constantly impeded our investigations into the progress and localities of the prevailing form of diphtheria. There are two sources of error, and two schools of confusion.

There are many observers who show an unfortunate facility in adopting the current title, and who are disposed to extend the nomenclature of this disease—in itself perfectly specific—to all forms of throat affection. There are many others who refuse to investigate the unassailable grounds on which a specific character is assigned to diphtheria, and retain habitually such loose designations as “throat fever,” or tacitly classify diphtheria as a form of ordinary cynanche—returning cases under that head without guiding note or observation. Hence, on the one hand, we must look for diphtheria in many districts where the disease exists, but the name does not; and we are compelled to reject the diphtheria returns from other localities where personal inspection has assured us that diphtheria does not, in fact, exist, but only some of the forms of scarlatinal sore-throat. There are some physicians of intelligence who maintain that diphtheria is closely allied to scarlatina, in the nature of its poison, and should be classed with it. But diphtheria is wholly distinct from scarlatina in symptoms and course; and we hold the contrary opinion to involve a nosological error, arising clearly from a confusion between diphtheric and sloughing sore-throat, and thoroughly refuted by clinical investigation. It is, however, desirable to note the coincidence of scarlatina and diphtheria wherever it occurs in any report, not only that the few advocates of this theory may have the full benefit of favourable facts, but also because the confusion between scarlatinal sore-throat and diphtheria is still so common as to be an element deserving of consideration in any numerical analysis of the returns of disease.

Aiming at brevity, no less than accuracy, we omit to insert here those historical gleanings from medical literature which we have gathered, and which throw an uncertain light upon the past invasions of this disease, reserving them for a future historical study of epidemics of throat disease in England, which the limits of this report forbid. The advent of that outbreak of diphtheria which is now under consideration was first notified in a plain and unmistakable manner early in 1857. It

showed itself in the south-eastern counties, and, travelling from station to station, visited especially the ill-drained and marshy districts, and the neglected and dirty localities of the towns. It prevailed in Canterbury from the beginning of the year. Mr. Rigden, a very competent observer, and trained to the study of epidemics, noted "seven cases of diphtheritic inflammation of the fauces and the tonsils, attended with considerable fever, depression, and swelling of the tonsils; the fauces and part of the mouth being covered with pasty lymph." Gradually it spread from Kent to Essex, and through all the eastern counties. Simultaneously there appeared a severe outbreak of what has been authoritatively pronounced to be diphtheria in one at least of the south-western counties. The local name was "throat fever." It appeared, after arriving at a certain stage, to baffle medical skill, and "something of a fungus nature showed itself in the throat." Croupal suffocation was one of its complications, which appears to eliminate "putrid sore-throat," and those therefore who classify this Cornish epidemic with diphtheria are probably warranted in so doing. The marshy districts of Essex suffered severely from diphtheria; but the mortality was not in proportion to the number of persons attacked. The winter of 1857 brought fresh force to the epidemic, and it showed itself with violence in the first seats of its invasion, at the same time that it spread to a wider circle. The south-eastern counties suffered severely; while observers from other stations recorded its advent. Dr. Williams, at Apsley Guise, described eight or ten cases of it under the name of muguet. Dr. Mackinder notified the appearance of this and other forms of throat disease at Gainsborough: scarlatina was at the same time prevailing in an anomalous form, and Dr. Mackinder appears to have had some tendency to generalize throat diseases, and class them under the one designation. At Teignmouth, Mr. Lake observed cases of that severest form of diphtheric inflammation, in which the local manifestation of the disease is from the first overshadowed in importance by the constitutional symptoms. The blood-making

powers were seriously compromised after the annihilation of the throat affection ; the patient sinking then through general failure of the powers of life, without anything like typhoid symptoms,—a distinction which it is very important to maintain,—or being left in a state in which he is liable to be carried off by any prevalent disorder, or during convalescence continuing unusually weak and anæmic. This description accords closely with the details afforded by Dr. Faure and Dr. Perrochaud, of the Boulogne epidemic ; such symptoms were seen also by Isambert in Paris. Mr. Crowfoot found diphthêrite at Beccles, with the not very usual complication of gastric fever. It showed itself in Staffordshire, and Mr. Houghton records some well-marked cases of diphtheria at Dudley, which were interesting because they occurred in persons in the prime of life and in good bodily health, and were all associated with the best sanitary state ; the patients all showed symptoms of alarming prostration, but all recovered. It had gained now a firm footing in Lincolnshire, and spread through all the breadth of that fenny county. Dr. Mackinder reported from Gainsborough, in that county, that a large number of throat affections had occurred, of which some were characterized by a deposit of small points of lymph, which united and spread circumferentially until the whole of the fauces and soft palate was covered, and sometimes also the tongue partly, and the mouth. In these cases there was generally some cough ; at others gastro-enteric irritation ; nearly always considerable depression, and sometimes absolute prostration of the vital powers. Through the winter months of 1858, diphtheria continued to hold its way. The south-eastern counties still suffered ; Canterbury was a principal station, scarlatina also still prevailing there. In parts of Essex the affection was almost universal. In Maldon, in that county, it appeared as the cause of eight out of twenty deaths under another designation. Upwards of 400 cases of “putrid sore-throat” were attended by the registrar. In Suffolk (Sudbury) and in Norfolk (Ludham and Bacton) it acted upon the population with a severity which

raised the mortality above the average, in the proportion of three to one in the latter case. No returns were made to the Registrar-General* yet from Wales or from the district north of Staffordshire; but its existence was intimated by Mr. Proctor, of Derby, scarlatina also being present.

Through the spring and early summer months of 1858, the country suffered less from diphtheric affections. They were still, however, to be found in their old haunts: at Brewood, Staffordshire, and perhaps also in the neighbouring county of Worcestershire; at Spalding and Gainsborough in Lincolnshire. It preserved its northward tendency, and we find it reported at Ashton-under-Lyne; but here, also, coincident with scarlatina. The autumn brought with it reports of diphtheria from a widely-extended range of country, due partly to an extension of the disease, partly to an increasing notoriety of its prevalence, which induced everyone to look for it. Some well-reported cases occurred in the south-eastern counties, especially at Tonbridge, Kent. Norfolk suffered more severely than heretofore: in the district of Tunstead, six children of one man, at Swafeld, were carried off within five weeks, being all the family with the exception of an infant at the breast. Passing over the south-western counties, it caused eleven deaths out of thirty-six cases at Melksham, and proved fatal at Chippenham. It was little noticed in the west midland counties; but, in the north midland division, it proved very fatal at Horncastle in Lincolnshire, much less so at Newark. Both Ridings of Yorkshire were visited, the average of deaths being greatly raised by it in several districts.

During the winter quarter of 1858, diphtheria by no means abated in severity. It prevailed extensively in the south-eastern counties. At Chertsey, in Surrey, it was very widely diffused, and the death-rate was raised one-third above the

* We wish to take this occasion of expressing our obligations to the Registrar-General, and to Dr. Farr and Mr. Hammick, of the Registrar-General's Office, for the great courtesy with which the public documents of the Office were placed before us for investigation, and for the ready aid which they afforded to us in this as in all other investigations of public interest.

average. In Kent, it prevailed at Brenchley, Tonbridge, and in the Maidstone district, where scarlatina also existed. It was very fatal also at Ashford, and at Faversham. At Easry it coexisted with "scarlatina and sore-throat." Passing through Sussex, we find it figuring amongst the causes of death at Hastings, and also at Brighton, where the death of one of its victims caused a general and painful sensation of grief; at Petworth, causing 4 deaths out of 20 from all causes; at Thakeham, 6 out of 22; and at the village of West Tarring. It still wandered through Hampshire, carrying off 3 persons at Kingston, raising the average mortality at Fareham (scarlatina coexisting) and at Christchurch, causing 9 deaths out of 32 at Droxford, and destroying four persons at Whitchurch. In Berkshire, it showed itself fatal in 3 cases at Wallingford, and was very prevalent at Reading, where 3 deaths occurred from it in one street. The south-midland division of England contributed its quota of deaths. Of 25 deaths which occurred at Acton, 11 were due to diphtheria, coexisting here with "measles," and children only attacked; 3 deaths in one family. At Twickenham, it was reported in conjunction with scarlatina. At Hertford, it caused 15 deaths out of 64, attacking chiefly children, and dying out in December. It was noted, under circumstances which leave some doubt as to its identity, at various parts of Northamptonshire, Huntingdonshire, Bedfordshire, and Cambridgeshire. The eastern counties suffered less from it than previously, except in the fenny parts of Essex. At Maldon, there was a marked recrudescence of the disease, the registrar of Southminster reporting that he had attended upwards of 60 cases; and 30 cases being recorded at St. Peter, where the deaths stand at 62. Diphtheria was reported fatal at Ongar and at Braintree, in the same county. In Suffolk, scarlatina and scarlatinal angina were very fatal, and diphtheria was reported from several localities, but it is doubtful whether these cases were not rather belonging to the category of scarlatinal sore-throat. Norfolk remained the seat of occasional outbreaks of diphtheria and inflammation, which were

especially localized at Buxton, Cromer, North Walsham, and Erpingham, where it caused 22 deaths out of the whole number, 53. In the south-western division, it prevailed in Wiltshire: at Mere, where it added 16 deaths to make up a total of 54; at Chippenham, where it showed itself more controllable by treatment; and, in company with scarlatina, it was certified from Cricklade, Longbridge, Deverill, and Wilton. It was observed in Dorsetshire at intervals. Much scarlatina was, however, prevalent over this county; and there is great reason to conclude that a confusion occasionally existed between diphtheria and other throat-affections. Deaths were certified from diphtheria at Poole, Exeter, Totnes (3 in one family), Plymouth, and Barnstaple. In Cornwall, the disease appeared to be dying out. It prevailed in old localities less severely: 4 deaths in Bodmin, 7 at Truro, 1 at Falmouth. Liskeard was growing clearer of all forms of epidemic disease. It was prevalent at Wellington and Taunton, in Somersetshire, but in a mild form. The west midland counties return a large number of deaths from this cause, occurring in the districts of Church-Stretton, Madeley, Ellesmere, and Wellington, in Shropshire; Tunstall, in Staffordshire, where it caused 8 deaths; Leek, where there were 18 deaths from diphtheria, out of a total of 81; Dudley, where 9 deaths occurred; and some other sporadic instances. In Worcestershire and Warwickshire, there were occasional and limited outbreaks at Stourbridge, Coventry, and Rugby. The north-midland counties suffered considerably from diphtheria. It prevailed extensively at Spalding, 11 deaths being registered from this cause. Small-pox occurred coincidentally at Boston: it raised the mortality of children. At Lincoln, it occasioned 3 deaths. In three of the sub-districts of Horn-castle it proved fatal in 20 cases. In the contiguous fen district of Spilsby, it was very prevalent: 12 deaths were attributed to its agency. At Saltfleet, it still prevailed amongst the young. At Caistor it was the cause of death in 21 cases. At Glanford Brigg, where scarlatina also existed, 9 deaths were

attributed to it, scarlatinal angina being specially distinguished from it. At Gainsborough, 6 deaths were recorded. All these deaths were registered in the county of Lincolnshire, which appears to have suffered, perhaps, more severely than any other in England during the last quarter of the past year. Nottinghamshire suffered less; yet at East Retford 12 deaths were recorded, principally amongst children; and, at Worksop, 15. In two or three of these cases, the patients were ill a few days, and then died—13 very suddenly. In Nottingham, many deaths were attributed to diphtheria; but as scarlatina was very prevalent, and some of the deaths were ascribed to scarlatina with diphtheria, it is not possible to say how many of the cases were scarlatinal rather than truly diphtheric. At Southwell, in the same county, 10 deaths were ascribed to scarlatina. In Derbyshire, diphtheria is reported to have been prevalent; 23 deaths were attributed to it, cases of scarlatina being also frequent. Many deaths also, under the like circumstances, occurred at Belper and Chesterfield. Passing to the north-western counties, we find "hooping-cough" and diphtheria prevailing at Macclesfield, at Congleton, and Nantwich; at the last district it caused 13 deaths out of a total of 59. In Lancashire, fewer deaths are recorded, considering the populous character of the county. It was noted at Liverpool and at Prescott, with small-pox; at Wigan and at Hulme, where the deaths all took place in one part of the district, and that part which is considered to be most healthy; at Oldham-above-Town, and at Rossendale, 16 fatal cases occurring, with a general total of 68 deaths.

These various epidemics possessed characters in common, presenting, however, occasional features of differentiation. Studying them in group, we are able to distinguish three forms of disease, identified by a common character; and that bond of union is found in the pathological anatomy of the disease. All forms of diphtheria are characterized by a peculiar exudation. This diphtheric exudation is found equally in the mouth, on the soft palate, the buccal membrane, the tonsils, the pharynx,

the nasal fossæ, the larynx, trachea, and bronchi, the conjunctiva, the cutaneous surface, the vulva and anus. It is not found, however, in the œsophagus or stomach, nor in any of those mucous membranes which are withdrawn from the influence of the air.* A question, therefore, naturally arises for discussion, as to the probable influence of the atmosphere in promoting diphtheric inflammation. When the diphtheric membrane is raised from the surfaces which it coats, it is found to be adherent at points, and from these points slight bleeding will frequently occur. This has been very often noticed: Mr. Henry Hayward, of Walsall, describes it as invariable. The surface is not ulcerated in the great majority of instances, but is found to be free from breach of continuity, and distinguished only by congestion of various degrees of intensity. This condition is entirely characteristic of diphtheria. It is an important pathological character which goes far to establish the specific nature of the disease. But the subjacent membrane does not always preserve its integrity. Both in the epidemics of Paris, 1855, and in those which have been observed in England in 1857-58, a loss of substance has often been noticed when the exudation has been removed. We have observed this especially in the pharynx and tonsils. Dr. Fuller, of St. George's Hospital, has made the like observation. Mr. Thompson, of Launceston, in an epidemic of which he has afforded an admirable description, not unfrequently found the subjacent tissue "scooped out into a large ulcer, with raised, violet-coloured edges." When the diphtheric inflammation attacks the cheek, this is the rule, as it is elsewhere the exception; hence Rilliet and Barthez have applied here the name of "ulcero-membranous stomatitis." The chemical composition of the diphtheric membrane is that of coagulated albumen, modified by the admixture of local secretion.

Its *microscopic* characters would appear somewhat to vary. Able and conscientious microscopists have described a distinct

* See the Memoir of M. Empis, A. G. M., 4, xxi., 143. M. Isambert, ib. 5, ix., 327.

fibrillation, which we have been unable to discover, and which certainly is not common. The elements which will usually be detected by microscopic examination are, mainly, molecular particles, matted epithelium cells of all kinds and shapes, pus, and blood cells. These are arranged in layers, and united by accretion to form a membranous deposit. The thickness varies from one-tenth of an inch or less to a much greater depth, according to situation. It is hard or soft according as local exsiccation has occurred, or a softening has ensued from the membrane being bathed in the fluid secretions of the part; changes of colour and structure rapidly occur under the influence of putrefaction, and the membranes are found in all stages of fœtid putrescence.

The development of the oïdium albicans or of the leptothrix buccalis must be regarded as purely accidental, and not in any way characteristic.* The essential character of these diphtheric exudations, and that which distinguishes them from other forms of exudation, is, that they have the power of organization, and never become vascular. Hence they never concur in the reparation of tissue, but putrefy on the surface if they be not removed, existing always as a foreign body.

We have insisted upon these characters of the diphtheric exudation, because this exudation constitutes the main pathological peculiarity of the disease; at the same time that it affords an important nosological indication for diagnosis, in uniting by a common character forms of disease of which the connexion might otherwise fail to be perceived.

Three distinct forms have prevailed in this country of diphtheric angina, or, more briefly, of diphtheria. The first may be properly called, simple diphtheric angina, or simple diphtheria; the second, croupal diphtheric angina, or croupal diphtheria; the third, malignant diphtheric angina, or malignant diphtheria.

I. Simple diphtheria is the mildest and the most frequent form of the disease. It is preceded by more or less of fever,

* See the letters of Dr. Laycock, Dr. Rogers, and Dr. Harley, on this subject, in THE LANCET for Jan. 22 and 29, and subsequently in the *British Medical Journal*.

and by headache; the tongue is coated by a thick creamy deposit; some discomfort is complained of in the fauces, perhaps a slight difficulty in deglutition. It is usually at this time that the medical man has the opportunity of seeing the throat, and now (from twelve to thirty-six hours after the first invasion) one tonsil—rarely both—is covered by a small patch of white membranous deposit. This may extend and cover the whole of the soft palate, and the pharynx,—but *rarely*. It commonly, in this form of the affection, remains stationary, or extends but little; it does not blacken or putrefy, neither does it exhale the fœtid odour of putrescence. The surrounding mucous membrane is swollen, purple, and projecting; the subjacent tissue not uncommonly betrays a breach of surface, partly due to the injurious surrounding pressure. The submaxillary glands are somewhat tumefied, but neither the parotid nor the cervical glands are implicated.

The duration of this affection varies from five to nine days. It has been observed in nearly every district where the diphtheric type has shown itself. The prognosis is favourable. The treatment which succeeds best is the local application of a solution of nitrate of silver, thirty grains to the ounce, and the ferrochloric mixture, containing the tincture of sesquichloride of iron, in combination with chlorate of potash, with a judicious and sparing use of evacnants.

II. Croupal diphtheria, or croupal diphtheric angina, is a more severe manifestation of the diphtheric type, and is undoubtedly that by which the greatest number of deaths have been occasioned in this country. It is more frequent in children than in adults. Its precurent symptoms are active fever, intense headache, hot skin, engorgement of the glands behind the jaw, and perceptible difficulty of deglutition. The parents are only now aroused to the existence of a morbid condition. When the surgeon is summoned, he finds the throat and mouth covered with yellow or brownish leathery exudation. Within a few hours a hoarse, barking cough, and a change in the tone of the voice are marked; oppression of the breathing supervenes;

then paroxysms of suffocation, more and more frequent; the cough is stifled, and the voice also dies out. As the access of suffocation is felt, the poor child turns from side to side, throws its arms into the air, clutches its mother violently, and struggles furiously to gain breath, then falls exhausted in the bed, and gaining strength from momentary repose, renews the hopeless struggle to the end. Perhaps, in a violent fit of coughing, it expels a false membrane from the air-tubes, which has extended down to the fifth division of the bronchi; then it breathes easily, smiles again, and sleeps, but soon wakes to resume its struggle with death—it may be again to expel the membrane, and finally to triumph. But such a happy victory is wholly exceptional, and when once the grip of the disease has closed upon the air-tubes, death claims its prey.

The drama is of another, but not less tragic character, if the sufferer be an adult. It is more prolonged; for the larynx and tracheal tube are more capacious, and the membrane advances far down the bronchi before the scene closes and the black curtain drops that shuts out the future from the gaze of straining human eyes. As the oppression of breathing, the piping tone of the voice, the stifled cough, and the agony of suffocation are perceived, the patient fights against them with all the energy which the intelligent perception of danger, the earnest desire for life, and the despairing sense of approaching fate can inspire. He has an heroic endurance, and does not murmur at the most barbarous cauterizations, if they afford only a temporary relief; nor must the surgeon shrink from them, but with deliberate and benevolent cruelty, thrusting back the epiglottis with a spatula, he must follow the disease into its home in the larynx, and freely brush the surface with effective solutions of nitrate of silver, or of hydrochloric acid.

As to the treatment of this croupal variety, empiricism has led to results widely differing from those which rational medicine had counselled. It is a disease characterized by rapid and excessive exudation. Therefore rational medicine

counselled every form of antiphlogistic medicine. Calomel, leeches, phlebotomy, and blisters, have been lavished on the sufferers with an unfortunate prodigality. When these failed, the alkaline remedies were strongly counselled, and especially the bicarbonate of soda. M. Marchal de Calvi and M. Lemaire contested the honour of recommending it.* Others have advocated with equal warmth the employment of full doses of bicarbonate of potash.† But these remedies, having been fully tested, may be pronounced useless here, or of exceptional utility only. "La rationalisme," says Trousseau in an admirable series of papers on this subject, which we have consulted with great interest and profit, "ne conduit en médecine qu'à des sottises." Croupal diphtheria is, indeed, a phlegmasia, but it is a specific phlegmasia, and in employing antiphlogistic remedies, you would arrive at results parallel to those of that unfortunate physician of Chapelle Véroux, who lost sixty patients out of sixty cases which he treated with blisters, leeches, and bleeding—bleeding, blisters, and leeches. Thus, Mr. Stiles, of Pinchbeck, who, in the short space of sixteen days, had not less than three hundred diphtheric patients under his care (and to whom we are indebted for a very important study of the epidemic, which he witnessed, and by his intelligent efforts succeeded in greatly ameliorating), had the annoyance, in two out of the only three cases in which he was induced to apply blisters, to see the vesicated surfaces quickly covered with a diphtheric deposit, followed by sloughing; and thus, also, in the epidemic at Launceston, Mr. Thompson found that blistered surfaces were attacked with diphtheric inflammation. So also with leech-bites.

Clinical experience teaches that the first importance is to be attached, in these cases, to local applications. The choice involves the exercise of judicious discretion. Unable to discuss

* The priority appears to be with M. Lemaire. See his paper "On the Employment of Bicarbonate of Soda as an Antiphlogistic," in the "Lancette Française," vol. xii., p. 1416.

† See further Marchal de Calvi, "L'Union Médicale," 1855; Dr. Lasegue, "Thèses de Paris," 1856.

here at length the cases on which we found our practice, we are compelled to adopt a mild dogmatism. In the earliest stage, a solution of nitrate of silver should be employed, of the strength of thirty grains to the ounce of distilled water. This is best applied to adults by the curved whalebone probang and sponge now in general use, and to the child with a full-sized camel-hair brush. For the adult, Dr. Richard Quain's tongue-depressor should be employed, if at hand, or the handle of a teaspoon. In the case of a child, he should be placed on the knee of an attendant,—not the mother,—and the head fixed. If he will not open the mouth,—and gentleness is very desirable,—the nostrils should be closed for a moment; as he opens the mouth for breath, the jaw should be firmly depressed, the lower lip being folded over the teeth to prevent the operator from being bitten, and then the tongue being kept down, the whole of the fauces are fairly brought into view, and may be thoroughly washed with the solution. This is no unimportant detail, for upon the effectual accomplishment of this manœuvre the success of the treatment will greatly depend. It should be repeated three or four times in the twenty-four hours.

If the exudation continues to extend, a collutory of hydrochloric acid should be applied in like manner, in the case of an adult. With children the addition of honey to the hydrochloric acid is desirable. But this is not only a much more painful application than the solution of the nitrate of silver, but it has the disadvantage of creating a superficial eschar which simulates the diphtheric exudation, and hinders the perception of the progress of the disease. The solid nitrate of silver labours under similar defects, and has a danger of its own, from the risk of a fracture of the pencil in the mouth, which, if swallowed, might be fatal—an accident which has happened, and which has come near to such a result in more than one case.

The constitutional treatment in croupal diphtheria should commence with the employment of an active emetic; it matters little of what nature, so that it be immediate in its action. Ipecacuanha is to be preferred, as being less depressing

than most others. If the symptoms should give evidence of arrest, the ferrochloric mixture may be employed with confidence. The valuable influence of the tincture of sesquichloride of iron has been fully tested in the English epidemics. Not only do Dr. Heslop, of Birmingham; Dr. Kingsford, of Boston; Mr. Stiles, of Pinchbeck, and other competent observers of extensive epidemics, speak in the most confident terms of its value, but we have confirmation on every side of the results which they announce. The combination of chlorate of potash and hydrochloric acid, with the tincture of sesquichloride of iron, is strongly to be recommended, especially in these croupal cases, the chlorate of potash having an undoubtedly antidiphtheric influence, where time exists to bring it into play.*

When, in spite of these measures, the diphtheric inflammation, travelling onwards, reaches the larynx, when the altered voice, the oppressed breathing, and the stifled and less frequent cough give warning that the vocal chords themselves are affected by the exudation, in spite of courageous and energetic cauterization, then the question of tracheotomy must be entertained. For us this is a settled point. There is no longer any need to recapitulate the arguments on the one side or the other: tracheotomy is a resource which surgery is bound to employ for the salvation of the patient under such circumstances, and in the view of what experience teaches is otherwise certain death. The statistics of tracheotomy at the Hôpital des Enfants in 1855, showed ten cures and thirty-eight deaths out of forty-eight cases, or one patient saved in five. But the statistics vary with the character of the epidemic, and with the courage of the surgeon who is so wise as to counsel or to perform the operation when the indications we have given are established, or hesitates until the most valuable time is lost, and eternity is at hand for his patient. We would give only one counsel as to the performance of the operation: it is, that the trachea should be fixed with an ordinary tenaculum, or one grooved on its convexity. It facilitates the operation by rendering it more secure

* See the *Revue Médicale*, 1856.

and speedy. The most important precautions are those connected with the subsequent care of the patient, which includes the employment of a double tube, of which the inner may be frequently removed and cleansed; the placing a light gauze around the neck; the impregnation of the air with vapour of water (from a kettle or otherwise); and the cauterization of the edges of the wound.

III. Malignant diphtheria, or malignant diphtheric angina, is that form which has attracted the most careful attention, and has impressed medical observers in this country most strongly with the active and fatal character of the diphtheric poison. We have ample materials for the description of this most severe form. Its prodromata are, intense headache, severe febrile condition, vomiting, or occasionally sudden nasal flux, or (as at Walsall) "hæmorrhage from the nose, mouth, rectum, or all the mucous canals;" the skin is hot and pungent; the tongue thickly coated. The throat soon becomes painful, deglutition difficult, and considerable engorgement occurs of the submaxillary, parotid, and cervical glands. This characteristic engorgement increases to a surprising extent, the glands often projecting far beyond the jaw; and the cellular tissue becomes deeply infiltrated and doughy to the touch. The throat, tonsils, and soft palate are covered with a yellow, leathery deposit, which early exhales a foetid odour that presently becomes intolerable. The patient is now in a condition of intense adynamia; the pulse is rapid beyond limit, the face of livid pallor, the lips congested, the eyes lachrymose, the mouth slobbering, deglutition difficult, perhaps almost impossible; from the nostril often a foetid ichor distils, showing that the exudation has also appeared on the walls of this cavity, where it may be seen if the nostril be expanded by an ear-speculum. Coma and extreme prostration follow; and if a fatal termination ensue, the patient dies in a state of somnolent quietude which strongly contrasts with the agitation preceding croupal suffocation.

We need not to adduce examples of a type which has been

but too commonly witnessed throughout the country. Many instances have been seen of an exceptional and much earlier termination by death. Thus, at Bagshot, death occurred in many cases in the first stage through sudden and extreme adynamia, before the exudation had fully formed. Dr. Semple exhibited the parts in one such case at the Pathological Society: there was only a slight effusion into the larynx; the tonsils and neighbouring parts were extensively congested, and it would appear that the patient had died from suffocation before there was time for further exudation to take place. Dr. C. J. B. Williams was called upon to treat cases in which the toxic influence had been equally apparent. Dr. Blount, of Bagshot, has added his experience in confirmation. In the fen district of Cambridge a series of cases occurred in May, in which death ensued from the intense depression of the vital powers.

The treatment of these cases must necessarily be energetic; it needs to be essentially tonic. Of the various local applications, none equal in efficacy hydrochloric acid freely applied, or Beaufoy's concentrated solution of chloride of soda. This was used by Mr. Davey, of Rumford, in Essex; by Mr. Stiles, of Pinchbeck; by Mr. Wilkinson, of Spalding; by Dr. Cammack, of Spalding; and by many other practitioners who were seated amidst wide-spread epidemics, and their testimony is strongly in its favour. Where other local applications are employed, a gargle composed of two drachms of Beaufoy's solution to eight ounces of water should be used concurrently. Dr. Cammack recommends that two ounces of glycerine should be added to the gargle. When the nasal fossæ are implicated, such a solution should be injected through the nostril: it is preferable to the solution of alumen, or the insufflation of powdered alum, recommended by M. Bretonneau and M. Trousseau.

Of other local applications, alumen is too feeble; sulphate of copper not very efficient, and more poisonous; bromide of potassium, recommended by M. Ozanam* as a solvent of diph-

* Académie des Sciences, May 19th, 1856.

theric exudation, theoretical and untried. Of the tincture of iodine, recommended by Dr. Marzel, we have no experience. Of the actual cautery, or of the cautery major dipped in boiling water, advised by Dr. Dauvin,* we do not desire to have any practical knowledge.

Of the many internal remedies which have been advised, we do not know of any on which so much reliance can be placed as on the tincture of sesquichloride of iron, with chlorate of potass, chloric ether, and hydrochloric acid, in the form of mixture, sweetened with syrup, full doses being employed according to the age of the patient, and frequently repeated. A free use should be made of generous wine, beef-tea, coffee, eggs in combination with brandy and wine, milk, and whatever other form of nutriment the ingenuity of the surgeon or the fancy of the patient can suggest. When food is refused, then enemata similarly composed must be administered frequently, in small quantities of two ounces and upwards, that they may not be rejected; for it is of the first importance that inanition should not open the last portals of life to the advancing disease.

If the medical attendant should have the good fortune to vanquish the disease, he must be prepared to meet with long-enduring debility and adynamia—with a loathing for food, which will tax all his ingenuity and patience—and with various complications which call for a brief notice.

The most frequent sequence retarding convalescence is *paralysis of the soft palate*. This has been frequently noticed by various observers. The symptoms are, a nasal twang in the speech, incapacity for suction, and the regurgitation of fluids by the nostrils. The treatment is by local application of astringents, feeble cauterization, or by the employment of Duchenne's Faradization: one conductor to be applied to the soft palate, and the other over the mastoid process; or, as Duchenne himself recommends, both in one handle to the soft palate.† This paralysis may be of local origin; and Dr. Gull

* L'Union Médicale, 1855.

† See "L'Union Médicale," 1857, Trousseau and Lasegue; Dr. Moriceau,

and Prof. Trousseau have held this opinion from cases under their observation.* But a general paralysis has also frequently supervened, which is evidently the result of the general toxic influence of the diphtheric poison on the blood. M. Trousseau had such a case lately under treatment at the Hôtel Dieu, and it has induced him to change his opinion as to the local origin of the paralysis. Dr. Gull and Dr. Kingsford also relate instances. M. Herpin, the surgeon of Tours, was so affected during several months, and has given a graphic account of his symptoms. Other sequences, more frequently observed in this country, have been severe otalgia, amaurosis, and headache. Diphtheric ophthalmia, of which epidemics were described in Germany, many by Græfe, in 1853-54,† and by M. Jobert, at the Hôpital St. Eugénie, Paris, in 1857,‡ has been very little noted in this country.

In terminating this Report, we may offer some concluding propositions by way of summary:—

I. Diphtheria is a *specific* disease. This is seen in its origin, march, and mode of extension; in the character of its exudation; in its local manifestation; in its seats of predilection; in its toxic influence; in its prodromata, its manner of termination, and its sequences.

II. It is often confounded with scarlatinal angina, and with gangrenous cynanche. We have sufficiently indicated the diagnosis.

III. It is propagated by infection and by contagion. It is both epidemic and sporadic in its manner of invasion, and is remarkable for the severity with which it is developed in limited centres of population.

IV. Diphtheric angina presents three varieties, which may be designated—1. Simple diphtheric angina. 2. Croupal diphtheric angina. 3. Malignant diphtheric angina. The pro-

ibid., 1857; Dr. Maingault, "Thèses de Paris," 1854, where an excellent monograph will be found on this subject.

* See THE LANCET, May 4th, 1858.

† Archives für Ophthalmologie; see also "Gazette Hebdomadaire," 1856: Warlomont et Testetin.

‡ Archives Générale de Méd., 1857.

gnosis of the first is favourable; of the second unfavourable; and, of the third, most unfavourable.

V. The treatment should include the local application of a solution of nitrate of silver, Beaufoy's concentrated solution of chloride of sodium, or hydrochloric acid, according to the circumstances also indicated. The internal remedies most useful are, emetics in the early stage of croupal diphtheria, and the tincture of sesquichloride of iron with chlorate of potash.

VI. Tracheotomy should be resorted to in the second or third stage of croupal diphtheria; leeching, blistering, and bleeding should always be avoided.

VII. The means of prevention, besides careful hygienic measures—as ventilation, &c.—must also include the daily examination of the throat where the epidemic type presides—a matter of the greatest importance, as experience has very fully shown, and the early isolation of the patient as soon as attacked—a precaution hardly less necessary. M. Bretonneau bore testimony to the exceeding value of the early examination of the throat each day at the Prytanée, where an alarming epidemic, which had already destroyed many victims, became innocuous from the moment that this precaution, and the remedial measures we have described, were put into force.

The contagious character of diphtheria having been clearly established in the course of this report, it follows that the isolation of the patients affected, from the first moment of the appearance of the disease, is a measure of the highest importance. It is in this way that we may hope to check the spread of diphtheria from one member of a family to another, and it is not until diphtheria is regarded as a disease of which the ravages should be warded off by the same prophylactic means which are employed in combating the extension of other contagious disorders, that we can expect to see the mortality diminished, and the relative frequency of deaths sink to that insignificant ratio to which it has not failed to be reduced whenever the disease has been resisted by all the resources of intelligent and enlightened medical aid, and has been early dealt with by competent means.